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Editorial

Computer Science and Technology and Its Application in Multiple Disciplines

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Page: ix

Computer science and technology brings multiple disciplines into one whole and gives a strong impetus to the development of modern society. It is closely knitted with electronic engineering, mechanical engineering, automation and control engineering, applied physics, modern communication technology and mathematics. The continuous development of computer science and technology has contributed to the emergence of a dazzling array of advanced research results on computer hardware and software systems, algorithms, models and platforms, and the extensive engineering application of these results in a number of disciplines. Against this backdrop, the combination of computer science and technology and specific engineering application is becoming increasingly important.

This issue aims at presenting a series of major developments in computer science and technology and offering strong support and reference to the computer integration of scientific problems and engineering realization. The articles probe deep into the successful application and promotion of new technologies, methods, algorithms, models, platforms, systems, strategies, concepts and mechanisms of computer science to the field of engineering.

We gratefully appreciate the authors for their scholarly contributions, and all the included contents were anonymously reviewed to maintain academic excellence and integrity by distinguished experts who have no conflict of interests with the authors. All submitted papers are clearly written in excellent English and contain only original work, which has not been published by or is currently under review for any other journal or conference.

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Automatic Generation of Attack Vectors for Stored-XSS

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Pages: 1–7

Abstract: Cross Site Scripting (XSS) is a vulnerability of a web application that consists in the exploitation of input validation flaws, with the purpose of injecting arbitrary script code which is later executed at the web browser of the victim. There are three modalities of XSS: reflected-XSS, stored-XSS and DOM-based XSS. The exploitation of stored-XSS can cause more damage compared to the other two modalities of XSS. Through the deep study on the characteristics and trigger mechanism of stored-XSS, and contraposing the input safeguards of web applications, such as filtration and purification, this paper presents an approach and a tool which can generate numbers of attack vectors for stored-XSS automatically. The results of experiments indicate that the attack vectors generated by our tool can effectively detect the existence of stored-XSS in web applications.

Keywords: Stored-XSS; Vulnerability; WebFuzz; Attack vector

1. Introduction

Vulnerabilities of web applications have become one of the most serious security risks on the Internet with the increase in popularity of web 2.0 applications. Cross Site Scripting (XSS) is the most common vulnerability of web applications (Scholte et al., 2012).

Cross site scripting (XSS) is caused by the failure of the application to check up on user input before parsing and displaying it in a web page. When a page that contains malicious HTML code is opened, the exploit code will be executed by the browser, thus threatening the user's security (Duchene F et al., 2013).

According to the causes of vulnerability, XSS can be divided into three modalities: reflected-XSS, stored-XSS and DOM-based XSS. Reflected and stored XSS attacks inject the script code through an HTTP request, usually as a parameter or input of a web form. In reflected attacks, attacker must entice the victim to visit his specially designed URL (Zheng and Wang, 2011, Lino et al. 2016). By contrast, stored-XSS attacks do not need this and it work in a different way: an attacker exploit vulnerability just once and inject the script code on the server. The injected script would execute as many times as the web page containing the script is visited. While reflected and stored XSS attacks are due to vulnerable web applications, DOM-based XSS are caused by vulnerabilities of the interpreter of the client-side script used by the web browser

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(Galán et al., 2010). Since the attack script code comes from the Web application server, stored-XSS attacks ranged more and the impact is more serious comparing to the other two modalities of XSS.

Two kinds of methods, static analysis and dynamic analysis, are now used to identify XSS vulnerabilities. Vulnerability scanners that use dynamic analysis have been proven to be valid tools. Attack vectors is very important in these scanners. The sufficiency and accuracy of attack vectors will directly affects the effectiveness and efficiency of the test results. However, the current attack vectors, most of which come from personal experience and someone's collection, are not sufficient to detect the existence of stored-XSS in web applications because of the input safeguards of web applications, such as filtration and purification. This paper presents an approach and a tool that generates a large number of attack vectors for stored-XSS automatically. Testers can get specific attack vectors by add or delete some HTML tags, events and methods of generation and mutation (Kieyzun et al., 2009; Raygoza et al., 2016).

2. Generation of the basic attack vectors

Web applications such as blog and email permit users to input HTML format contents on their blog web pages and email (Chen and Zhang, 2010). If the script code are not filtrated or purified, a stored-XSS exist. Most of the script codes are using JavaScript as the scripting language, so if we want to trigger a stored-XSS, what we need is to import JavaScript and make it executed in the HTML page (Wei and Ryder, 2013).

There are several ways to import JavaScript from the input area of web applications. The most common way is using tag <script>. For example:

```
<script>alert('xss')</script>
```

Another way is using JavaScript pseudo-URL in some specific html attributes. For example:

```
<a herf="javascript:alert('xss'))">click here</a>
<img src="javascript:alert('xss')" />
```

The third way is to use JavaScript as an event handler. For example:

```
<body onload="alert('xss')"></body>
<img src="#" onerror="alert('xss') " />
```

The fourth way to import JavaScript is the use of Cascading Style Sheets (CSS). For example:

```
<div style="background-image: url(javascript:alert('xss'))">
<style type="text/javascript">alert('xss');</style>
```

In addition to the common methods just illustrated, there are also other ways to import JavaScript codes, arising from the complexities of the HTML language. Different browser platforms and versions have their own way to handle some unusual HTML. For example:

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Many tags will accept a style attribute containing JavaScript in an expression string on Internet Explorer version5-7. For example:

Based on the analysis above, we present a technique to generate the basic attack vectors for stored-XSS automatically. Contrapose the first way to import JavaScript code, we just need use the example code as a basic attack vector.

For the second way, we list the usual HTML tags and attributes, and then combined them according to the HTML grammar. The HTML attributes which support JavaScript pseudo-URL are herf, src, dynsrc, longdesc and lowsrc (Qiu YJ, 2010). The HTML tags are listed in table 1.

For the third way, we list and classify the HTML tags and events by their behavior, then combined them by the rules of HTML grammar (Gebre MT et al., 2010). This can generate numbers of basic attack vectors. We can add or delete some HTML tags and events according to our need. Tables 1 and 2 show the details.

The reason why we classify the HTML tags and events is some events can be only executed with special tags, for example, window events is useful only in window tags, thus we can improve the efficiency of our attack vectors. We can also choose whether the fourth way and the expression string to use. By the use of style as a tag or an attribute, we can generate some basic attack vectors.

Window tags	**Form tags**	**Image tags**	**Other Tags**
<body>, <frameset>	*<input>, <form>, <textarea>, <button>, <select>, <option>,<isindex>, <label>, <fieldset>, <legend>, <optgroup>*	*<img>*	*<table>,<meta>, <base>,<object>, *

Table 1 – HTML tags classified by their behavior

Window events	**Form events**	**Image events**	**Keyboard and mouse events**	**Other events**
onload onunload	*onchange, onsubmit onreset, onselect onblur, onfocus*	*onabort*	*onkeydown, onkeypress, onkeyup, onclick, ondblclick, onmousedown onmousemove, onmouseout onmouseover, onmouseup*	*onerror*

Table 2 – HTML events classified by their behavior

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3. Mutation of the basic attack vectors

In many cases, we will found the initial attempted exploits do not actually get returned unmodified by the server, and so do not succeed in executing the JavaScript. That's because the application made some processing on our input. There are three broad methods to prevent the executing of our JavaScript (Stuttard and Pinto, 2008):

1. There is a list of attack signature in the application and it blocks the input altogether.
2. The application accepts the input but perform some kind of sanitization or encoding on the attack string.
3. The application truncates the attack string to a fixed maximum length.

We can bypass some application's processing by using a series of measures if the filtering rules are not sufficient. Next we will discuss various ways in which we can bypass the obstacles presented by the application's processing (Shar & Tan, 2012). If the filters check for only the usual lowercase version of malicious tags, these filters can be bypassed by varying the case. For example:

<scRipT >alert('xss')</sCriPt >

Many filters match specific tags, including the opening and closing angle brackets. We can add a whitespace before the closing bracket, thus bypass the filter. For example:

<script >alert('xss')</script >

If the sanitization is not applied recursively, it may be possible to smuggle that expression past the filter. For example:

<scr<script>ipt>alert('xss')</scri</script>pt>

For some complex filtering rules, we have other solutions. One option is insert the ASCII of control characters into the code, in order to confuse the filter rules. For example:

<img src="ja
 vasc
ript:alert('xss')" />

Sometimes we will find that not all the characters such as javascript are filtered out. Only the special characters in HTML tag will be filtered out. This lead another way to bypass the filter. In that way, we insert another attribute in front of the attribute of inject JavaScript. We can insert a confusing character into the attribute which the application misunderstanding as a tag terminating character, so that the filter can be bypassed. For example:

<img src="abc>" onmousemove="alert('xss')">

Since browsers ignore the comment symbol for each code, we can insert some comment characters in the code to bypass the filter. For example:

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The attack vectors can be HTML-encoded in various ways that are tolerated by many browsers because the browser will decode your payload again. This is another way to bypass the filter. For example:

<img src=javascript:a

lert('XSS')>

The basic attack vectors can be mutated by the used of methods just illustrated, so that they can bypass the filtering rules of web applications.

4. Evaluation

We developed a tool to realize the approach illustrated above. The tool can generate a large number of attack vectors for stored-XSS automatically, including the basic attack vectors and the mutated attack vectors. Choices of four generation methods and four mutation methods are provided in the tool. The choices of generation methods include use <script>, use event, use pseudo-URL and use CSS. The choices of mutation methods include use nesting, insert confusing characters, vary the case and use HTML-encode. We can also add and delete the HTML tags and events according to our need. The attack vectors are generated and saved in a .txt file.

To test the useful of our technology, we choose some HTML tags, events and all of the methods, and then generate numbers of attack vectors. Table 3 show the detail of the generation methods used.

HTML tags	HTML events	Generation methods	Mutation methods
*<body>, <input>, <img>, <table>, *	*onload, onselect, onabort, onmousemove, onerror*	*use <script>* *use event* *use pseudo-URL* *use CSS*	*use nesting* *insert confusing characters* *vary the case* *use HTML-encode*

Table 3 – HTML tags, events and methods used

We input the attack vectors on a famous online video site in China. The website has a blog system that allows users input HTML format contents. We use WebFuzz to post the attack vectors. WebFuzz is an open source application written by C#, and it can send custom HTTP requests to a host automatically (Sutton M, 2007). We made some improvement to WebFuzz so that it can sent HTTP POST requests correctly. The steps of the test are listed below (also see Fig. 1):

Attack vectors are saved in an xssinjection.txt file, so that the WebFuzz can read it.

The WebFuzz read the xssinjection.txt file line by line and post them to the application automatically.

The Application respond and return the results.

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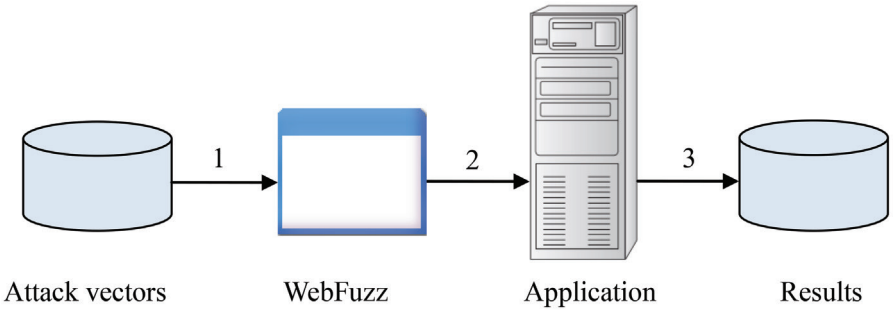

Figure 1 – The steps to identify stored-XSS of a web application

We post 648 attack vectors on the application and 16 of them succeed and get returned unmodified by the server. Some of the succeed attack vectors are listed below:

<img style="xss: expression(alert('xss'))">

<input onerror="alert('xss')" src="#" type="image">

<img src="javascript: alert('xss');">

This was an expected result, and it demonstrates the effectiveness of our approach.

5. Conclusions

In this paper, we discuss the methods how to generate and mutate the attack vectors for stored-XSS automatically. We developed a tool to realize the methods. The results of the evaluation clearly show the sufficiency and effectiveness of our technology.

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Research on Construction of Implementation System of Political Education & Ideological Education of Computer Network for Undergraduates

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Abstract: based on extensive absorption of research achievements on network ideological and political theory of predecessors and under the precondition where much disciplinary knowledge including computer science, management, communication and pedagogy, etc is widely used for reference and applied, the paper has blended concepts of system engineering, project management and standardized construction, and integrated national leading practical case on network political education & ideological education. Starting with the view of paying attention to application and striving to effectiveness, the scheme on construction of implementation system of network political education & ideological education of colleges and universities has been proposed, which provides useful reference and basis for implementation process of network political education & ideological education of colleges and universities.

Keywords: political education & ideological education, computer network, college students, system implement.

1. Introduction

In the network information age, website has become the first information dissemination media and main source to obtain information for all teachers and students in addition to interpersonal society. Network culture has enjoyed popular support and become an important force for shaping the ideology of human beings. The development of network society makes political education & ideological education transferred to network culture position, and the level and effect of network political education & ideological education concern the sound development of socialist culture undertakings and culture industries, the safety of national cultural information and national long-term stability, as well as the overall situation of socialism with Chinese characteristics. As the cradle for talent cultivation, base for scientific and technological innovation, position for advanced culture, original place for new ideas and window for social service, colleges and universities play important role in undertakings on construction of socialism with Chinese characteristics. It is the significant historical mission for political education & ideological education

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workers to cultivate advanced socialist construction talents with unwavering political stand and lofty ideology and morality and to escort socialist construction (Winter, 2002). Therefore, the important task faced by educational circles includes constructing feasible implementation system of network political education & ideological education of colleges and universities, effectively promoting the level of network political education & ideological education and cultivating all-round developed advanced talents. Hence, I choose the topic of Research on Construction of Implementation System of Political education & ideological education of Computer Network for Undergraduates (Quinonez et al., 2016).

2. Constitution of implementation system of network political education & ideological education of colleges and universities

As sub-discipline of political education & ideological education, the time of development of network political education & ideological education is still short now. Although the educational circles have gotten some theoretical achievements and obtained some practical experience, the research is still not profound and comprehensive. Among these achievements, scholars are used to adopting declarative or definitive words to make qualitative presentation for network theoretical and political education to strive to solve the problem on "how to recognize". Achievements obtained mainly contain the following ten aspects, including: 1. Concept of network theoretical and political education (Chao, 2015). 2. Principle of network theoretical and political education. 3. Target of network theoretical and political education. 4. Features of network theoretical and political education. 5. New opportunity brought by network theoretical and political education. 6. New challenge presented by network to theoretical and political education. 7. Means and methods of network theoretical and political education. 8. Guarantee mechanism of network theoretical and political education. 9. Operating mechanism of network theoretical and political education. 10. Content domain of network theoretical and political education (seen in Figure 1).

Mediator system of network theoretical and political education of colleges and universities is the approach and method taken and information exchanged for education to object of education by subject of education to reach a certain education target, and it is the "education link" acted on object of education by subject of education in the process of implementation of network theoretical and political education (Eck, 2008). Mediator of network theoretical and political education of colleges and universities contains work carrier of network theoretical and political education of colleges and universities, content carrier of network theoretical and political education of colleges and universities and the method of network theoretical and political education of colleges and universities.

Construction and operation system of network political education & ideological education of colleges and universities is the general term of construction principle confirmed, construction method and operating means adopted for education environment and education mediator by subject of education to reach a certain education target in the process of implementation of network political education & ideological education of colleges and universities (Julian, 2000). Construction and operation system of network political education & ideological education of colleges and universities includes construction principle of network political education & ideological education of colleges

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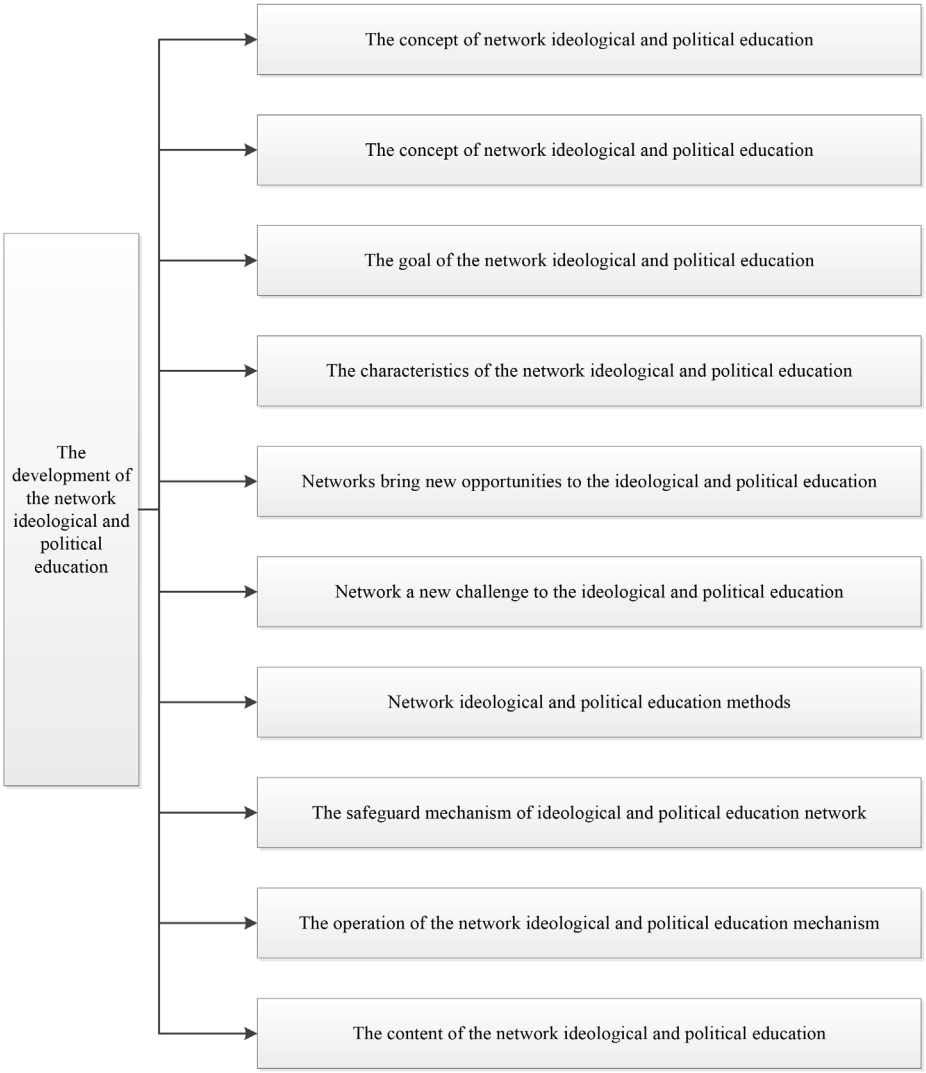

Figure 1 – The development of the network political education & ideological education

and universities, construction method of network political education & ideological education of colleges and universities and operating mechanism of network political education & ideological education of colleges and universities (GREGORY, 2003, Gonçalves et al., 2016). Support and guarantee system of network political education & ideological education of colleges and universities is the general term of construction method and cultivation method adopted for subject of education, evaluation and measurement method and effect guarantee mechanism for education effect by subject of

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education to reach a certain education target in the process of implementation of network political education & ideological education of colleges and universities (Hakhverdian et al., 2012). Support and guarantee system of network political education & ideological education of colleges and universities contains team construction of network political education & ideological education of colleges and universities, detecting and evaluating method of network political education & ideological education of colleges and universities and safeguard method of network political education & ideological education of colleges and universities. See Figure 2 for each part of implementation of system of website on network political education & ideological education of colleges and universities.

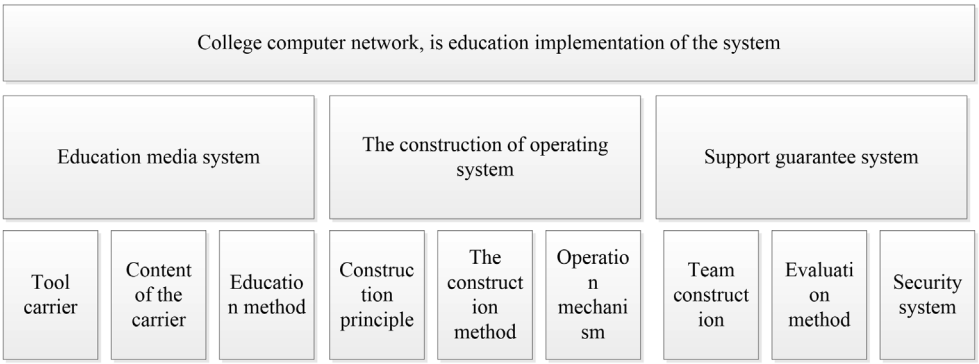

Figure 2 – College computer network, is education implementation of the system

3. Construction and operation system of network political education & ideological education of colleges and universities

Construction and operation system of network political education & ideological education of colleges and universities is the general term of construction principle confirmed, construction method and operating means adopted for education environment and education mediator by subject of education to reach a certain education target in the process of implementation of network political education & ideological education of colleges and universities (Gough, 1994). Construction and operation system of network political education & ideological education of colleges and universities includes construction principle of network political education & ideological education of colleges and universities, construction method of network political education & ideological education of colleges and universities and operating mechanism of network political education & ideological education of colleges and universities.

3.1. Basic procedure for construction of website on network political education & ideological education of colleges and universities

Website on political education & ideological education discussed in the paper is the comprehensive position for network political education & ideological education starting with the overall situation of network political education & ideological education of colleges

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and universities, containing all contents, overall argumentation, unified construction and joint operation and maintenance on network political education & ideological education of colleges and universities and oriented to all teachers and students for implementation of education under digitized campus environment, and it is the place where the soul of advanced network culture of colleges and universities is located.

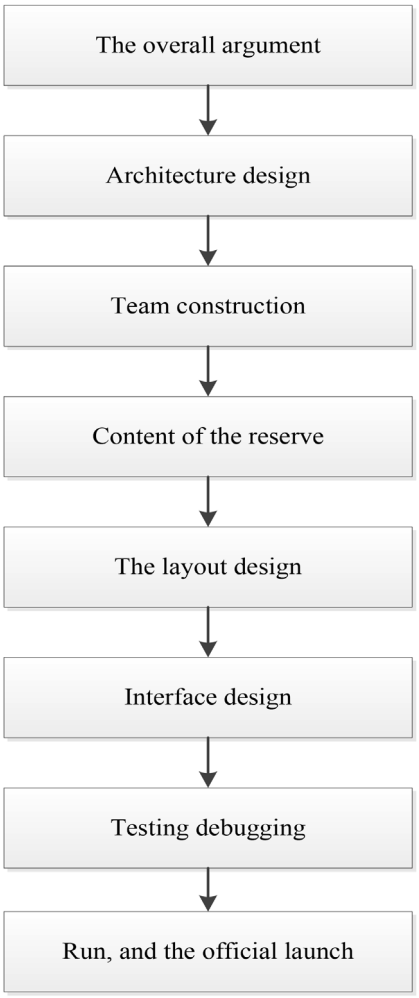

Figure 3 – political education & ideological education website construction process

It is necessary for construction of website on political education & ideological education of colleges and universities to apply political education & ideological education, computer science, communication, pedagogy, marketing, management and other relevant multi-disciplinary knowledge, which is a kind of complex system engineering. Its construction

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procedure generally includes eight stages of overall argumentation, architecture design, team preparation and construction, content store, layout design, interface design, inspection and commissioning, trail operation and official release(seen in Figure 3).

Overall argumentation is the first stage for construction of website on political education & ideological education of colleges and universities, which is mainly to research, judge and make decisions for significant problems. It determines the fundamental strategy of website construction and the place where website soul is located. Main tasks in this stage include: ① investigating and surveying audience demands for result analysis; confirming education contents in the macro level, especially key education contents and characteristic education contents, and determining that which kind of content carrier is to be constructed based on this; ② cleaning up the relation between website on political education & ideological education of colleges and universities and other website of the whole school, such as the relation between core and subject and that between specialization and generalization; ③ cleaning up the relation between existing scattered website on political education & ideological education and that nearly newly established, and confirming contents to be reused and website modification scheme; ④ research tool carrier to be used with determination, and confirming single sign-on and data integration schemes; ⑤ estimating construction period, appropriation expenditure and labor cost. Architecture design is the second stage for construction of website on political education & ideological education of colleges and universities, and it determines website information nodes and relation between them, which is the most critical link for construction of virtual contents of website and equivalent to skeleton of website establishment (Dung, 2005). Main tasks in this stage include: ① subdividing category of information nodes, and distinguishing the primary and secondary of information nodes; ② clearly specifying the attribute of information node in four dimensions containing W (meaning page as the uncategorized node), X (meaning information node collection), Y (meaning similar information node collection) and Z (meaning marginal information node collection), and establishing overall model of information node. At the time of design in such stage, pay particular attention to avoiding that node shall not be effectively updated and is the nominal node not focused by audiences, and it is specially noted that other component parts with campus network culture are reasonably integrated (Hakhverdian et al., 2012).

Team preparation and construction are the third stage for construction of website on political education & ideological education of colleges and universities, and it determines the constitution of team personnel, division of task, working mechanism and cooperative relationship, which is the safeguard for website operation and equivalent to blood vessel of website. Main tasks in this stage include: ① carrying out explanation on structure of content carrier, training of application of tool carrier and work method training; ② initially establishing working mechanism, safe security mechanism, management method of contents published and relevant management provisions.

Interface design is the sixth stage for construction of website on political education & ideological education of colleges and universities. In this stage, the vision art design and information node packaging are carried out for website, and the actual user interface is formed, which is equivalent to designing costume for website and building overall image. Main tasks in this stage include: ① confirming the mood of website design style

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according to campus cultural characteristics; ② designing base style sheet for website according to principle of easy use and feasible design; ③ designing interface scheme with population correlation and different characteristics for each advanced information node; ④ comprehensively designing and configuration all or different levels of information node interfaces.

Inspection and commissioning are the seventh stage for construction of website on political education & ideological education of colleges and universities, and it determines the overall quality and degree of reliability of website. Main tasks in this stage include: ① reviewing design quality of information node, and modifying design defects; ② reviewing quantity, quality and standardization of content store; ③ checking to see whether software setting and website setting are correct and reasonable; ④ checking safety of equipment, such as server, etc, under configuration; ⑤ carrying out simulated load test and security attack, and solving problems if they are discovered.

3.2. Standardization management mechanism

Work procedure system is the sum of each kind of work procedure of education activity implemented by special agency for network political education & ideological education and each relevant organization in the practice of network political education & ideological education (Lai and Liu, 2014). Work procedure system with reasonable design may guarantee well-ordered implementation of network political education & ideological education, increase efficiency and reduce of internal consumption. Work procedure system generally includes information audit and release procedure, website and special subject construction procedure, website application system deploy and application procedure, website safe operation procedure, website co-construction procedure, activity co-organization procedure, questionnaire inquiry procedure and program development procedure, etc.

Post responsibility system is the sum of post responsibilities of network political education & ideological education workers, and it plans the constitution of division of labor of network political education & ideological education personnel, and stipulates specific responsibilities of each post (Obakhedo, 2011). Post responsibility system contributes to defining relation among responsibilities, rights and benefits in the work for educators, understanding the mutual relation among other posts in business collaboration and making education practice target clear and has purpose. Post responsibility system generally includes instruction for management post responsibility, instruction for editing post responsibility and instruction for technology post responsibility of special agency for network political education & ideological education, containing all instructions for post responsibility relevant to education full-time personnel and part-time personnel of organization, and instructions for post responsibility of part-time student cadre and work-study students participating in education.

Office platform is the network transit hub of network political education & ideological education information, which plays role in management and coordination of education work of each relevant organization and educator himself. Office platform contributes to improving efficiency of education management and operation; it carries relevant notice and accouchement, education news, work guideline, learning material, working arrangement, presentation and report, request and application, opinions and

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suggestions as well as related administrative document of network political education & ideological education, and generally shares a set of network office system with network culture construction.

3.3. Product strategy and construction mechanism

Project construction mechanism is the construction mechanism of political education & ideological education with high level and quality, and the business normal form and operating rule of education products under independent design and realization by special agency for network political education & ideological education in addition to carrying out joint activity organization and website co-construction works with cooperative organizations (Tang, 2012). The objects of project construction mechanism are core website and characteristic website on political education & ideological education, and these websites include national key co-construction projects, school characteristic brand work and core websites on political education & ideological education. In such websites, it reflects work level and education ability based on main direction of network political education & ideological education of school, and whether they have rich information, excellent contents and are popular with audiences may all directly affect cultivation of behavior, cognition and ideological and ethical standard of teachers and students (Xiao, 2009).

Construction of information channel is an important aspect for invigoration of construction of network political education & ideological education contents, and the construction level of information channel directly affects quality and quantity of political education & ideological education information and education effectiveness. It consists of two parts of contents including the down-going information dissemination and up-going information dissemination. The down-going information dissemination means educational product delighted to hear and see by teachers and students of construction, and the construction goes deep into teachers and students and makes education contents sent to basic level to develop effectiveness with extensive information channels covered (Weisseno and Eck, 2012). The up-going information dissemination means establishing all kinds of education topic projects with rich intension and edutainment to encourage and attract relevant organizations, educators, all teachers and students to participate in construction of network political education & ideological education and to plan, design, create and transport educational resources for enriching form and resource of political education & ideological education.

Construction of product pedigree is the key of long-term development of website on political education & ideological education, and it determines the design of education product system and education product constitution of website on political education & ideological education, as well as the self-development, education ability and follow-up ability to situation policy of website on political education & ideological education. Core constitution of product pedigree is mainly dominated by 9 kinds of core information nodes on network political education & ideological education including information node of political education & ideological education, information node of political education, information node of public opinion guiding education, information node of patriotism education, information node of national defense education, information node of cultural quality education, information node of campus cultural education, information node

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of psychological health education and information node of legal education, and it is supplemented by information node of three aspects of education. Subsidiary functional structures, such as search engine, information promotion position and discussion board, etc, sometimes may also appear as education product subsidiary structure.

4. Support and guarantee system of network political education & ideological education of colleges and universities

4.1. Moral education guarantee law

Moral education guarantee may be carried out through off-line education and on-line education. The off-line education shall give full play to functions of education, guidance and prevention. Course of moral education shall set up contents relevant to network moral education, such as *Network Ethic and Morality* and *Network Behaviors Standard*, etc. By linking theory with practice and combining case-based teaching, the importance of moral quality in network society is indicated to educates, and the correct network moral idea is formed under cultivation to them to urge them to restrain and standardize their personal speech and behaviors on their own initiative. The on-line education shall strengthen edification, infection and assimilation of advanced network culture (Yang, 2010). It is necessary to actively establish advanced network culture position; vigorously carry forward advanced spiritual civilization; make efforts to build favorable network educational environment; provide harmonious network educational atmosphere and give full play to leading function of moral education of advanced culture, so that all students may be urged to get online and use network with civility, and the improvement of their personal moral quality could be realized.

4.2. Laws and regulations guarantee law

Legal guarantee is the fundamental guarantee of network political education & ideological education of colleges and universities. Laws are management clauses prepared, issued and executed by the country, and it stipulates relation between right and obligation of citizen, which has general binding force and coercive force of the state (Brunold, 2006). As the reflection of national will, laws and regulations may fundamentally protect successful implementation of political education & ideological education practice, all of which are the most solid and reliable educational education guarantee. Although network society exists in the form of being "virtual", it equally carries activity of human beings and has relation with human beings in realistic society, which also needs intervention, regulation and control of laws. Especially, when the network is regarded as carrier of culture and position of political education & ideological education, compulsory means and measures must be taken for management and control to guarantee healthy contents and harmonious atmosphere of network position.

4.3. Technology guarantee law

Technology guarantee is the regular guarantee of network political education & ideological education of colleges and universities. Technology is the foundation of existing of network society, the footstone of development of network culture and the channel of

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circulation of network information. Without Internet technology and computer science and technology, there is almost no network civilization. As a double-edged sword of information society, on the one hand, the technology powerfully drives development of economic society and promotes prosperity of cultural society; on the other hand, all kinds of bristletails are bred, and these bristletails constitute any damage to people's economic benefit even personal safety and further affect the health of Marxism spiritual civilization. This requires that we must make good use of technology weapon to make bristletail killed in the cocoon ova. As the guarantee of political education & ideological education, the technology is mainly applied in the following several aspects, and the first is DNS diversion mechanism; the second is search engine for bad information; the third is IP real-name system management, and the fourth is content screening.

4.4. Public opinion guarantee law

Public opinion guarantee is the critical guarantee of network political education & ideological education of colleges and universities. Public opinion determines the direction of ideology of audiences in event, which has significant influence on quality of network political education & ideological education, on-line and off-line speech and activity of audiences (Monteiro & Daniel, 2011). With rapid development of Internet, the function of network as communications media and carrier of culture is being strengthened continuously. With increase of the number of undergraduates surfing the Internet, the public opinion force of undergraduates to network news and events is also being increased, and for characters and events widely drawing public attention of audiences, some heated debates and comments frequently arise by them. Agency for network political education & ideological education shall inflict close attention on and make appropriate regulation and control for dynamic state of public opinion with relatively sensitive contents and cluster explosion characteristics. It is an important task for public opinion guarantee to make the ideology of audiences in a positive status.

4.5. Policy guarantee law

Policy guarantee is the fundamental guarantee of network political education & ideological education of colleges and universities. Policy is the action principle established for realization of a certain target and the political measure for distribution and regulation of resource and benefit. Favorable policy guarantee may promote a quicker and better development of network political education & ideological education practice, and relevant organizations must lay emphasis on providing policy guarantee in the four aspects of talent policy, material policy, funds policy and administrative policy for network political education & ideological education.

5. Conclusions

The paper has provided relatively comprehensive education mediator system, construction and operation system, support and guarantee system for implementation of network political education & ideological education of colleges and universities, which may effectively promote the construction level and education effect of network political education & ideological education of colleges and universities. Theoretical achievements

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researched in the paper are the important supplement for network political education & ideological education in the fields of education carrier, education content and education methods, etc. Although the research target is set by aiming at population of colleges and universities, the design thought, implementation method and theoretical framework all also have high universality and applicability for network political education & ideological education of all sectors of society. Through the enrichment of research achievements in the paper, the disciplinary knowledge system on network political education & ideological education will be further mature and improved.

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Research on the Competitiveness of Talents in Eastern China based on Data Mining

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Abstract: On the basis of related research, we constructed an evaluation index system of talent competitiveness. Values are assigned to the indices with the use of the entropy weight method, so that reflecting the characteristics of competitiveness between different evaluation objects. In order to include more uncertainties of raw data in the evaluation process, the evaluation results were expressed by intuitionistic fuzzy sets and the data output was aggregated accordingly. By using the intuitionistic fuzzy information based data mining comprehensive evaluation method, a comparative research was conducted on different levels of talent competitiveness in eastern China. Meanwhile, some targeted advices were offered with respect to promoting the competitiveness levels of talents in eastern China.

Keywords: data mining, intuitionistic ambiguity, talent competitiveness, comprehensive evaluation

1. Introduction

The Internet is both a tool and a way of thinking. The "Internet Plus" action plan is helping develops a new type of operation. It has become a development priority for China to deepen the implementation of innovation-driven development strategy. Nowadays, as the Internet is more and more leading the innovation-driven development, the country has entered a new stage of innovation, transformation and development. According to national statistics and forecasting, the Internet will lift China's GDP by 0.3%-1.0% from 2013 to 2025. This means that in the next decade or more, the contribution of the Internet to GDP will gain a new height as a crucial engine of economic progress (Cao and Zou, 2014). Technology is the primary productive force, and its most active and pioneering component is talents—the first resource and the pillar of scientific and technological innovation. As China's economic center, the eastern region has a high level of science and education, with massive talents being attracted here. The economic and social growth in eastern China has an important role to play in leading and promoting national economy. Therefore, we researched into talent competitiveness in eastern China in the Internet age as well as the difference between talents fostering at the regional level. Our research findings are of great practical significance to the implementation of regional measures to comprehensively uplift all-round talent competitiveness.

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2. Overview of the research area

Eastern China lies in the eastern margin of Asian Continent, on the west coast of the Pacific Ocean. It covers the northeastern areas in China, the eastern margin of North China, East China, the southeastern areas in China and the southern and eastern sea areas including Bohai Sea, Yellow Sea, East China Sea and South China Sea. There are several provinces and municipalities in eastern China, such as Beijing Municipality, Tianjin Municipality, Shanghai Municipality, Hebei province, Jiangsu province, Zhejiang province, Fujian province, Shandong province, Guangdong province, and Hainan province. The resource-rich eastern areas have regional superiority with respect to science and education, by encompassing the economic, political and cultural centers of China. Over 50% talents are accumulated in the area, as the major driving source of national innovation (Fortes et al., 2016).

Objective layer	Factor layer	Weight	Index layer	Weight	Unit
talent competitiveness	*Talent resource*	0.369	Technical personnel number per ten thousand people	0.101	people
			The overall number of scientific and technological staff	0.083	10^5 thousand people
			The growth rate of scientific and technological staff	0.071	%
			The number of universities, colleges, and science and technology institutes	0.063	-
			The number of students in colleges and universities per 10, 000 population	0.051	people
	Talent input	0.327	Investment in research and development	0.102	100 million yuan
			The ratio of investment in research and development to GDP	0.081	%
			The sum of appropriation expenditure on science and technology activities	0.063	100 million yuan
			Education appropriation input	0.081	100 million yuan
	Talent output	0.304	The number of accepted patent application	0.094	Piece
			The number of science and technology papers	0.064	-
			The volume of transaction of technical contracts	0.085	100 million yuan
			The added value of high-tech industry	0.061	100 million yuan

Table 1 – The talent competitiveness evaluation index system in eastern China

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3. Construction of the evaluation index system and evaluation method

3.1. The principle of evaluation index system construction

1. Scientificity. Evaluation indices should be selected in accordance with the nature and characteristics of talent competitiveness in the internet context; subjective judgment should be reduced or avoided as far as possible, so that reaching the goal of evaluation and comparison.
2. Operability. Quantitative or easy-to-quantify evaluation indices are a preference. Based on the analysis of factors of talent competitiveness in eastern China, we take full advantage of the statistical indexes released by the government statistics department and corresponding index data, in order to ensure data authenticity.
3. Dynamicity. The evaluation index system constructed in the paper should fit for the requirements of the time, and keep up with the latest research achievements at home and abroad. The research reports from international organizations and policy documents formulated by Chinese government departments should be the source of new evaluation indices free for dynamic update.

3.2. Construction of evaluation index system

Based on the principle of talent competitiveness evaluation index system construction at the regional level as well as related studies (Zhu et al., 2012; Li and Yang, 2013), we stratified and methodized the regional talent competitiveness evaluation index system into a three-layer hierarchic structures. The objective is to identify the evaluation indices themselves and their relationships in the internet age. Specifically speaking, the three layers are objective layer, factor layer and index layer, as listed in Table 1.

3.3. Determination of the intuitionistic fuzzy information evaluation method based on data mining

In the context of the Internet era, the research issue of talent competitiveness evaluation in eastern areas of China can be treated as a comprehensive evaluation project of city-varying talent competitiveness in the same set of evaluation criteria. The intuitionistic fuzzy information based on data mining evaluation method is used here to research on the project.

1. The standardization of evaluation indicators

In order to eliminate the difference in non-uniform evaluation index dimensions, we necessarily standardize raw data. If the index value of the target a_i in the evaluation index c_j is x_{ij}, the data normalization method of c_j is:

For positive indicators, the normalized formula is

$$X'_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \tag{1}$$

For negative indicators, the normalized formula is

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$$X'_{ij} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}} \tag{2}$$

If the evaluation values of different targets are deemed to obey the normal distribution, we may have $\max x_{ij} = \bar{x}_j + 3\sigma_j$, $\min x_{ij} = \bar{x}_j - 3\sigma_j$, where $\bar{x}_j$ and σ_j are the respective mean value and standard deviation of each evaluation index. In the case that the two cycles of values are considered, the standardized value of c_j related a_i may be more than one. We let the smaller one is $\mu^l{}_{ij}$, and the bigger one is $\mu^u{}_{ij}$.

In the intuitionistic fuzzy value, the membership degree $_{ij}$ is an expression of the worst performance of the evaluation target in the worst criteria. The fuzziness index $\pi_{ij} = 1 - (\mu_{ij}) - (\nu_{ij})$ reflects the fuzzy degree of μ_{ij}, which means that the actual performance falls into the interval of $[\mu_{ij}, 1-\nu_{ij}] = [\mu^l{}_{ij}, \mu^u{}_{ij}]$, where $\mu^l{}_{ij}$ and $\mu^u{}_{ij}$ are the respective upper boundary and lower boundary of the interval obtained in the process of standardizing evaluation index data (Chen et al., 2014). Therefore, we have $\mu_{ij} = \mu^l{}_{ij}$, $\nu_{ij} = 1 - \mu^u{}_{ij}$. Accordingly, we acquire the intuitionistic fuzzy evaluation data of evaluation indices.

2. Weight assignment of evaluation indices

The relative importance of a random evaluation indicator c_j in the evaluation index set can be expressed by the weight W_j. As said before, the importance is directly controlled by the competitiveness situations among different schemes. Such being the case, we adopt the following entropy weight method to calculate the situation-based index weight.

Assuming that there are n evaluation indexes in m to-be-evaluated schemes with unknown weight, we thus obtain a multi-index evaluation matrix $X = (x_{ij})_{m \times n}$

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$$

Where x_{ij} is the original value of the i th evaluation index of the j th to-be-evaluated scheme.

In light of the great difference between both the dimension and the order of magnitude of different evaluation indexes, the first step is to normalize the raw data, whose approaches are seen in (1) and (2).

Next, we calculate the information entropy E_i of the i th evaluation index

$$E_i = -1/\ln(m) \sum_{i=1}^{n} \frac{q_{ij}}{q_j} \ln\left(\frac{q_{ij}}{q_j}\right) \quad (i = 1, 2, \dots, m;\ j = 1, 2, \dots, n) \tag{3}$$

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Where q_{ij} is the normalized value of the raw index data of x_{ij} , q_j is the sum of normalized value of evaluation indices in the year of j . We let $\frac{q_{ij}}{q_j}\ln(\frac{q_{ij}}{q_j})=0$ when $\frac{q_{ij}}{q_j}=0$.

Finally, according to the entropy theory, the information entropy E_i of the i th evaluation index is obtained and used to calculate the weight of the i th index:

$$Q_i=(1-E_i)/(n-\sum_{i=1}^{n}E_i)\ \ (i=1,2,\ldots,n) \tag{4}$$

Where Q_i is the weight of the i th evaluation index, E_i is the information entropy of the i th evaluation index, n is the number of evaluation indices. Also, we have $\sum_{i=1}^{n}Q_i=1$, $Q_i \in[0, 1]$.The entropy weight method based index weight is listed in Table 1.

3. Collection and comparison of evaluation information

In the evaluation process, we collect the intuitionistic fuzzy evaluation results of different evaluation indices according to the calculation result of intuitionistic fuzzy sets. The formula of a pair of arbitrary intuitionistic fuzzy sets $\widetilde{B}$ and $\widetilde{Q}$ as well as the real number$\beta\geq 0$ is

$$\widetilde{B}+\widetilde{Q}=\left\{\left(\left\langle x,\mu_{\widetilde{B}}(x)+\mu_{\widetilde{Q}}(x)-\mu_{\widetilde{B}}(x)\mu_{\widetilde{Q}}(x),\nu_{\widetilde{B}}(x)\nu_{\widetilde{Q}}(x)\right\rangle\right)\middle|x\in X\right\} \tag{5}$$

$$\widetilde{B}\widetilde{Q}=\left\{\left(\left\langle x,\mu_{\widetilde{B}}(x)\mu_{\widetilde{Q}}(x),\nu_{\widetilde{B}}(x)\nu_{\widetilde{Q}}(x)-\nu_{\widetilde{B}}(x)\nu_{\widetilde{Q}}(x)\right\rangle\right)\middle|x\in X\right\} \tag{6}$$

$$\beta\widetilde{B}=\left\{\left(\left\langle x,1-(1-\mu_{\widetilde{B}}(x))^{\beta},(\nu_{\widetilde{B}}(x))^{\beta}\right\rangle\right)\middle|x\in X\right\} \tag{7}$$

$$\widetilde{B}^{\beta}=\left\{\left(\left\langle x,(\mu_{\widetilde{B}}(x))^{\beta},1-(1-\nu_{\widetilde{B}}(x))^{\beta}\right\rangle\right)\middle|x\in X\right\} \tag{8}$$

Thus, the target a_i 's intuitionistic fuzzy evaluation result obtained in different criteria is $\widetilde{a_{ij}}=\left\langle\mu_{ij},\nu_{ij}\right\rangle$ (j =1, ...n) . According to the index weight vector $W=(w_1,\ldots w_n)^T$, the comprehensive evaluation result can be expressed by the intuitionistic fuzzy weighed mean operator M_w ;

$$\widetilde{a_i}=M_w(\widetilde{a_{i1}},\ldots\widetilde{a_{in}})=\sum_{j=1}^{n}(w_j\widetilde{a_{ij}})=\left\langle 1-\prod_{j=1}^{n}(1-\mu_{ij})^{w_j},\prod_{j=1}^{n}(\nu_{ij})^{w_j}\right\rangle \tag{9}$$

Accordingly, the overall and factor-layer-level intuitionistic fuzzy evaluation result of all indices is:

The overall value

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$$\widetilde{a_i} = \left\langle 1 - \prod_{j=1}^{13} (1-\mu_{ij})^{w_j}, \prod_{j=1}^{13} (\nu_{ij})^{w_j} \right\rangle, \ i = 1...10; \tag{10}$$

The talent resource value;

$$\widetilde{a_i}' = \left\langle 1 - \prod_{j=1}^{5} (1-\mu_{ij})^{w_j'}, \prod_{j=1}^{5} (\nu_{ij})^{w_j'} \right\rangle, \ w_j' = w_j / \sum_{j=1}^{5} w_j, \ i = 1...10 \tag{11}$$

The talent input value;

$$\widetilde{a_i}'' = \left\langle 1 - \prod_{j=1}^{4} (1-\mu_{ij})^{w_j''}, \prod_{j=1}^{4} (\nu_{ij})^{w_j''} \right\rangle, \ w_j'' = w_j / \sum_{j=1}^{4} w_j, \ i = 1...10 \tag{12}$$

The talent output value;

$$\widetilde{a_i}''' = \left\langle 1 - \prod_{j=1}^{4} (1-\mu_{ij})^{w_j'''}, \prod_{j=1}^{4} (\nu_{ij})^{w_j'''} \right\rangle, \ w_j''' = w_j / \sum_{j=1}^{4} w_j, \ i = 1...10 \tag{13}$$

With the comprehensive evaluation result of various schemes, we realize the comparative analysis of talent attraction in different regions (Hong and Choi, 2000; Puello et al., 2016). In comparing the volume of two intuitionistic fuzzy sets, we define the score function Δ and the precise function σ of an arbitrary intuitionistic fuzzy set $\widetilde{A} = \langle \mu_{\widetilde{A}}, \nu_{\widetilde{A}} \rangle$ as:

$$\Delta(\widetilde{A}) = \mu_{\widetilde{A}} - \nu_{\widetilde{A}} \in [-1,1], \sigma(\widetilde{A}) = \mu_{\widetilde{A}} + \nu_{\widetilde{A}} = 1 - \pi_{\widetilde{A}} \in [0,1]$$

Thus, for arbitrary intuitionistic fuzzy sets $\widetilde{A} = \langle \mu_{\widetilde{A}}, \nu_{\widetilde{A}} \rangle$ and $\widetilde{B} = \langle \mu_{\widetilde{B}}, \nu_{\widetilde{B}} \rangle$

If $\Delta(\widetilde{A}) > \Delta(\widetilde{B})$, we have $\widetilde{A} > \widetilde{B}$

If $\Delta(\widetilde{A}) = \Delta(\widetilde{B})$, we have three sub-results:

(a) If $\sigma(\widetilde{A}) > \sigma(\widetilde{B})$, we have $\widetilde{A} > \widetilde{B}$;

(b) If $\sigma(\widetilde{A}) = \sigma(\widetilde{B})$, we have $\widetilde{A} = \widetilde{B}$;

(c) If $\sigma(\widetilde{A}) < \sigma(\widetilde{B})$, we have $\widetilde{A} < \widetilde{B}$.

4. Evaluation results and analysis

According to the formulas (1) - (13) of the intuitionistic fuzzy data mining evaluation method (Gonçalves et al., 2015), in combination with the raw value of each evaluation index in 2014 and 2015, we obtain the eastern China talent competitiveness evaluation result in 2015 in the Internet age.

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	Comprehensive Value			Talent Resource			Talent Input			Talent Output		
	μ	ν	Δ	μ	ν	Δ	μ	ν	Δ	μ	ν	Δ
Beijing	0.608	0.389	0.219	0.553	0.402	0.153	0.502	0.316	0.186	0.531	0.383	0.148
Tianjin	0.545	0.391	0.154	0.498	0.413	0.085	0.369	0.301	0.068	0.498	0.404	0.094
Hebei	0.495	0.458	0.037	0.447	0.491	-0.044	0.458	0.401	0.057	0.479	0.432	0.047
Shanghai	0.614	0.367	0.247	0.538	0.436	0.102	0.511	0.372	0.139	0.571	0.391	0.180
Jiangsu	0.597	0.400	0.197	0.467	0.342	0.125	0.457	0.339	0.118	0.501	0.378	0.123
Zhejiang	0.562	0.402	0.160	0.455	0.441	0.014	0.516	0.387	0.129	0.502	0.380	0.112
Fujian	0.548	0.440	0.108	0.417	0.471	-0.054	0.430	0.338	0.092	0.412	0.376	0.036
Shandong	0.562	0.407	0.152	0.493	0.374	0.119	0.473	0.360	0.113	0.485	0.354	0.131
Guangdong	0.574	0.462	0.112	0.426	0.324	0.102	0.546	0.402	0.142	0.481	0.367	0.114
Hainan	0.477	0.442	0.035	0.407	0.462	-0.055	0.479	0.429	0.050	0.461	0.423	0.039

Table 2 – The talent competitiveness evaluation result in 2015 in eastern China

As shown in Table 2 and Figure 1, the overall talent competitiveness is strongest in Shanghai, followed by Beijing, Jiangsu, Shandong and Tianjin. The contributing factors to intensified talent competitiveness include geological advantage, massive universities colleges institutes, well-developed scientific and education resources, talent aggregation, and the governmental support of huge investment in science and education development. In this way, these regions witness the initial driving force of scientific and technological talents to promote economic development and transformation. As a comparison, regions with the weakest and second last weakest talent competitiveness are Hainan and Hebei, respectively. The major cause to the less satisfactory situation is little science and technology activities investment and the small number of universities, colleges, science and technology institutes in these areas. The power of science and technology innovation to promote the development of local high-tech and economy should be strengthened further.

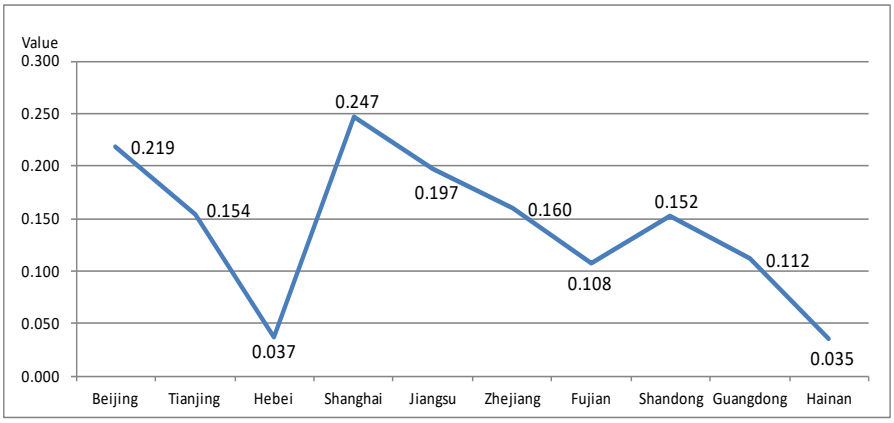

Figure 1 – The talent competitiveness comprehensive evaluation result

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From the figure 2 below, we can see that in terms of human resources, the eastern region of Beijing, Jiangsu, Shandong, Shanghai and Guangdong are the biggest pool of scientific and educational resources, topping the list of the number of universities, colleges and science and technology institutes as well as the percentage of in-school college students in ten thousand population. It lays solid foundation for the enhancement of local talent competitiveness. The scores of talent resource in Hainan, Fujian and Hebei are negative, hitting the bottom of the score list. The major reason is the small number of universities, colleges and science and technology institutes as well as inadequate talent attraction power.

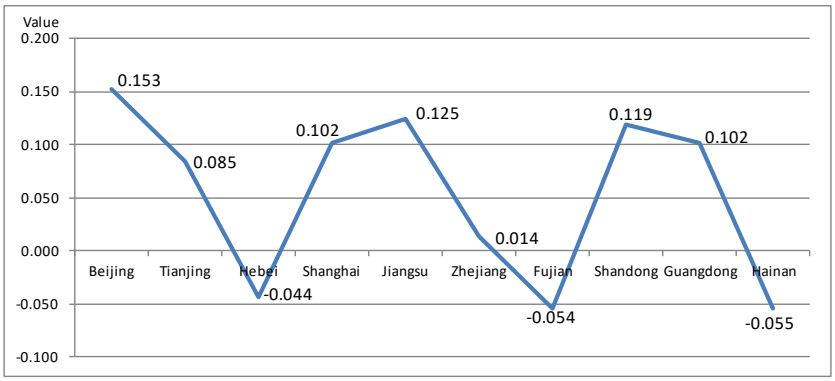

Figure 2 – Human resources evaluation results

As seen in Table 2 and Figure 3, in terms of talent input, Beijing obtains the highest score, followed by Guangdong, Shanghai, Zhejiang, Jiangsu and Shandong. The economy in these regions has been among the forefront of our country, with adequate financial resources, and large appropriation in education, science and development. The area of lowest score in talent input is Hainan, whose economic strength is the worst among the target regions. What is more, the funds for education and science and technology are limited, far less than those in the rest of the regions.

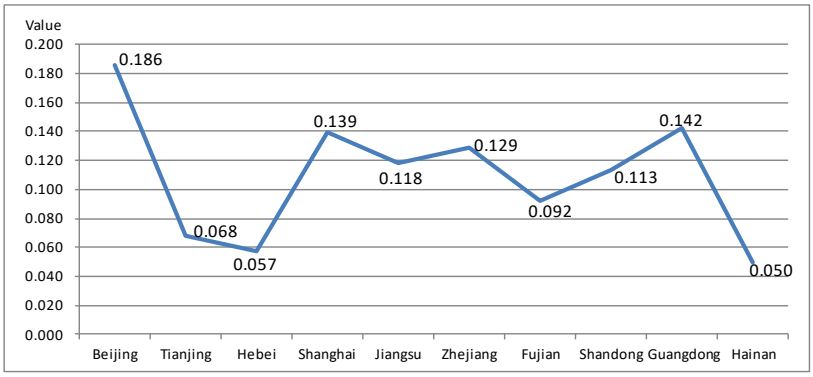

Figure 3 – Halent input evaluation results

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Figure 4 is the talent output evaluation results. By simultaneously referring to Table 2, we find that the highest level of talent output appears in Shanghai, followed by Beijing, Shandong, Jiangsu, Guangdong and Zhejiang. The regions with the last three levels of talent output are Hebei, Hainan and Fujian, respectively. The contributing factors are large investment in talent cultivation, education, and science and technology, and good environment of talent innovation. Remarkable results of economic development and shift have been achieved after more investment is released to talent innovation.

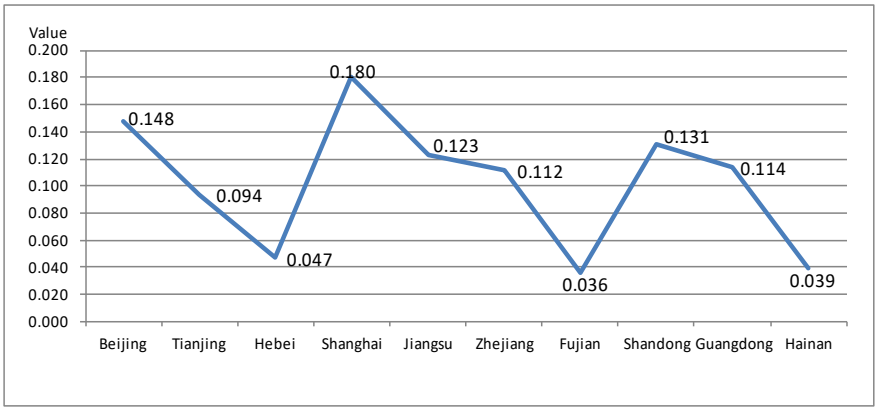

Figure 4 – Talent output evaluation results

5. Conclusion

In this paper, we evaluate the 2015 talent competitiveness in the eastern China in the Internet era. By referring to related research, we establish a talent competitiveness evaluation index system, the data mining evaluation method is adopted on the basis of intuitionistic fuzzy information. The results show that: as a whole, the area of the strongest talent competitiveness is Shanghai, followed by Beijing, Jiangsu, Shandong and Tianjin; the regions with the weakest and second last weakest talent competitiveness are Hainan and Hebei, respectively; the areas of the most abundant science and education resources are Beijing, Jiangsu, Shandong, Shanghai and Guangdong, and the areas of the poorest science and education resources include Hainan, Fujian and Hebei; in terms of talent input, the highest score is obtained by Beijing, followed by Guangdong, Shanghai, Jiangsu and Shandong, and the lowest score is obtained by Hainan; Shanghai has the highest level of talent output, followed by Beijing, Shandong, Jiangsu, Guangdong and Zhejiang, and the worst level of talent output appears in Fujian.

In the Internet era, in order for talents to better play the important role of promoting the regional economic and social development, the talent development efforts in eastern China should be centered on the core connotation of the Internet, especially guided by Internet thinking. Strong impetus should be provided to talent development system

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reform and policy innovation, with an overall planning of the construction of talent teams of all types. The advantaged gained by skilled personnel should be highlighted, so that releasing human and capital bonuses and forming the new situation of talent-driven development. Intense endeavors are suggested for the creation of "new environments" of talent development.

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Finite-time Synchronization of Complex Networks

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Abstract: This paper study finite-time synchronization for complex networks. By the theory of the finite-time stability, the feedback controller is designed to realize finite-time synchronization and exponential synchronization. Not only the unknown structure complex network topological is identified but also the parameters of the complex networks are identified. Numerical simulations are presented to illustrate the effectiveness of the theoretical analysis.

Keywords: Finite-time, Synchronization, Complex Networks

1. Introduction

The types and structure of the complex networks are the same or different, which were confirmed (Tung and Chen, 1993, Lino et al., 2016). Synchronization means that two or more systems can eventually reach common dynamical behavior, which were confirmed (Zhang and Mao, 2002). The synchronization of complex networks is defined that the state of slave complex network state consistent with the master complex network state, which were confirmed (Mahmoud et al., 2008, Mahmoud et al., 2007, Fowler et al., 1983, Gibbon and McGuinnes, 1982, Mahmoud et al., 2010). The exponential synchronization has fast convergence rate which have good effect for synchronization.

Finite-time synchronization has good convergence time which can be calculated in advanced. Finite-time synchronization will be more reasonable than other synchronization due to its synchronization in a given time, finite-time synchronization is more important than asymptotic synchronization. This implies the optimality in settling time. To realize faster convergent time in a control system, finite-time control way is a very important tool. Moreover, the finite-time synchronization with better robustness (Chen et al., 2015).

Up to now, few paper research finite-time synchronization, parameter identification and topology weight identification and exponential synchronization in complex dynamical networks. How one realizes these methods in dynamical networks is an urgent issue to tackle. In this paper, we research how to realize them in time delay networks with disturbance.

This paper is organized as follows. In the second section, finite-time synchronization, parameter identification and exponential synchronization between two complex networks with delay and disturbance are researched. In Section 3, we present how to realize

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finite-time synchronization, parameter identification and exponential synchronization. In Section 4, some numerical simulations are showed to test the effectiveness of theoretical analysis. Finally, some conclusions are drawn in the last part (Lucas and Souza, 2016).

2. Preliminaries

A dynamical system with uncertainty can be showed as follows,

$$\dot{x}(t) = f_i(t, x_i(t)) + g_i(t, x_i(t))\alpha_i \tag{1}$$

where $x_i(t) = (x_{i1}(t), x_{i2}(t), \ldots, x_{in}(t))^T \in R^n$ is the ith node state vector, $\alpha_i \in R^{n_i}$ are unknown parameter vectors, $i = 1, 2, \ldots, N$, n_i is nonnegative integers. $f_i(t, x_i(t))$ is an $n \times 1$ matrix, $g_i(t, x_i(t))$ is an $n \times n_i$ matrix.

The controlled dynamical system can be showed as follows,

$$\dot{y}(t) = f_i(t, y_i(t)) + g_i(t, y_i(t))\hat{\alpha}_i + u_i(t), \tag{2}$$

where $y_i(t) = (y_{i1}(t), y_{i2}(t), \ldots, y_{in}(t))^T \in R^n$ is the ith node state vector, $\hat{\alpha}_i \in R^{n_i}$ are unknown parameter estimated vectors, $i = 1, 2, \ldots, N$, n_i is nonnegative integers. $f_i(t, y_i(t))$ is an $n \times 1$ matrix, $g_i(t, y_i(t))$ is an $n \times n_i$ matrix.

This paper will apply the following definition and lemmas.

Definition 1. The drive–response system is said to be finite-time topology identification and parameter estimated if there is a constant T > 0 so that

$$\lim_{t \to T}(\tilde{c}_{ij} - c_{ij}) = \lim_{x \to T}(\tilde{\alpha}_i - \alpha_i) = 0 \tag{3}$$

Where I, j = 1, 2, ..., N, topology identification and parameters identification is realizing in a finite-time.

Definition 2. The system (2) and the system (1) realize exponentially synchronization if there exists a controller $u(t)$ and positive constants h and a such that the synchronous error satisfies

$$\|e(t)\| \le th \times \exp(-\alpha t), \quad \forall t \ge 0, \tag{4}$$

Where a is called the exponential convergence rate.

Definition 3. Supposing that $W(t)$ is a system's Lyapunov function. If $\dot{W}(t)$ satisfies the following inequality,

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$$\dot{W}(t) \le -\lambda W(t) - \beta W^{\omega}(t), \quad \forall t \ge 0, \; W(0) > 0, \tag{5}$$

then the system (5) can realize exponentially finite-time stable, where $\alpha, \beta > 0$, and $0 < \omega < 1$ are constants. In the inequality (5), λ are the exponential convergence rates and β is the finite-time convergence rates.

Lemmas 1 (Chuang et al., 2012**)** According to **Definition 3**, if the Lyapunov function $W(t)$ satisfies Eq. (5), the following inequality holds:

$$W^{1-\omega}(t) \le -(\beta/\lambda) + \left(\exp\left(\ln(\lambda W(0)^{1-\omega} + \beta) - \alpha(1-\omega)(t-0)\right)/\lambda\right), \; 0 \le t \le T, \tag{6}$$

and $W(t) = 0, \; \forall t \ge T,$ where the finite time T can be illustrated follows,

$$T = \left[\ln\left(\left(\lambda W^{1-\omega}(0)/\beta\right) + 1\right)/\lambda(1-\omega)\right] \tag{7}$$

The finite time T is decided by the positive values of α,β and ω. The following **Lemmas 2** extend from the paper **(**Chuang et al., 2012**)** is applied to prove the main theorem.

Lemmas 2. There exists inequality (8),

$$(a_1 + a_2 + \ldots + a_n)^c \le a_1^c + a_2^c + \ldots + a_n^c \tag{8}$$

where $a_1, a_2, \ldots, a_n$ are all positive numbers and $0 < c < 1$.

3. Finite-time adaptive synchronization in complex networks

We will research finite-time adaptive synchronization in complex networks.

$$\dot{x}_i(t) = f_i(x_i(t)) + g_i(x_i(t))\alpha_i + \sum_{j=1}^{N} c_{ij}\Gamma x_j(t) + u_i(t), \quad i = 1, 2, \ldots, N, \tag{9}$$

Definition 1. The complex networks (9) is said to achieve adaptive synchronization in finite-time if there exist a $s(t)$ such that

$$\lim_{t \to T} \|\boldsymbol{e}_i(t)\| = \lim_{t \to T} \|\boldsymbol{x}_i(t) - \boldsymbol{s}(t)\| = 0, \quad i = 1, 2, \ldots, N, \tag{10}$$

where $\|\bullet\|$ is the Euclidean vector norm and $\boldsymbol{s}(t) \in R^n$, $\boldsymbol{s}(t)$ satisfies $\dot{s}(t) = f_i(x_i(t)) + g_i(x_i(t))\alpha$.

Theorem 1. The error system (9) can realize finite-time adaptive synchronization and exponential synchronization via using the following controller and updated laws,

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$$u_i(t) = -f_i(x_i(t)) - g_i(x_i(t))\hat{\alpha}_i - \sum_{j=1}^{N} c_{ij}\Gamma x_j(t) + \dot{s}(t) - \frac{\lambda}{2}e_i(t) - \frac{\beta}{2}e_i^{\frac{p}{q}}(t) - g_i(t, x_i(t))\tilde{\alpha}_i \tag{11}$$

$$\left.\begin{aligned} \dot{\hat{c}}_{ij} &= -\frac{\lambda}{2}\tilde{c}_{ij} - \frac{\beta}{2}\tilde{c}^{\frac{p}{q}} - e_i(t)\Gamma x_j(t) \\ \dot{\hat{\alpha}}_i &= -\frac{\lambda}{2}\tilde{\alpha}_i - \frac{\beta}{2}\tilde{\alpha}_i^{\frac{p}{q}} \end{aligned}\right\} \tag{12}$$

where $\lambda > 0$, $\beta > 0$, $\frac{p}{q} \in (0,1)$, p and q are two positive odd integers. The finite-time adaptive synchronization in complex networks (9) in a finite time

$$T = \left[\ln\left(\left(\lambda W^{1-\omega}(0)/\beta\right)+1\right)\Big/\lambda\left(1-\frac{p}{q}\right)\right] \tag{13}$$

where $W(0) = \frac{1}{2}\sum_{i=1}^{N} e_i^2(0) + \frac{1}{2}\sum_{i=1}^{N}\tilde{\alpha}_i^2(0) + \frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2(0)$, $e_i(0)$, $\alpha_i(0)$, $c_{ij}(0)$ are the initial values of $e_i(t)$, α_i, c_{ij}.

Proof. We design the following Lyapunov function

$$W = \frac{1}{2}\sum_{i=1}^{N} e_i^2 + \frac{1}{2}\sum_{i=1}^{N}\tilde{\alpha}_i^2 + \frac{1}{2}\sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2 \tag{14}$$

where $\tilde{\alpha}_i = \hat{\alpha}_i - \alpha_i$, $\tilde{c}_{ij} = \hat{c}_{ij} - c_{ij}$. $\dot{\tilde{\alpha}}_i = \dot{\hat{\alpha}}_i$, $\dot{\tilde{c}}_{ij} = \dot{\hat{c}}_{ij}$.

The error dynamical network is defined as follows,

$$\boldsymbol{e}_i(t) = \boldsymbol{x}_i(t) - \boldsymbol{s}(t), \tag{15}$$

The time derivative of Eq. (15)

$$\dot{\boldsymbol{e}}_i(t) = \dot{\boldsymbol{x}}_i(t) - \dot{\boldsymbol{s}}(t), \tag{16}$$

Substituting Eq. (9) into Eq. (16)

$$\dot{e}_i(t) = g_i(x_i(t))\tilde{\alpha}_i + \sum_{j=1}^{N}\tilde{c}_{ij}\Gamma x_j(t) + u_i(t) - \dot{s}(t), \tag{17}$$

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Substituting Eq. (17) into Eq. (17)

$$\dot{e}_i(t) = g_i(x_i(t))\tilde{\alpha}_i + \sum_{j=1}^{N} \tilde{c}_{ij}\Gamma x_j(t) - \frac{\lambda}{2} e_i(t) - \frac{\beta}{2} e_i^{\frac{p}{q}}(t) - g_i(t, x_i(t))\tilde{\alpha}_i, \tag{18}$$

The time derivative of Eq. (15)

$$\dot{W} = \sum_{i=1}^{N} e_i(t)\dot{e}_i(t) + \sum_{i=1}^{N} \tilde{\alpha}_i \dot{\hat{\alpha}}_i + \sum_{i=1}^{N}\sum_{j=1}^{N} \tilde{c}_{ij}\dot{\hat{c}}_{ij}, \tag{19}$$

Substituting Eq. (21) and Eq. (24) into Eq. (22)

$$\begin{aligned}
\dot{W} &= \sum_{i=1}^{N} e_i(t)[g_i(x_i(t))\tilde{\alpha}_i + \sum_{j=1}^{N} \tilde{c}_{ij}\Gamma x_j(t) - \frac{\lambda}{2} e_i(t) - \frac{\beta}{2} e_i^{\frac{p}{q}}(t) - g_i(t, x_i(t))\tilde{\alpha}_i] \\
&\quad + \sum_{i=1}^{N} \tilde{\alpha}_i[-\frac{\lambda}{2}\tilde{\alpha}_i - \frac{\beta}{2}\tilde{\alpha}_i^{\frac{p}{q}}] + \sum_{i=1}^{N}\sum_{j=1}^{N} \tilde{c}_{ij}[-\frac{\lambda}{2}\tilde{c}_{ij} - \frac{\beta}{2}\tilde{c}^{\frac{p}{q}} - e_i(t)\Gamma x_j(t)] \\
&= -\frac{\lambda}{2}[\sum_{i=1}^{N} e_i^2(t) + \sum_{i=1}^{N}\tilde{\alpha}_i^2 + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2] - \frac{\beta}{2}[\sum_{i=1}^{N} e_i(t)e_i^{\frac{p}{q}}(t) + \sum_{i=1}^{N}\tilde{\alpha}\tilde{\alpha}^{\frac{p}{q}} + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}\tilde{c}_{ij}^{\frac{p}{q}}] \\
&= -\frac{\lambda}{2}[\sum_{i=1}^{N} e_i^2(t) + \sum_{i=1}^{N}\tilde{\alpha}_i^2 + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2] - \frac{\beta}{2}[\sum_{i=1}^{N}(e_i^2(t))^{\frac{p+q}{2q}} + \sum_{i=1}^{N}(\tilde{\alpha}^2)^{\frac{p+q}{2q}} + \sum_{i=1}^{N}\sum_{j=1}^{N}(\tilde{c}_{ij}^2)^{\frac{p+q}{2q}}] \\
&\le -\frac{\lambda}{2}[\sum_{i=1}^{N} e_i^2(t) + \sum_{i=1}^{N}\tilde{\alpha}_i^2 + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2] - \frac{\beta}{2}[\sum_{i=1}^{N} e_i^2(t) + \sum_{i=1}^{N}\tilde{\alpha}^2 + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2]^{\frac{p+q}{2q}} \\
&= -\frac{\lambda}{2}W - \frac{\beta}{2}W^{\frac{p+q}{2q}}.
\end{aligned} \tag{20}$$

So, under the controller (11) and updated laws (24), the complex networks (9) are synchronized in a finite time $T = \left[\ln\left(\left(\lambda W^{1-\omega}(0)/\beta\right)+1\right)\Big/\lambda(1-\frac{p}{q})\right]$.

By Eq. (23), we can have deduced that

$$\exp(2\lambda t)\times\dot{W}(t) + \exp(2\lambda t)\times 2\lambda W(t) = \frac{d}{dt}[\exp(2\lambda t)\times 2W(t)] \le 0, \quad \forall t < 0. \tag{21}$$

$$\int_0^t \frac{d}{dt}[\exp(2\lambda t)\times W(t)]dt = \exp(2\lambda t)\times W(t) - W(0) \le \int_0^t 0dt = 0, \quad \forall t > 0. \tag{22}$$

By Eqs. (15) and (25),

$$\|e(t)\|^2 \le 2W(t) = \sum_{i=1}^{N} e_i^2 + \sum_{i=1}^{N}\tilde{\alpha}_i^2 + \sum_{i=1}^{N}\sum_{j=1}^{N}\tilde{c}_{ij}^2 + 2\sum_{i=1}^{N}\int_{t-\tau}^{t} e_i^2(\vartheta)d\vartheta \le 2\exp(-2\lambda t)\times W(0), \quad \forall t \ge 0. \tag{23}$$

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$$\|e(t)\| \le \sqrt{2W(0)}\exp(-\lambda t), \quad \forall t \ge 0 . \tag{24}$$

So, the controller (11) and updated (24) realize exponential synchronization in complex networks (9) in a finite time.

Remark. To realize the finite-time stability, the parameters p/q have to satisfy the condition that $(p/q) \in (0,1)$ is an irreducible fraction with two positive odd integers p and q. If p is even and q is odd, then the state of $e_i^{\frac{p}{q}}(t)$ $(i = 1, 2, \ldots, N)$ is always positive which can cause the system to be unstable when $e_i(t)$ is negative. In contrast, if p is odd and q is even, then the state of $e_i^{\frac{p}{q}}(t)$ $(i = 1, 2, \ldots, N)$ will become complex when $e_i(t)$ is negative. The parameter p/q can be assigned arbitrarily under the condition mentioned above, then $p + q/2q \in (0,1)$.

4. The simulation research

In this section, the chaotic Lorenz system is chosen as the nodes of networks (9) which can be described as follows,

$$\begin{pmatrix} \dot{x}_{i1}(t) \\ \dot{x}_{i2}(t) \\ \dot{x}_{i3}(t) \end{pmatrix} = \begin{pmatrix} 0 \\ -x_{i1}x_{i3} - x_{i2} \\ x_{i1}x_{i2} \end{pmatrix} + \begin{pmatrix} x_{i2} - x_{i1} & 0 & 0 \\ 0 & x_{i1} & 0 \\ 0 & 0 & -x_{i3} \end{pmatrix} \begin{pmatrix} a_i \\ b_i \\ c_i \end{pmatrix} + \sum_{j=1}^{3} c_{ij} x_j(t-\tau) + u_i(t), \quad i = 1, 2, 3,$$

where τ is time delay, the controller $\boldsymbol{u}_i(t)$ and updated rules are,

$$u_i(t) = -f_i(x_i(t)) - g_i(x_i(t))\hat{\alpha}_i - \sum_{j=1}^{N} c_{ij}\Gamma x_j(t) + \dot{s}(t) - \frac{\lambda}{2} e_i(t) - \frac{\beta}{2} e_i^{\frac{p}{q}}(t) - g_i(t, x_i(t))\tilde{\alpha}_i$$

$$\dot{\hat{c}}_{ij} = -\frac{\lambda}{2}\tilde{c}_{ij} - \frac{\beta}{2}\tilde{c}^{\frac{p}{q}} - e_i(t)\Gamma x_j(t), \dot{\hat{\alpha}}_i = -\frac{\lambda}{2}\tilde{\alpha}_i - \frac{\beta}{2}\tilde{\alpha}_i^{\frac{p}{q}}, \quad i = 1, 2, 3.$$

In the numerical simulation, taking the initial states as: $x_i(0) = (1, 2, 3)^T$, $\hat{c}_{ij}(0) = 1$, $(\hat{a}_i(0), \hat{b}_i(0), c_i(0)) = (-1+i, 1+2i, 3+i)$, where $1 \le i, j \le 3$. $s(0) = (4, 5, 6)^T$, selecting $\lambda = \beta = 1$. Fig. (4) shows the synchronization errors, Fig. (5) shows the parameters identification, Fig. (6) shows the identification of networks weight.

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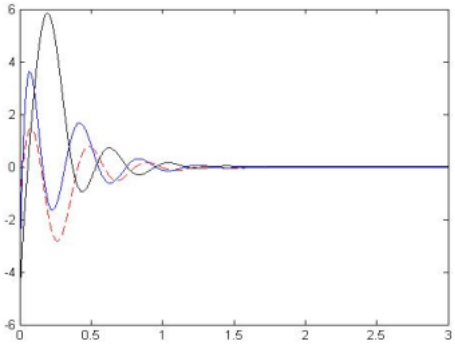
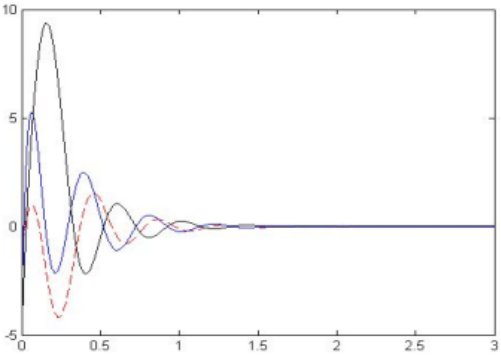
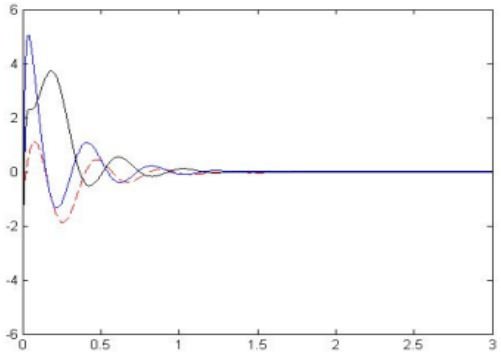


t/s (e1)



t/s (e2)



t/s (e3)

Figure 4 – The synchronization errors in complex networks

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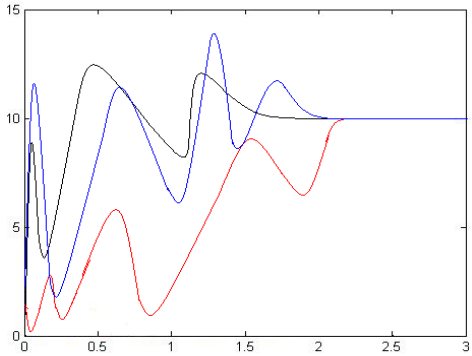
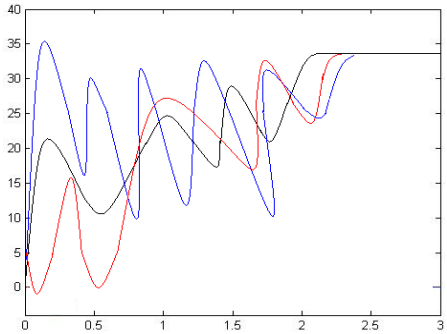
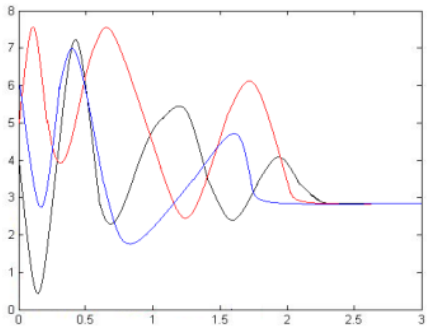


t/s (ai)



t/s (bi)



t/s (ci)

Figure 5 – Parameters identification in complex networks

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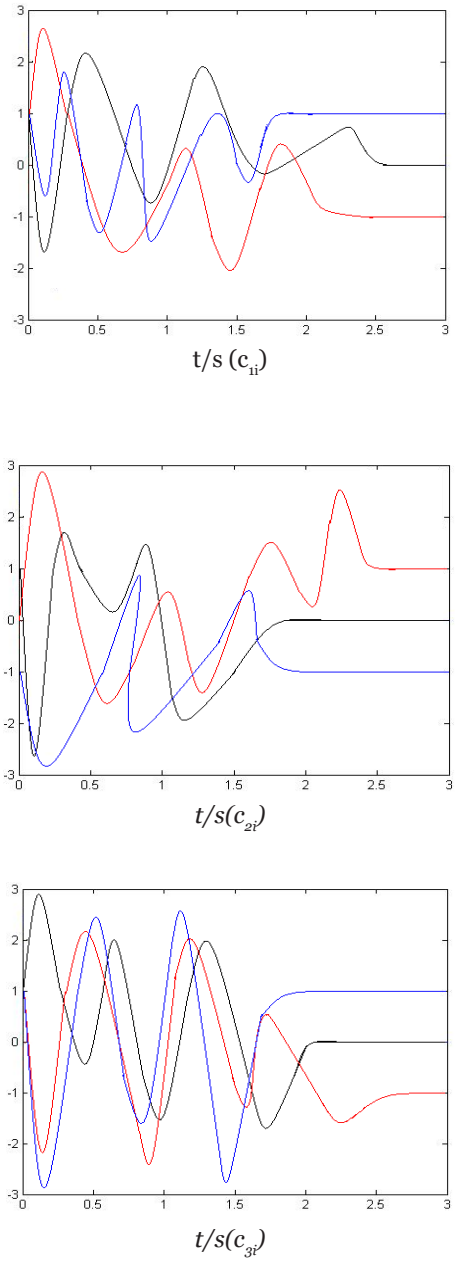

Figure 6 – Identification of networks weight in complex networks

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Conclusions

This paper present an approach for complex networks with delay and disturbance to realize finite-time synchronization, parameter identification and exponential synchronization. When complex networks with delay exist parameters disturbance, exotic and topology weight disturbance, based on the theory of finite-time stability and Lyapunov theory, a feedback controller and updated rule are designed to realize finite-time synchronization and exponential synchronization, realize parameter and topology identification. Numerical simulation is provided to show the effectiveness of the proposed method.

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Study on the Influential Factors in the New Rural Cooperative Medical System based on Sample Survey in Chongqing

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Abstract: The implementation of the new rural cooperative medical system has a direct impact on the treatment level of the residents to enjoy medical insurance. Through the survey questionnaire and interviews of NCMS in Chongqing city about the status of the implementation of the investigation, using Logistic regression analysis method, from the individual and family characteristics, participation and other point of view, the analysis was made about factors affecting the implementation effect of the new rural cooperative medical system to develop the rural economy and increase the income of farmers, promote farmers' initiative participation, step up publicity efforts to raise public awareness of the new rural cooperative medical system and medical staff of agencies to improve service attitude, improve efficiency and enhance the satisfaction of the new rural cooperative medical.

Keywords: New rural cooperative medical system, Implementation effect, Logistic regression model, Influencing factors

1. Introduction

The new rural cooperative medical care system is organized, guided and supported by the government, and gives farmers autonomy of participation. The funds come from individuals, collective and government (Lv, 2013). In order to improve the degree of benefit farmers National subsidy standards in 2015 NCMS reached a total of 380 Yuan per capita. Since the implementation of the new rural cooperative medical system, reducing the burden of farmers in health because the disease causes poor family situation to be worsened, so that the health of farmers rights are guaranteed. But in the development of NCMS, some unsatisfactory results are exposed: NCMS transparency, public awareness is not high, and fund supervision is not in place, etc. This article through the questionnaire and interviews in Chongqing City, implements the new situation of the investigation, using Logistic regression analysis method, from the individual and family characteristics, participation situation, and makes an analysis of the factors affecting the implementation effect of the new rural cooperative medical system (Miramontes et al., 2016, Vázquez et al., 2016).

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2. The NCMS condition about Chongqing City in China

Chongqing actively responds to national policies, in accordance with national requirements, from 2003 to start the pilot, in 2010 to achieve full coverage of the policy. NCMS participation can be understood from the following three aspects: (1) In terms of participation: The participation of staff of 26.7775 million people, down 0.1%. (2) Health resources: at the end of 2015, a total of all types of medical and health institutions (including village clinics) 19806, A total of 176.7 thousand beds of medical institutions, including hospital beds of 124 thousand, township hospital beds of 39.3 thousand. (3) Medical personnel aspects: The city has a total of 166.5 thousand health technical personnel, including practicing physicians and practicing assistant physician of 61 thousand people, registered nurses of 70 thousand people. (4) Free participation in NCMS: 902.5 thousand rural people through government funding to participate in NCMS.

3. Survey and data processing

3.1. The data source

From January- March in 2016, the members of the research group randomly selected 20 districts to do Interviews and survey questionnaires. A total of 700 questionnaires were distributed, of which effective recovery of 679 copies with the effective rate of 97%. On the basis of field investigation and interview, SPSS software is used to process the data.

3.2. Data analysis

3.2.1. Basic personal information

3.2.1.1. Gender and age characteristics

The male respondents are 334(49.2%) and female 344(50.7%). One people is omitted. From the data it is not difficult to find the proportion of women surveyed is slightly higher than men.

The age is divided into: under 30, 30 - 45, 46 - 59, above the age of 60. There are 31.5% people under the age of 30, 30 - 45(31.7%), 46 - 59(19.0%), and above the age of 60 is 17.4%.

3.2.1.2. Education information

There are 192 people in primary school and below (28.3%), junior high school 190 (28%), high school 111 (16.3%), college 68 (10%), undergraduate and above 116 (17.1%).

3.2.2. Participation information in NCMS

According to the questionnaire survey, 571 people participated in the new rural cooperative medical system, of which there were 108 people not participating in NCMS. The reasons are: no money to buy (17 people), have confidence in their own health (24), the scope of reimbursement is too narrow (57) and other (10). Preliminary statistics data can be found in the scope of reimbursement for the masses participation. About 454 people choose to pay grade A, and 224 choose grade B.

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3.2.3. Cognitive characteristics of NCMS

The Cognition about the new rural cooperative medical system can mainly from the following indicators to measure: familiarity about NCMS policy; Whether to understand the NCMS reimbursement criteria; whether to know the NCMS pay line, cap line and the proportion of total pay; Whether to understand the special disease system. Specific results of questionnaire survey can be seen as table 1.

question / option	Understand well	Basic understand	Not know much	Know nothing	select nothing
Do you know the new rural cooperative medical policy?	68	262	261	67	21
understand the NCMS reimbursement criteria or not	50	266	271	72	20
know the NCMS pay line, cap line and the proportion of total pay or not	40	198	246	179	16
understand the special disease system or not	50	155	300	155	9

Table 1 – The survey of the NCMS Cognition (unit: person)

As can be seen from the table about the level of participation of the masses of the NCMS specific policy is generally not high, especially the special disease system implemented in recent years, the people who do not understand and who do not know account for over 67%. Thus it reflects that there are still a lot of shortcomings about the policy in the implementation process of mass propaganda, and it needs to be further strengthened.

3.2.4. Satisfaction analysis of NCMS implementation

When asked whether the investigation object after the illness will choose to go to the hospital, only 15% will go to the hospital; Up to 53% of people find they will take medicine to with little illness, and go to hospital with serious illness. Another 22% choose to look at the situation and then make a decision. 10% of people will not go to hospital. Up to 74.2% of people believe that the new rural cooperative medical policy benefits farmers. About the economic impact after participation: 12.4% of people think that premiums increase the economic burden; 34.6% think there is no difference; 43.6% of people believe that the implementation of the new rural cooperative medical insurance in the employment of farmers need to bear their own economic aspects eased; but the specific degree of remission is limited. Only 5.7% of people believe that the implementation of new rural cooperative medical system for their medical treatment burden has been significantly reduced. About satisfaction from the masses of the system and staff service attitude and efficiency of two factors, the specific situation is shown in Table 2 as follows.

From the Table 2 we can see the participation of the masses of the new rural cooperative medical system, the staff service attitude and efficiency. The degree of very satisfied with the proportion of NCMS reimbursement level is generally low. Most of them choose to be neutral, thus the relevant departments need to do more to improve it.

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question / option	Very satisfied	satisfied	neutral	unsatisfied	Far from gruntled
Are you satisfied with the current new rural cooperative medical system?	2.3%	24.7%	61.7%	9.4%	1.8%
Are you satisfied with the service attitude and efficiency of NCMS staff?	3.5%	20.4%	63.2%	9.4%	3.3%
Are you satisfied with the reimbursement procedure?	10%	25%	51.7%	12%	1.3%

Table 2 – Satisfaction degree of NCMS implementation effect

4. Analysis on Influencing Factors of NCMS implementation

The implementation effect of NCMS affects residents' medical treatment level. In order to understand the security level of NCMS more effectively, we choose 16 variables which may influence the effect of NCMS. See Table 3 about the variable description. The results of Logistic regression model are shown in table 4.

Consider vectors with n independent variables $x=(x_1,x_2,\cdots,x_n)$, Conditional probability $P(y=1|x)=p$ as Probability of occurrence of an event x relative to an event. So the Logistic regression model can be expressed as $P(y=1|x)=\pi(x)=\frac{1}{1+e^{-g(x)}}$

Among the above $f(x)=\frac{1}{1+e^{-x}}$ is the function of Logistic and $g(x)=w_0+w_1x_1+\cdots+w_nx_n$, $w_i(i=0,1,2,\cdots,n)$ is it's coefficient.

So Under the x conditions, y does not occur probability is:

$$P(y=0|x)=1-P(y=1|x)=1-\frac{1}{1+e^{-g(x)}}=\frac{1}{1+e^{g(x)}},$$

The ratio of probability of occurrence to non occurrence is:

$$\frac{P(y=1|x)}{P(y=0|x)}=\frac{P}{1-P}=e^{g(x)}$$

This ratio becomes the incident ratio, Get the log:

$$\ln\left(\frac{P}{1-P}\right)=g(x)=w_0+w_1x_1+\cdots+w_nx_n$$

If you set the $x_i(i=1,2,\cdots,16)$ as gender, age, etc, through the known data using SPSS statistical software can get Table 4.

Based on table 4, it can be found the age, family income, NCMS participation degree, from which channels we understand the new rural cooperative medical policy participation

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Variable		Range of variables
personal characteristics	sex	1= male; 2= female
	age	1=Under 30 years of age; 2=30 - 45; 3=46 - 59; 4=above 60
	educational background	1=Primary school; 2=junior middle school; 3= senior school (technical secondary school); 4= Junior College; 5= Bachelor or above
home situation	Annual household income	1=3000 Yuan and below; 2=3001 - 6000; 3=6001 - 9000; 4=Above 9000 Yuan
	Main source of income	1= Grain income; 2=Wage income such as working and doing business; 3=Land subcontract and transfer payments; 4=Other
Participate in the new rural cooperative medical system	Understanding of the new rural cooperative medical system	1= Understand well; 2=Basic understand; 3= Not know much; 4= Know nothing
	From which channels to understand the NCMS policy	1= publicity material; 2= the press; 3= network 4=TV; 5=health-care worker; 6= friends and relatives; 7= Other
	Whether to participate in the new rural cooperative medical	1= participate in; 2= uncommitted
	Pay grade	1=the first; 2=the second
	the reason of not participating in the NCMS	1= No money; 2= Have faith in your body; 3= Limited scope of reimbursement is too narrow; 4= Other
	What is most worried about the problem after participation	1=Medical expenses can not be reimbursed or reimbursed too little; 2=Worried about the price rise; 3=Worry about seeing a doctor is not free; 4=Worry about the reimbursement procedures are too cumbersome; 5=Worry about prescribing a prescription for more
	The impact on the economy after participation	1=Premium increases the economic burden; 2=And there is no difference between the original; 3=Ease economic burden but limited role; 4=The burden of significant effect; 5= Other
	After participation whether enjoy medical aid	1=yes; 2=no; 3=don't know
	If you go to the hospital after the disease preferred medical institutions level	1=Village health room; 2=county hospitals; 3= city-hospitals
	The new pay line, cap line, the proportion of total pay is reasonable or not	1=yes; 2=no; 3=don't know
	which need to be improved and improve the local NCMS	1=Increase the type of drugs, increase national subsidies; 2=Improving rural hardware facilities; 3=Improve service attitude;4=improving medical technology level; 5= Other

Table 3 – Name, type and range of variables

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Variable		regression coefficient	standard error	Wals.	Sig.
personal characteristics	sex	0.536	0.288	3.875	0.058
	age	0.076	0.144	12.589	0.013
	educational background	0.006	0.231	5.682	0.628
home situation	Annual household income	0.436	0.408	21.489	0.001
	Main source of income	0.098	0.345	15.463	0.007
Participate in the new rural cooperative medical system	Understanding of the NCMS	1.340	0.285	22.052	0.000
	From which channels to understand the NCMS policy	0.435	0.310	15.352	0.001
	Whether to participate in the new rural cooperative medical	0.008	0.153	3.569	0.732
	Pay grade	0.007	0.294	5.368	0.483
	the reason of not participating in the NCMS	0.508	0.113	14.389	0.005
	What is most worried about the problem after participation	-0.103	0.476	12.894	0.002
	The impact on the economy after participation	0.012	0.325	0.792	0.036
	After participation whether enjoy medical aid	0.383	0.187	4.208	0.060
	If you go to the hospital after the disease preferred medical institutions level	0.458	0.176	8.561	0.006
	The new pay line, cap line, the proportion of total pay is reasonable or not	0.003	0.258	13.263	0.002
	which need to improve and improve the local NCMS	0.014	0.326	14.253	0.004

Table 4 – Logistic model results of influencing factors of NCMS implementation

after most worried about the problem, influencing on the economy. Sig Values are less than 0.05, was statistically significant. That is to say, the implementation effect of NCMS will produce more obvious restrictive function in practice, as follows:

4.1. Personal and family income

We can find the model by Table 4 above, the value of Sig about sex is more than 0.05, the results show that the effect of the new rural cooperative medical care and gender is not statistically significant. But the Sig values of age and family income are both less than 0.05, and the two regression coefficients are positive. It shows that the masses are affected by their age and family income in the choice of new rural cooperative medical system. The older the more inclined to choose it and the higher income families' intention is more obvious.

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4.2. Policy advocacy factors

The understanding of NCMS has a direct impact on the implementation of NCMS, when Sig= 0.000, the influence is most obvious. Policy publicity is a key factor in the awareness of NCMS, Survey found that 60% of people through relatives and friends to understand the new rural cooperative. This is closely related to the farmers' educational level and the length of their education. When the cultural level of some farmers is limited, the access to the new rural cooperative policy channels will be affected accordingly. Then they can only enjoy the new rural cooperative treatment through relatives and friends to understand. In fact, from the experience of others they can only get the general understanding of the new rural cooperative medical system, and know that the policy can ease the difficulty of seeing a doctor; you can have a certain degree of protection of the health rights of residents. But there is no effective understanding of the system's higher level of security efficacy, so the system of long-term and continuous cognition is greatly reduced. The cognition of the new rural cooperative medical system is limited, the degree of trust is not high and the income level of farmers, rural economic level, the new rural cooperative medical system propaganda factors are inseparable.

4.3. Analysis of related factors affecting the implementation after participation

The Sig values of after participation the most worried about problem and the impact on the economy after participation are both less than 0.05. These two factors are directly related to the effect of NCMS. Statistics show that the enthusiasm of the six choices after participation worry selected more participation is low, so the regression coefficient is negative. After participation influence on the economy is a direct response to the effect of the implementation, some respondents felt significantly reducing economic burden but limited effective. In addition, the satisfaction of service attitude and efficiency of NCMS staff and the satisfaction of the respondents showed a positive correlation, and higher satisfaction of participation enthusiasm is strong.

5. Policy recommendations for improving NCMS satisfaction

Through the above analysis, it is found about household income, rural economy, publicity and other direct impact on the implementation of NCMS. The government should play a leading role in increasing farmers' income, so as to promote the long-term and sustainable development of rural economy and ensure the steady growth of rural income. Specific recommendations are as follows:

5.1. Developing rural economy and alleviating shortage of new rural cooperative medical fund

Shortage of funds limits the establishment and development of NCMS, therefore in practice through the development of rural economy, farmers' income has increased, effectively alleviate the plight of shortage of funds. The government should play a leading role, so as to promote the long-term and sustainable development of rural economy, Ensure steady growth in rural incomes. Reducing farmers' demand for medical assistance in the face of disease; it can make farmers from passive relying on government "blood transfusion"

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relief to vigorously promote rural economic development "hematopoietic" rescue (Xiao and Sun, 2010). According to the actual demand of rural, the government should improve infrastructure and rural highway construction, especially the reconstruction of rural drinking tap water and toilet to create a good living environment. Then, it should give full play to the characteristics and advantages of local resources, adjust the extensive rural production structure and realize the optimization and upgrading of agricultural products. The government should develop the potential market and form a local leading economy, so as to achieve steady development of rural local economy. It can also promote the effective growth of farmers' personal and family income, vigorously develop rural township collective enterprises to achieve the nearest effective employment, so as to promote the effective transformation of "hematopoietic" relief model, achieve the transformation of relief model and ease the shortage of funds for NCMS.

5.2. Increase publicity to improve awareness of NCMS

The survey found that the general understanding of the masses of NCMS is generally low. Most know it through relatives and friends affecting the implementation effect of NCMS, so publicity needs to be increased, and help promote the development of NCMS. Professionals are more conducive to policy advocacy. Therefore, the government should make a propaganda through the organization of professional personnel. At the same time, it should make full use of rural propaganda platform to deliver propaganda column NCMS policy. In addition, regular leaflets can be issued to farmers. Let the masses directly understand the new policy from the leaflets (Huang, 2012). College-graduate village official as a group of rural grassroots organizations in the higher level of education. They can take advantage of their knowledge, and preach the new rural cooperative medical policy for farmers, combing with their own work experience and grassroots farmers to establish a good working relationship. Due to the limited knowledge, farmers in the new rural cooperative medical information should be added clear reimbursement ratio and reimbursement procedures, so that farmers are more likely to see the effectiveness of NCMS. Government should strengthen the concept of farmers to participate in NCMS, so that establish the masses' awareness of insurance (Dong, 2013). Through explaining the benefits for participating in the new rural cooperative the NCMS, making a propaganda in reimbursement knowledge, increasing the transparency of the new rural cooperative medical information, farmer's awareness can be increased about the participation, and their rights and interests can be truly protected (Lv and Liu, 2013).

5.3. Improve the information system, enhance the quality of service agencies

El siguiente tema importante es la infraestructura. Hoy en día, la responsabilidad de ampliar la red de cámaras y de gestionarla recae totalmente en el gobierno municipal (D'Amato and Dominguez, 2016) In the rapid development of "Internet +" period, the social public agencies for NCMS has also put forward new requirements on the service level and efficiency: First, the need should be consistent with the development trend of social insurance; second, the services provided are inseparable with the country's economic system reform and the transformation of government functions. The network platform should be made full use to build and update the NCMS Information System, for the purpose of making adjustments to the internal management procedures system of medical insurance agencies, and achieving the purpose of optimizing the work flow. On

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the basis of information platform construction, the resources are effectively allocated. while optimizing the use of innovation, the quality of personnel's service and the ability to implement agencies should be further improved. In order to make better use of medical resources at the grassroots level, grading clinics can be set up to focus on departmental projects delegated to the community service network.

5.4.Revitalize the county medical and health services to improve the difficulty of medical treatment in remote areas residents

Because of the scattered living population in the rural area, complex environment and even inconvenient local traffic, the law to provide the medical and health services lacked, even in the developed countries. Given the health services in remote areas, market forces is unwilling to enter for without very good income. So it becomes a weak link in the field of health services. This situation can only be solved by the government or policy providing tilt solution (Li, 2011). It can be improved from the following aspects: 1. playing the grassroots functions of rural hospitals, and rural areas of remote county health services gradually sinking. 2. County Rural Medical and health service agencies can cooperate with each other to form a convenient mobile medical service team to meet the needs of women and children, elderly and disabled patients in remote rural areas. 3. Because rural remote areas inconvenient to seek medical treatment, telemedicine can be carried out to achieve effective medical treatment.

Acknowledgment

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Discussion and Analysis of Management of College Students under Computer Network Public Platform

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Pages: 50–61

Abstract: In the era of network with rapid change in nowadays, the rapid development of network public platform as well as other emerging computer communication media has explored new ideas for the management of college students and brought about new challenges at the same time. This paper has studied the influence of network public platform on computer using habits, reading and learning as well as way of life etc. among college students by taking behavioral scientific management theory and communication theory as basis and attaining data through questionnaire based on the characteristics of contemporary college students and by taking college students of one university as investigation objects. It has put emphasis on analyzing the challenges brought about by computer network public platform for management mode of traditional public opinion information, quality of student manager, guidance of public opinion among students and self-consciousness of college students. According to the challenged content, countermeasures and suggestions have been summarized to improve the management of college students with the adoption of computer network public platform.

Keywords: Management of college students, Computer network, Public platform.

1. Introduction

The extensive application of network public platform has produced great influence on the ideas, way of life and moral concept of college students. Contemporary college students with sharp thinking and courage of trying new things have become the main force of firstly using network public platform; with this emerging computer communication media, they have further enriched their interpersonal relationship and satisfied own emotional demand and cognition demand (Schein, Mueller and Jacobson, 1989). However, college age is the key period for college students to form systematic outlook on life, world outlook and values. The college students are with multiple values, weak self-control ability and discrimination ability, inadequate ability of dealing with interpersonal relationship, which make them easy to be affected by bad internet and social atmosphere. Network public platform and other social applications are double-edged, how to draw on the advantages and avoid disadvantages and how to guide the students to use network public platform correctly by making the best use of the situation

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has become an important subject for public opinion information management workers (Schein et al., 1988; Lucas and Souza, 2016).

Network public platform has not only brought about challenges but also brought about unprecedented opportunity for management of college students. For the diversified functions of network public platform, we need to increase the management consciousness for public opinion information on network public platform continuously (Shahani et al., 1990, Gonçalves et al. 2016). Enrich colleges and universities to make use of network public platform and other new media methods to make public opinion information management, explore the new methods and new ways for student management, update concepts and methods, set up strong public opinion information management team of network public platform for college students and improve related laws and regulations through studying the habits of college students using network public platform (Lowry et al., 2000). Realize teaching students in accordance with their aptitude and individualized education through adjusting the working mode of student education in the era of network public platform, which can make our management for students close to students, close to work and close to life and serve for the growth of college students. Further enrich the connotations of management for public opinion information, fully play the role of network public platform in management for college students and in public opinion management, strengthen the attraction and appeal of ideological and political education and students management (Greaney et al., 2009). At present, academic circles have made a lot of related researches on the role of new media in management for students, but there are few researches on the role of the emerging network public platform on the students management work in colleges and universities. Related information of network public platform is commonly seen in news media reports or analysis and summarization of IT industry, but its internal action mechanism has not been studied deeply and extensively.

The writer has analyzed the habits and rules of college students using network public platform, studied the influence of network public platform on the daily life of college students and explored the challenges of network public platform on the management for college students as well as countermeasures study by taking 3G/4G network, campus wired and wireless network as conditions and college students with basic coverage of network public platform as background, which is of great realistic significance for further strengthening and improving public opinion information management work among contemporary college students (Danes and Hira, 1986).

2. Psychological characteristics of contemporary college students and the influence of network public platform on their study and life

2.1. Psychological characteristics of contemporary college students

1. Active thinking but lack economic independence consciousness

One investigation on “growth and responsibility of college students” has shown that when face the selection for future, 66.4% college students like making decisions on their

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own, like expressing own opinions and performing independently (Janan et al., 2008). The first investigation report for college students published by Wuhan University in 2008 has shown that 51.4% students will turn to family for help if their monthly living expenses are deficit; only 18.1% college students will earn money through part-time jobs and make it up with own efforts (Wdowik et al., 2001). This has reflected that college students depend on the family greatly in economy, they lack the economic independence consciousness and idea of self-dependence comes out late.

2. Has the sense of responsibility but with weak psychological bearing capacity

College students are not spoiled as others imagined; investigation on college students has shown that 92.5% young adults at 18 years old are willing to be volunteers and 83.9% young adults at 18 years old believe that they have to bear more responsibilities and obligations for families and society when grow up, in which 87.9% have made at least one time volunteer work (Harring et al., 2011). Students' Federation in Shenzhen city has initiated one public welfare investigation for the growth and responsibility of college students and nearly ten thousand votes have been received. The results have shown that 70% "college students" believe that they will become the backbones in the future, 85% "college students" believe that they should bear the social responsibility. The investigation also shows that 43% believe that they are with strong sense of social responsibility, 49% believe that they are related to social and political events and over 59% are interested in becoming student cadres (Chiauzzi et al., 2008). It can be seen that in the eyes of the public, college students who are lacking hardship experience and without worrying about the food and clothes during childhood are with strong patriotic enthusiasm and have strong sense of responsibility for the fate of the country and the future of the nation.

3. Distinct personality but with weak rule consciousness

But at the same time, we have found out that college students are with strong self-consciousness, paying attention to personalities and very confident; therefore, the human ego hidden behind this phenomenon cause the contradictions between words and deeds; on one hand, they are with independent thinking and knowing how to use laws and other methods to protect own legitimates rights and interests; on the other hand, they have tasted the bitter pills of violating regulations, not restricted or ignoring others' interests and campus rules, some people even do not understand the punishment they suffered (Henry et al., 2001). It can be seen that the college students are with strong rules of law but with weak implementation ability for the enforcement of legal rules.

2.2. Investigation on the influence of computer network public platform on study and life of college students in one university

This investigation is accomplished on webpage, the investigated objects are college students at one university, finished by forward filling through network public platform and other methods and totally 368 effective questionnaires have been received (Kidwell and Turrisi, 2004).

1. Influence of network public platform on the habits of college students using computer

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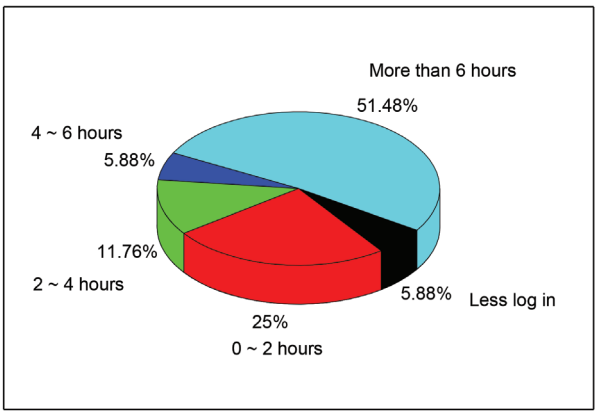

Figure 1 – Daily time using the network platform

The investigation has shown that in the aspect of using time of network public platform among college students, using time for 51.47% students are above 6 hours, using time for 5.88% students are between 4 and 6 hours, using time for 11.76% students are between 2 and 4 hours, using time for 25% students are between 0 and 2 hours and 5.89% students log in every few days (Tang and Zhang, 2009) It can be seen from figure 1 that using network public platform has become part of the daily life for over half of the college students. Quick and economic features of network public platform are well known to every household, just as the advertisement of network public platform says "network public platform is a way of life", they are keen on sharing all that they saw and heard with relatives and friends (Hirokawa et al., 2002).

2. Influence of the functions of network public platform on the demand of college students

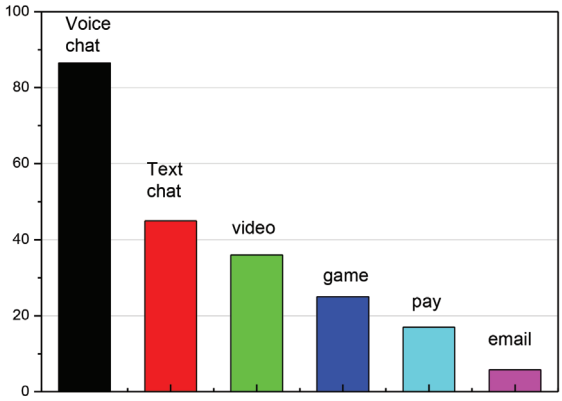

Figure 2 – Used the platform function

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It can be seen from figure 2 that among all the functions of network public platform used by college students, over half of the college students used “moments”, “text chat”, “audio chat”, “group chat”, “video chat”, “scan QR code” and “shake”.

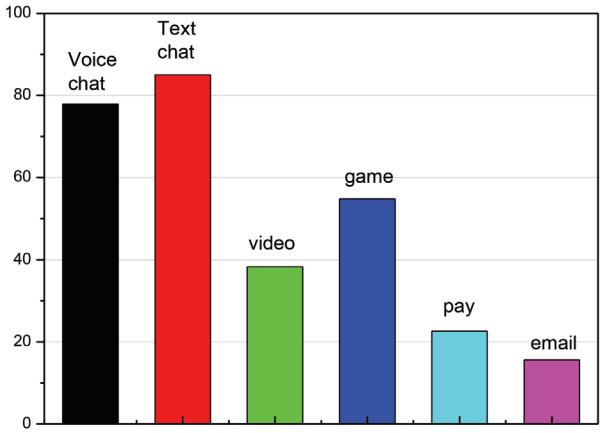

Figure 3 – Network platform commonly used functions

Among all the commonly used functions of network public platform, the top three are “text chat”, “moments” and “audio chat”, which account for 91.18%, 88.24% and 77.94% respectively among all the investigated students (Chao,2012). Compare figure 2 and figure 3, it can be seen that “text chat”, “moments” and “audio chat” ranks the top three. It indicates that the main functions of college students using network public platform focusing on live chat and media entertainment. It needs to pay attention that about 48.53% students once used subscriptions and public accounts, but only 20.59% students use frequently.

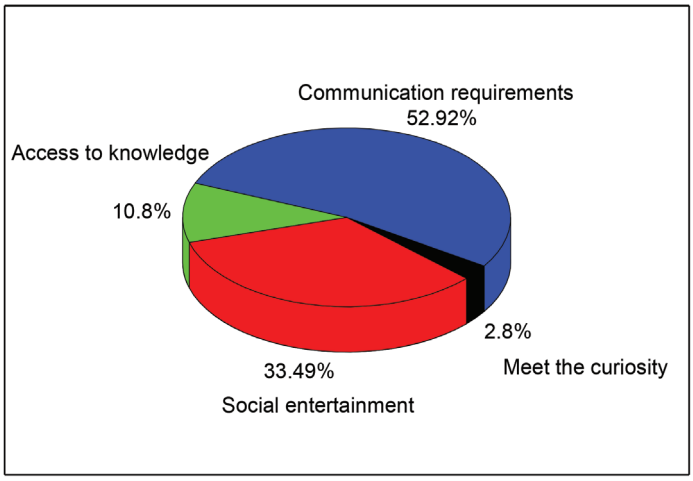

Figure 4 – The demand of network platform

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College students use network public platform to satisfy self-demand through using some functions of network public platform in figure 3. Communication demand ranks the first, accounting for about 52.94%, followed by social entertainment demand, accounting for about 33.8% and then followed by acquiring knowledge and meeting curiosity, accounting for 10.29% and 2.95% respectively (as shown in figure 4).

2.3. Influence of network public platform on reading and learning of college students

It is indicated in the investigation results in figure 5 that the top five public account types followed by college students are "related professional knowledge", "industry information", "news media", "practical encyclopedia" and "health encyclopedia"; after reading and learning, "practical encyclopedia" is more likely to be shared. It indicates that college students are more likely to be touched by "chicken soup for the soul" in network public platform, produce resonance or willing to learn and practice. According to the related data published by network public platform team, each person read 5.86 articles every day on average on network public platform, in which the most popular articles include not only emotions and health care, but also political and law news, enterprise management and business news etc.

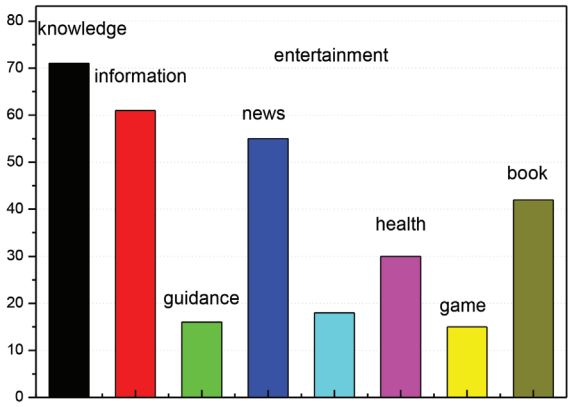

Figure 5 – Be focus on public network platform

2.4. Influence of network public platform on the way of life of college students

Motivation of using network public platform, 61.76% college students believe that the reason why they use network public platform is that all the friends are using and it is easy to contact friends; 19.13% college students believe that network public platform can attain practical information and related knowledge through moments or information push and other functions; there are also 8.82% college students believe that network public platform helps to save the network flow and test (as shown in figure 6).

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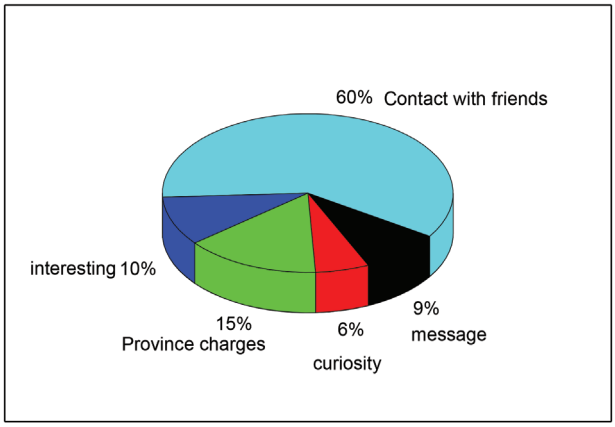

Figure 6 – Using motivation of network platform

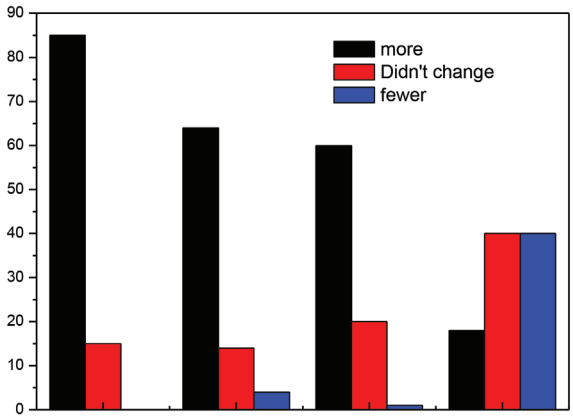

Figure 7 – The influence of the college students' life and study network platform

Figure 7 has analyzed the influence of network public platform on life and study of college students and made evaluations for "computer using time", "frequency of contacting friends", "relationship among friends" and "efficiency of work and study"; there are 85.29% college students believe that computer using time becomes longer with adoption of network public platform; there are 64.71% college students believe that they contact friends more frequently; there are 60.29% college students believe that they are get closer with friends; but there are 39.71% college students believe that work and study efficiency has decreased compared with before.

2.5. Investigation on the attraction of college network public platform for college students

It can be seen from figure 8 that among all investigated people, 8.82% college students do not follow the public platform of official network public platform of one university;

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among followers, 63.24% students share the articles in public platform in their moments occasionally, 20.59% students never share and only 7.35% students share the articles in public platform frequently. For college students, campus public platform is with rich and colorful content, information can meet their demands and the practicability is strong etc, all of these attract their attentions most.

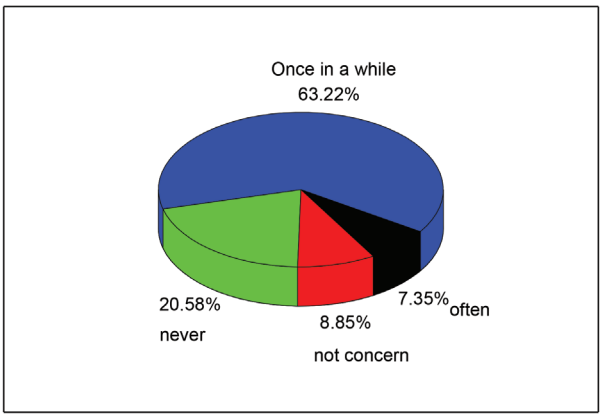

Figure 8 – Attention to network platform

3. Challenges brought about by computer network public platform on the management for college students

3.1. Challenges for management mode of traditional public opinion information

1. Authority of public opinion information manager has been weakened

With the popularity of PC, computer and panel computer etc. among college students, network public platform, micro blog, various social networking websites and other new media have become the main media method for communications among college students. Contemporary college students are different from former students, the unified call and uniform approach of past public opinion information management worker are difficult to be recognized and accepted by them. In the selection for the education, they are more inclined to personal preference and improvement of own qualities, while the authority of public opinion information manager has been weakened.

Public opinion information work in colleges and universities are unable to adapt to the development of modern information society if it still stay in fixed time and space and follow the "closed" single and traditional education mode. Public opinion information management should further adhere to the concept of people oriented and implement based on fully respecting the dignity of personality and understanding the development demand of people. For the defect of traditional public opinion information management focusing on "touch infusion", it has to respect the dominate role of people in public

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opinion information management, pay attention to the spiritual appeal of people, be good at discovering the positive thinking of people and inspire the enthusiasm of people in self-education and self-improvement.

2. The communication effect of mainstream ideology are difficult to master

The extremist in western culture erodes the thoughts of young students. Extremist, egoism and utilitarianism in western culture are eroding the thoughts of young students. Some people with ulterior motives public a lot of remarks demonizing socialism and they spread rumors, which affect the values and beliefs of part of college students. Fierce collision between western culture and Chinese culture, interaction among various values and ideologies, frictions between traditional culture and modern civilization, positive and noble and negative and decayed ideas affect students and teachers in colleges and universities.

3.2. Challenges for teachers of public opinion information class

In the curriculum system of public opinion information class at high school, no matter for the basic principles of Marx doctrine or for the Mao Zedong thought and Chinese socialism theory system, all are experience summary and theoretical sublimation of people transforming subjective world and objective world and are the truths inspected by practice. Because shortages exist in theoretical innovation and practice experience etc. among college students, it is a gradual and deepening understanding process for the theoretical results of Marxism in China, which needs the teachers of public opinion information class to spread and explain the theories of Marxism in China effectively, guide the students to understand the theoretical results of Marxism in China correctly and make them fully understand the charm and value of Marxism theory. However, the traditional teaching mode of "teacher teaching and student learning" can't adapt to the society with rapid development in information era and the traditional teaching mode needs to be improved.

3.3. Challenges for the guidance of ideological and public opinion of students

which makes their values difficult to focus. If the visual and vivid information transferred on network public platform is not handled properly, it will penetrate into the hearts of college students and then change their way of thinking and values. Network public platform provides platform for student communication, at the same time, brings about difficulties for the monitoring of campus network public opinion, which brings about difficulty for instructors in colleges and universities to make thought management for college students and guidance their values and outlook on life.

4. Countermeasures and suggestions for improving the management work for college students with adoption of network public platform

4.1. Improve the construction for spread of campus network security knowledge

As the worker for student management, firstly, it needs to improve the processing capacity for acquiring, analyzing, evaluating and transferring various kinds of information, apply

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this ability to modern media flexibly and then change the education concept which takes mastering public opinion information management work as premise and adapts to the trend of times; secondly, it needs to make the teachers and students understand how does the new media operate, how to construct reality and how to make media information, and then learn to understand, identify and summarize media information correctly, learn to use media effectively and improve study and work efficiency; lastly, it needs to implement information supervision and guidance mechanism, supervise and guide the spread of information in colleges and universities correctly and timely.

First, change "blocking" into "clear" and keep the clearing of the information. Second, interfere timely for the sensitive topics and guide the students to understand problems correctly and objectively. Third, strengthen the care for students, publicize the student affairs properly to attain assistance from more people, pay attention to record problems on line timely, strengthen interaction and supervision among school, family and society with new media.

4.2. Strengthen legal consciousness, responsibility consciousness and moral consciousness

Strengthen legal consciousness: till today, the absence of our country in the supervision of computer communication media causes the not standard operation of current computer communication media market and incomplete industry chain. Therefore, when calling for the country to speed up legislation, student workers at colleges and universities should walk together with teachers and students at the frontier of exploration and prepare and improve the related rules and regulations of computer communication media at university campus. Firstly, use the rules and regulations of school to regulate the daily behavior of college students, cultivate them to respect intellectual property right, abide laws consciously, respect the law consciousness of others' privacy, resist the spread of various obscene, superstitious and false information consciously, maintain normal learning and living order at school and construct a good harmonious information environment.

Strengthen moral consciousness: in the social era of network, communication between people has new moral requirements. There are less immoral phenomenon on internet, but people realize the importance of resources sharing, mutual cooperation, mutual benefit and other moral norms after realizing the harm of those immoral phenomenon; and then ponder and improve own moral obligations and responsibility consciousness in a further way.

4.3. Improve the network quality of public opinion information management worker

The improvement of media literacy of public opinion information management worker at colleges and universities can help college students to improve the ability of dealing with media information. Media literacy of college students can be well improved through improving own media literacy continuously, so the colleges students can discard the false and retain the true, discard the dross and select the essential and selecting useful information when facing complicated media information; the improvement of media literacy of public opinion information management worker at colleges and universities can help college students resist the erosion of western ideology media products, help them resist the invasion of unhealthy information, and then identify socialist beliefs and

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become the important premise and guarantee of qualified constructor for the cause of socialism; the improvement of media literacy of public opinion information management worker at colleges and universities is good for improving the pertinence of network public opinion information management. Put emphasis on the influence changes of new media for the psychology, emotion, interest and other aspects of college students, improve ways and means and then perform public opinion information management work based on the characteristics of era that college students are in.

4.4. Improve the supervision and management mechanism used by network public platform at colleges and universities

The monitoring and management mechanism of network public platform needs to be determined by the demand and purpose of education management in colleges and universities. In the era of network public platform, to well perform the public opinion information management work of educated people, it not only needs to well control the main channel and main position of public opinion information management, but also needs to strengthen the monitoring of network culture, pay timely attention to the dynamic thinking of college students, timely master the hot topics among college students, improve the information acuity and insight, discover problems and solve timely, make dredging and digestion for the dynamic thinking expressed in network public platform, check erroneous ideas at the outset and then realize the effect of public opinion information management work in guiding the trend. Network public platform belongs to activities of students and relates to the independent management of students; it is with education and practicality. Once deviation appears in the spontaneous activities, it will cause serious mistakes. Therefore, in the supervision and management process, it needs to seek truth from facts, start from reality and adopt hidden management mode.

5. Conclusion

Student managers at colleges and universities need to be good at using network public platform to make public opinion information management and other student management work for students. Network public platform at colleges and universities should use the management mechanism with cooperation between teachers and students and operated by students independently which takes network laws and regulations as background and under the supervision and guidance of publicity department of party committee. Starting from the perspective of school using new media, make corresponding management system based on types and features of new media, with clear division of labor, each one bear own responsibility and maintain good network environment together.

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Promotion of Internet Technology to Cross-border Cultural Communication Analysis

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Abstract: The intervening of network media for international cultural transmission has changed the current structure of cultural transmission and brought the transnational cultural communication into the digital age. In view of the long history of cultural communication between China and South Korea, network media provides a new opportunity for China and South Korea's cultural communication with its strong technical advantages, Under the historical background that in years of 2016 is the 24th Anniversary of the establishment of China-South Korea diplomatic Relations as well as the year of Sino-Korea exchange, according to the unique differences between Chinese and Korean people in the network cultural communication, taking the cultural communication between China and Korea as the research object, from the perspective of network transmission, the paper carries on the rational thinking and analysis to China and South Korea's cultural communication in network media environment, and discusses the influence and effect of network transmission on cross-cultural communication. The study points out that democracy and freedom in cyberspace make cultural communication in cyberspace more creative, cultural communication need more interaction in the network media environment. In addition, cultural communication between China and South Korea need to seek common ground while reserving differences, and try to find common ground. Between different cultures actively engage in exchanges and dialogue, mutual communication, learn from other culture's positive factors, mutual complementarity, mutual blending, so as to achieve diversified exchange development.

Keywords: internet, information technology, cross-border cultural communication, Chinese and Korean culture, cultural consumption.

1. Introduction

Since the late 80s and early 90s of the 20th century Internet technology began to provide services to civil, to the beginning of the 21st century, after just a dozen years time (Rocha, 2012), it had been amazing popularity, it is changing people's living habits in all directions, and gave birth to the network economy and the new form of the development of cultural industry, made the boundaries between the Internet industry and cultural industry increasingly blurred (Antunes, 2004). In an increasingly flat world, the Internet has fundamentally changed the interactive relationship between "transmission" and

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"audience", and profoundly changed the way of cultural production, promotion and consumption (Chen & Ractham, 2013). At the same time, the rise of the network also makes cross-cultural communication with the new characteristics compared with the past, that is cross-cultural communication carry out simultaneously and interactively in the cyberspace and real space, this new feature on the one hand to promotes people's understanding and communication between different cultures, on the other hand also exacerbates the people's misunderstanding and estrangement between different cultures (Lim, Yap and Lau, 2010, Leite et al., 2016).

In the past, cross-cultural communication has been studied from a single perspective, that is, place cross-cultural communication in the cyberspace or the real space for single perspective research, such researches often exist limitations (Cowley & Hanna,2005). If the authenticity and accuracy of the information can't be guaranteed, it will lead to misunderstanding and estrangement, conflict and confrontation among different cultural backgrounds in cyberspace (Hanna et al., 2007). It will impede the smooth intercultural communication in cyberspace. While at the same time it will bring negative impact on cross-cultural communication in real space (Holtbrugge et al., 2012; Lucas and Souza, 2016).

Regarding to the above-mentioned problems, the paper investigates cross-cultural communication from the perspective of interaction between cyberspace and real space (Starke-Meyerring, 2004). In this paper, we take the cross-cultural communication between China and Korea as the breakthrough point, select Qingdao Chengyang Koreans gathering area as the field survey points, select the network forums established by China and South Korea as the network survey points (Yoon,2011), through the combined method of observation, interview and questionnaires to collecting data, and the operating mode of the cross-cultural communication in the interaction between the cyberspace and the real space is investigated (Lewis & George,2008). The reasons for smooth proceed of the cross-cultural communication in the interaction between the network and the real space is explored. The purpose of this study is to provide useful information for the friendly exchanges between people of different cultural backgrounds in the new era.

2. Intercultural Communication in Cyberspace

The Internet has created a new interactive space for contact and cross-cultural communication to people from different countries, cultures and nations (Jiang and Wen, 2009). Unlike the form of cross-cultural communication in the real space, intercultural communication in cyberspace is carried out in its unique form and characteristics (Bruce, 1979). In the real space, there is little contact between Chinese and Korean people and cultural communication. On the contrary, in cyberspace, the people of China and South Korea frequently explore each other.

2.1. Communication in cyberspace

Because Chengyang is concentrated area where the Korean people live in, Chengyang Sino-Korea Cultural communication Network Forum naturally becomes a cyberspace for searching and cultural exchanging between the Chinese and the South Korean people (Roger and Cheryl, 2008). For a period time of observation and analysis on the forum

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post found that there were a total of 255 posts be searched out by using "South Korea" as a keyword in the site during the past six months, if computing in day, then a new post which using "South Korea" as a keyword will appears a average day. The posts using "South Korea" as the keyword are divided into several categories, one kind of Chinese and Korean culture posts, this posts is generally introduce customs, cultural differences between China and South Korea; the rest is China and South Korea evaluation posts, such posts mainly are the introduction of the Koreans in Chengyang and the evaluation of Koreans in Chengyang. In these posts, the discussion of evaluation posts of China and South Korea is particularly intense. For example, in November 29, 2015 Chengyang user "Youxian" published a post "talk about my impressions of Chengyang Koreans," in ChengYang gossip section of the Chengyang forum, this post has triggered an extensive discussion of Chengyang Users, until December 1, 2015, the post had a total of 192 "Reply."

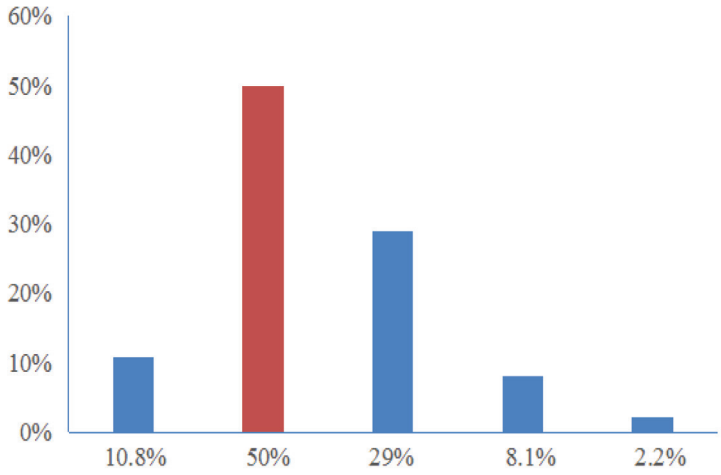

Figure 1 – Koreans' attention to evaluation of Chinese to Koreans on Internet

A questionnaire survey of Koreans in Qingdao shows that most Koreans are more concerned with the evaluation of Chinese to Koreans on Internet, and only a small percentage of them do not care (see Figure 1) (Ying and Sun, 2009). Among them, 10.8% of the Koreans expressed great concern about the evaluation of Chinese to Korean, 50% of South Koreans expressed concern, 29% of South Koreans expressed general concern, while 8.1% did not pay attention, expressed very little attention is only 2.2%. From evaluation and discussion of Chinese to Koreans in networks, as well as the higher degree of concern from Korean people on evaluation of Chinese to Koreans, it can be seen that they are frequently explore each other between the Chinese and South Korean people in cyberspace (Mehra and Papajohn, 2007). In the view of main content of the entire website, Chinese news is the most in the various types of information, all this information provide a window for the Koreans in Qingdao to understand China (Xiang, 2008).

Based on the above observations of content of two Chengyang website forum of China and South Korea, netizens from China and South Korea are mainly in browsing information,

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releasing information, replying to the information and other ways to familiar with each other, understanding, contacting and cultural communication in the network.

2.2. The media effect of cultural information

Compared with the real space, the Chinese and Korean people are more likely to explore each other in cyberspace (Gerber, 2012). The main reason is that the intermediary and carrier of this explore is information, people with different cultural backgrounds can search for the information resources according to their own situation and needs, so as to achieve each other's understanding, awareness, contact and cultural communication. Chinese and Korean people to interact with each other through information obtained on internet (Skoric and Park, 2014), In essence, the interaction is a kind of indirect, people-information-people of non face to face interaction process.

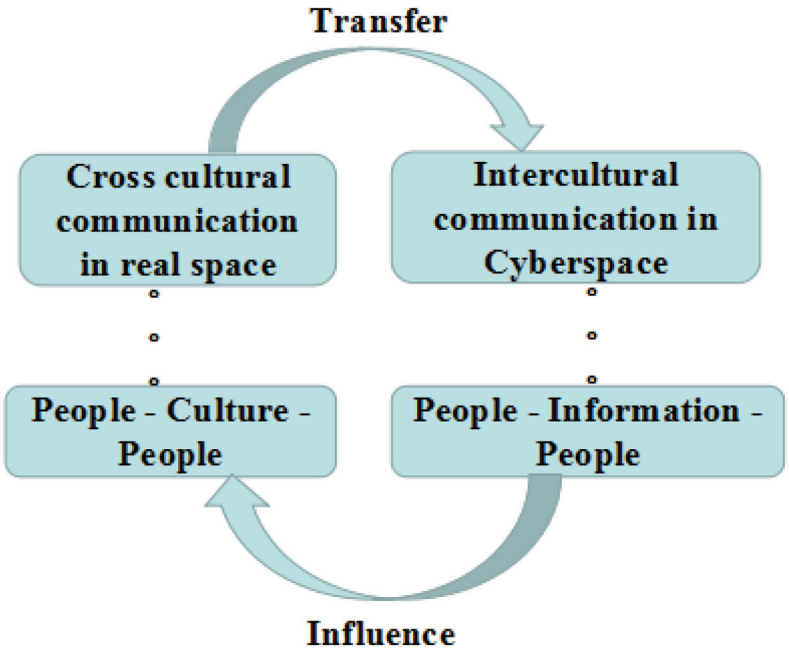

Figure 2 – Cultural communication model

When people open the computer, click the mouse to enter the cyberspace constructed by Internet, people began a way of interaction different with that of the real space, we are not directly facing a single person or group, but the computer screen and the text, pictures, sound, video and other information presented by computer screen (Rivera & Rogers,2006). The essence of people's contact and communication between different cultural backgrounds in cyberspace is the people-information-people interaction process (see Figure 2). In the intercultural communication of cyberspace, the

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information elements have replaced the cultural elements which play an important role in communication in the real space, all of these make the information become the most important intermediary for the interaction between people (Docenko, 2012).

3. Cross-Cultural Communication of Network and Real world

3.1. The impact of the network

The Internet connects people from different countries, nations and cultures, and provides convenient conditions and communication opportunities for people from different cultural backgrounds (Gates, 2013). Intercultural communication in cyberspace has profound impact on cultural communication in the real world, the impact includes both positive and negative impact. Intercultural communication in cyberspace promotes cross-cultural communication in real space and enhances communication between different cultural groups in both countries, this is the positive aspect (Jang and Barnett, 1994). While intercultural communication in cyberspace is not smooth, in the real world cross-cultural communication will also be affected to varying degrees, resulting in the gap between different cultural groups, intercultural communication can't be sustaining and normally proceed, this is the negative aspect(Petr & Gauzente,2013).

Since 2005, beginning with Korean's inscription success of "Dragon Boat Festival", the "Sino-Korean cultural dispute" started in network (Verjans et al., 2015). Then many so-called South Korean professors claimed that "poet Li Bai is a Korean", "Sun Zhongshan is a Korean", "Korean national invented the Chinese characters" and so on, the information of Chinese culture source from South Korea is full of forums and websites. Before and after the 2008 Beijing Olympic Games, such as "torch relay storm", "Wenchuan Earthquake evil", "Olympic opening ceremony leak", these events which are not conducive to the friendly relations between China and South Korea had also widely spread through the network(Wu,2012). In addition, some people who have been to Korea or have contact with Koreans through the blog, the site forum to breakdown the information that all sorts of unfriendly words and deeds of Koreans to China and Chinese, those information also was widely reproduced by users on network. The emotions of "Dislike Korea ", "Hate Korean" and even "Anti-Korean" in the network have continued to heat up and start to extend from the network to the real world, which has affected the Sino-Korean folk relations and even international relations.

In response to the intensified emotions of "Dislike Korea ", "Hate Korean" and "Anti-Korean" in cyberspace, On September 5th, 2008, South Korean civil organization officially announced that they would launch a campaign in China called "Modesty and Warmth activities ". And specially the establishment of the "modest and warmth activities headquarters", to promote to carry out the development of a variety of colorful activities by the committee, such as actively excavate positive examples to promote the friendly relations between the two countries (Jean et al., 2010), to help the unfortunate people around, to carry out scholarship matters, on the whole had made certain achievements in the promotion of Korean folk relations.

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According to the results of 7192 questionnaires, 71.7 percent of Koreans said they had heard of the "Hate Korea" of public opinion in the network (see Figure 3). 9% of Koreans who have ever heard the emotion of " Dislike Korea " and " Hate Korea " thought emotion of "Dislike Korea " and " Hate Korea " was very serious, 38.2% of people think that this emotion is serious and fuss. 48.7% of people think that such emotion is not serious (Popova, 2013), there are 5.3% of people think that no need to make a fuss.

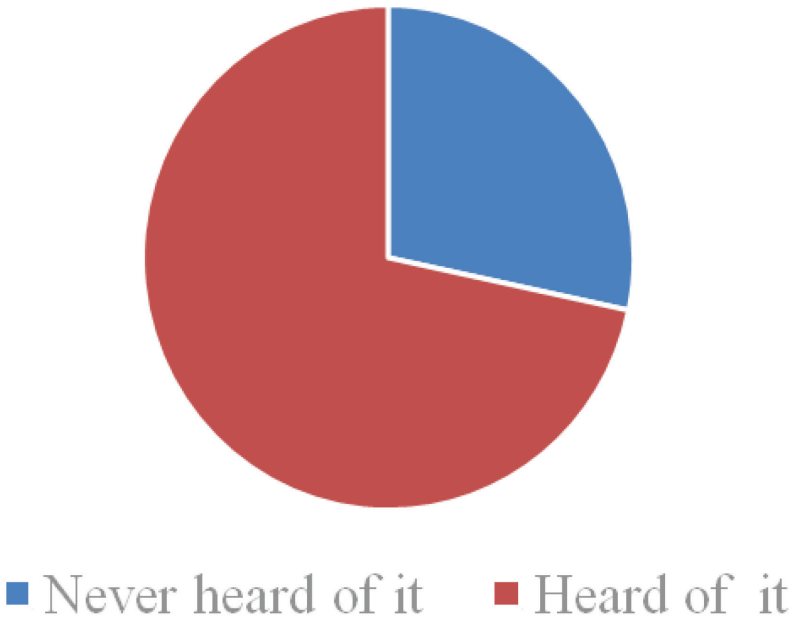

Figure 3 – Ever heard of the "Dislike Korea" and "Hate Korea" of public opinion

Regarding to the disseminated emotion of "Dislike Korea " and " Hate Korea ", a large proportion of Koreans lived in Qingdao believed it had affected their daily life to a certain extent, account for 28% of total respondents, who thought the influence is very large of total respondents, account for 4.8%, who thought the influence is large account for 21.4%, very small accounted for 18.5%, only a small number of people thought it had no influence or with the attitude of uncertain. However, many of the information disseminated on the network has been proven to be false.

3.2. The power of information

At Internet age, the role of power of culture in the cross-cultural communication is reducing, while the power of information plays a more and more important role in cross-cultural communication. Information has become an important intermediary in the process of cross-cultural communication at Internet age, and demonstrates its great strength, which controls the smooth progress of cross-cultural communication.

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The fast accessed information of the network brings people infinite convenience, also makes the intercultural communication benefit from it. People of different cultural backgrounds can know each other instantaneously through the information on the network, and can communicate with the objects that want to communicate through fast information. When the information is rapid spreading and affecting the cross-cultural communication, another attribute of information becomes very important, it is the accuracy and authenticity of information. This attribute directly affects the success of cross-cultural communication. Today with the highly development of Internet, countless of the information generated every day, for cross-cultural communication which require to use information intermediary to complete in cyberspace, the accuracy of information is particularly important. If the information is accurate and truth, it can promote the cross-cultural communication to proceed smoothly in cyberspace, otherwise it will hinder the process of cross-cultural communication, the accuracy of information control "quality" in cross-cultural communication

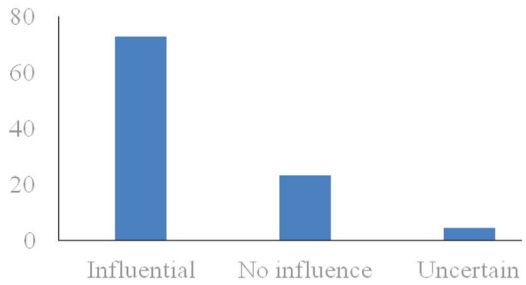

Figure 4 – Influence of "Dislike Korea ", "Hate Korea" on the Korean daily life in Qingdao of public opinion

The "fast" and "accurate" of information relates with the "quantity" and "quality" of cross-cultural communication. The choice of "fast" and "accurate" of information, in fact is the choice of "quantity" and "quality" of cross-cultural communication. If the information only showing its "fast" attribute, then cross-cultural communication may be only has the growth in "quantity", and can't bring improvement on the "quality" of cross-cultural communication. "quality" improvement of cross-cultural communication is guaranteed by " accurate " attribute of the information, and this guarantee is the result of the interaction of the "publisher" and "recipient" of the information.

Our ultimate desire is to increase cross-cultural communication "quantity" while cross-cultural communication "quality" is also guaranteed. But the fact is often not the case. With the aid of information, Cross-cultural communication in cyberspace generally takes place in three steps: the generation of information, the reception of information, and the action of information, the publisher and recipient of information are responsible to the first two steps, cross-cultural communication is the result of the last step. When the information is manipulated by people with various purposes and lost its original authenticity and accuracy, at the same time the inaccurate information

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are selectively received by the people has been lost the ability to distinguish, thinking, then the effect of information as important intermediaries will be hindered in cross-cultural communication.

4. Conclusions

1. Network media has become the new fulcrum of cultural communication. The Internet achieved instantaneous spread of information within the wide area, made the different cultural patterns unprecedented approaching, realized free exchange of a variety of different ideas. All these have greatly promoted the cultural development of different nations and regions, and also led to the generation of new cultural forms. The democracy and freedom of cyberspace make the cultural communication more creative, laying a technical foundation for the development of culture.
2. Cultural communication need to interact in the network media environment, Cultural communication, not only to come in, but also to go out, the freedom and opening of Internet has opened up a door for cultural communication between China and South Korea, give both China and South Korea an equal opportunities, and only make good use of this opportunity and let two cultures learn from each other, can achieve considerable development in cultural communication and collisions.
3. Cultural communication between China and South Korea need to seek common ground while reserving differences. In terms of culture, we advocate seek common ground while reserving differences, that is, under the conditions of recognizing the differences and diversity strive to find common ground, actively engage in exchanges and dialogue between the different cultures, mutual communication, learn from other culture's positive factors, mutual complementarity, mutual blending, so as to achieve mutual development.

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Analysis on Spatial Econometrics of China' s Institutional Change and Regional Economic Growth Based on BIM Technology

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Abstract: As for the structural arrangement of spatial econometric analysis, this paper firstly studies the geospatial interaction and overflow effect of marketization processes of all regions in China from the perspective of spatial analysis by using Moran`s I spatial autocorrelation computing method; then, in consideration of the endogen effect of spatial agglomeration, based on the traditional C-D production function, this paper inspects influences of the marketization index scales, fixed capitals, talent capital inputs and other determinants of all regions on regional economic growth by using the geographically weighted regression method and the spatial error model and spatial lag model of spatial econometrics.

Keywords: BIM Technology, regional economic growth, endogene effect, big data analysis

1. Introduction

Any regional economy cannot be independent and is always closely related to or inextricably linked with other economic entities. In classical theoretical researches on economic growth, the setting of econometric model usually neglects or omits the fact of interaction among regions. Besides, spatial dependence, which is the key content of research on regional economy, can be described as the first theorem of Tobler geography: "geographic objects are interrelated and the interdependent among spatially adjacent geographic objects is high." Spatial econometrics, a very new small branch of econometrics, has been developing for recent years and is originated from the theory of spatial interaction and econometric model (Chen, 2011). People has always researched and paid attention to spatial interaction, which has always been friendly neglected in economic researches due to the lack of a complete theoretical system and implementation method (Shen and Kuan, 2011). In the late 20th century, as the theoretical analytical framework of spatial relation gradually grew distinct, the spatial econometrics also developed gradually. The spatial econometrics, which is mainly used for cross-section data and panel data, solves the complicated problems of spatial interaction and spatial dependent structures in a regression model. As there may be some biased errors

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in regression analysis with the classical econometric model due to the complicated problems spatial interaction and spatial dependent structures in a spatial sample, the spatial econometrics has a significant advantage in analyzing the spatial sample data (Zhang and Gu, 2002; Faria et al., 2015).

The current data available: marketization indexes, GDP, fixed-asset investments and human capital investments of 31 provinces, cities and autonomous regions of China from 1997 to 2007. At first, the marketization index and Moran's I index of GDP were calculated below. The spatial changes in color on the map (diagram for distribution of spatial zones) show the evolution process of marketization and GDP's change process with the passage of time in all regions (Li and Han, 2011; Fortes et al., 2016).

2. Overview of BIM technology

Marketization, which is a transitional structural reform from planned economy to market economy, is not engaged in just a few simple changes in rules and regulations, but is engaged in a series of reforms in economy, society and legal system. Therefore, it is proper to use the relevant index of marketization process as the institutional change index after China's reform and opening-up policy. The preceding paragraph of this paper analyzed the extremely important role played by the market-oriented reform in boosting China's economic growth, and quantitatively analyzed the contributions of institutional changes of the whole country, eastern China, middle China, western China and southeast China to economic growth with the time series analysis method. This chapter will continue using the relative indexes of marketization processes of all provinces in China to represent the institutional variables and quantitatively investigate the influence of China's market institution change on regional economy based on provincial data (Rojas, 1999).

For the study and analyses on the thought of econometric modelling, please see Figure 1 below:

As for spatial econometric analysis, at first, it is required to establish a spatial weight matrix expressing the spatial concept. It is the premise and foundation for spatial data analysis and a link to establish the spatial relation of attribute value, so its appropriateness directly relates to the explanatory power of relation model.

Usually, W, a binary symmetric spatial weight matrix, is defined to express the adjacent relations of n positions in the spatial region; its form is as follows:

$$W = \begin{bmatrix} w_{11} & w_{12} & \cdots & w_{1n} \\ w_{21} & w_{22} & \cdots & w_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ w_{31} & w_{n2} & \cdots & w_{nn} \end{bmatrix} \tag{1}$$

In the formula above, w_{ij}, which signifies the adjacent relation between regions i and j, can be measured according to the adjacency standard or distance standard (Turvey, 2006). There are many rules to determine a spatial weight matrix and the following two rules are most common:

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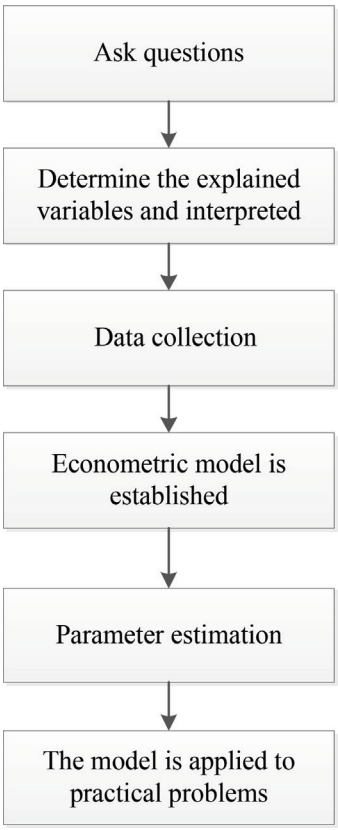

Figure 1 – Econometric modelling

1. Simple binary adjacent matrix:

$$w_{ij}=\begin{cases}1\\0\end{cases} \tag{2}$$

If i and j are adjacent, $w_{ij}=1$; or else, $w_{ij}=0$.

2. Distance-based binary spatial weight matrix:

$$w_{ij}=\begin{cases}1\\0\end{cases} \tag{3}$$

In the formula above, region i is not adjacent to itself; namely, $w_{ij}=0$.

The selection of index aims to depict the spatial autocorrelation and there are many indexes with such a function. Usually, Moran's I is used as the spatial autocorrelation index. The coefficient is the reference parameter which is used to measure the relation between

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adjacent spatially distributed objects and their attributes value. The coefficient value range is between -1 and 1. A positive value means that the attribute distribution of the spatial object shows positive correlation; a negative value means that the attribute distribution of the spatial object shows negative correlation; 0 means that the attribute distribution of the spatial object shows no correlation. Its calculating formula is shown in formula (4):

$$I = \frac{n \times \sum_{i}^{n}\sum_{j}^{n} W_{ij} \times \left(y_i - \overline{y}\right)\left(y_j - \overline{y}\right)}{\left(\sum_{i}^{n}\sum_{j}^{n} W_{ij}\right) \times \sum_{i}^{n}\left(y_i - \overline{y}\right)^2} \tag{4}$$

In the formula above, n signifies the number of samples; y_i and y_j are the attribute values of region i or region j; y is the mean value of all points; w_{ij} is the weight matrix to measure the relation between spatial objects and is usually a symmetric matrix.

The reliability inspection method of Moran's I is shown in formula (6):

$$Z(I) = \frac{I - E(I)}{S_{E(I)}} \tag{5}$$

$$SE(I) = SQRT\left[\frac{N^2 \sum_{ij} w_{ij}^2 + 3\left(\sum_{ij} w_{ij}\right)^2 - N\sum_{i}\left(\sum_{j} wij\right)^2}{\left(N^2 - 1\right)\left(\sum_{ij} w_{ij}\right)^2}\right] \tag{6}$$

3. Combination of BIM technology with numerical simulation technology

3.1. Monitored data for the supports of the foundation pit

Year	GDP	P
1997	0.3475	0.017
1998	0.3512	0.010
1999	0.3598	0.024
2000	0.2687	0.032
2001	0.2478	0.024
2002	0.2369	0.029
2003	0.2214	0.024
2004	0.2225	0.031
2005	0.189	0.032
2006	0.2146	0.036
2007	0.2129	0.034

Table 1 – GDP index and Confidence level of Morian' s

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It is obtained through calculation that the Moran's I coefficients of GDP from 1997 to 2007 is shown in Table 1. All coefficients are greater than zero, indicating the positive spatial correlation of GDP from 1997 to 2007. As for inspection of the significance of spatial autocorrelation, the significance level of Moran's I coefficient is tested with the method of Monte Carlo simulation. The corresponding P value is equal to 0.0016. It indicates that the spatial correlation of GDP under the confidence of 99.84% is significant and shows a normal distribution. Thus, it means the spatial distribution of GDP showed the trend of congregation during the whole sample period.

After comprehensively comparing the changes in GDP's spatial autocorrelation coefficients from 1997 to 2007, we can see the coefficients show a declining trend. The change trend of GDP can also be seen from the specific analysis on cross-section data of the four time points below.

3.2. Analysis on spatial autocorrelation of marketization index

The high Moran's I coefficients of China's marketization indexes from 1997 to 2007 obtained through calculation indicate the strong correlation of spatial distribution and concentrated distribution of geographic positions, as shown in Table 6.2. All the coefficients in the table are greater than zero, indicating the positive spatial correlation of China's marketization indexes from 1997 to 2007. Besides, there are fluctuations in the spatial autocorrelation coefficients of marketization process. There is a declining trend from 1997 to 2000 and a process of rising, declining and rising later. Therefore, we divide it into four time points for observation, namely, 1997, 2001, 2004 and 2007. From the four time points, we can further see the Moran's I changes from 0.68 to 0.72, 0.66 and 0.70 successively. Even though there are slight fluctuations, it generally reflects that the marketization processes of 31 provinces, cities and autonomous regions of China show the significant positive correlation and remarkable spatial dependence; namely, there is an institutional overflow effect.

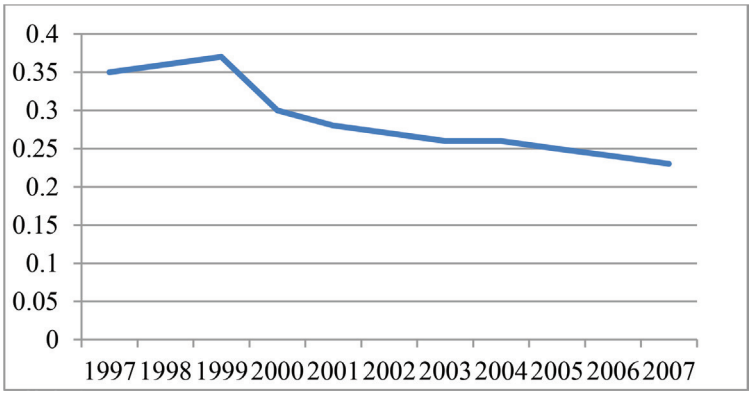

Figure 2 – Index change trend of GDP Morian' s

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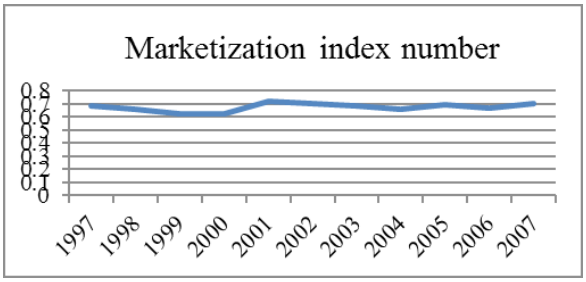

Figure 3 – Marketization index number change trend for Morian' s I

Year	Spatial autocorrelation coefficient	P
1997	0.6821	0.001
1998	0.6591	0.001
1999	0.6243	0.001
2000	0.6251	0.001
2001	0.7212	0.001
2002	0.7015	0.001
2003	0.6825	0.001
2004	0.5624	0.001
2005	0.3894	0.001
2006	0.6658	0.001
2007	0.7059	0.001

Table 2 – Spatial autocorrelation coefficient and Confidence level of Morian' s I

3.3. Analysis on spatial autocorrelation of capital stock

Similarly, as shown in Table 3 and Fig. 4, the analysis on global spatial correlation of capital also shows the significant spatial dependence in geographic space.

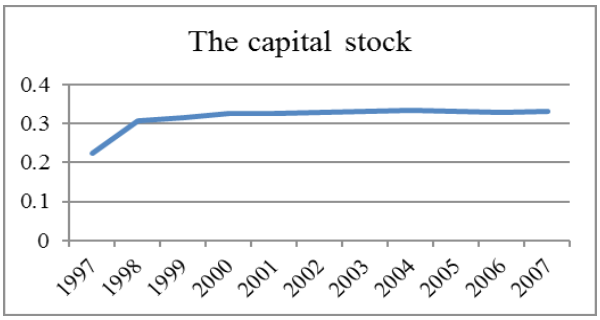

Figure 4 – The capital stock change trend For Morian's I

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Year	Marketization index number	P
1997	0.2229	0.014
1998	0.3069	0.025
1999	0.3145	0.029
2000	0.3251	0.021
2001	0.3274	0.017
2002	0.3298	0.016
2003	0.3326	0.020
2004	0.3345	0.021
2005	0.3324	0.018
2006	0.3304	0.017
2007	0.3316	0.019

Table 3 – The capital stock and Confidence level of Morian' s I

3.4. Spatial autocorrelation of employee

Year	Spatial autocorrelation of employee	P
1997	0.2051	0.059
1998	0.1982	0.069
1999	0.1985	0.072
2000	0.1925	0.075
2001	0.1854	0.080
2002	0.1828	0.083
2003	0.1755	0.084
2004	0.1725	0.087
2005	0.1698	0.095
2006	0.1657	0.098
2007	0.1453	0.112

Table 4 – Spatial autocorrelation and Confidence level of employee of Morian' s I

Practitioners of Moran's I values are relatively low, and reduced year by year, as shown. The Practitioners of the P value is also reduced year by year, the corresponding P value is equal to 0.111 in 2007, shows that under 89.9% confidence level of space is a significant correlation between the GDP.

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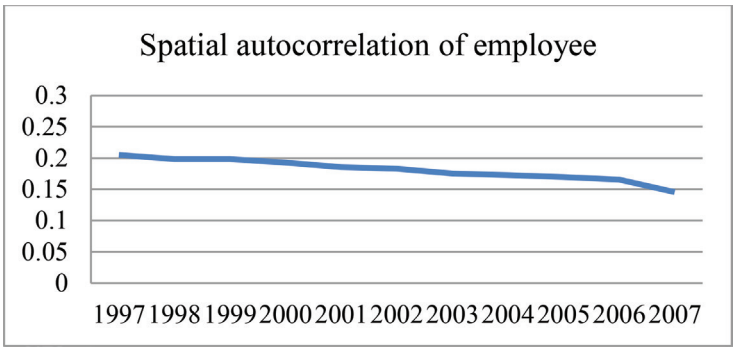

Figure 5 – Spatial autocorrelation of employee of Morian' s I

Conclusion

In this chapter, we studied the spatial effect of marketization processes represented by institutional changes in all regions from the perspective of spatial analysis and their influences on regional economic growth, and measured the contribution of institution to economic growth by using the spatial econometric model. Firstly, based on GIS, we calculated and analyzed the spatial distribution and correlation of GDP, marketization index, capital and labor by using the global and local spatial autocorrelation analysis method, southeast China and western China; The institutional variables represented by marketization indexes in all regions show the significant spatial autocorrelations in the geographic space; thus, it verifies that the marketization processes in all regions show the institutional overflow effect. On this basis, in the third part of this chapter, we mainly quantitatively measured the contributions of institutional changes of 31 provinces, cities and autonomous regions, including the spatial effect. Based on the analysis on spatial trend of main variables, we used the spatial econometric model for least square estimation, spatial lag regression, spatial error regression, spatial lag error and many spatial econometric model methods; the comparison and analysis of model results verified the significant role of institutional change in boosting China's economic growth after the spatial effect is taken into consideration. Although the significance of institutional variable is low when the combined action of capital, labor and institutional variable is considered, this may be caused by the multicollinearity incurred due to the capital and labor information contained in the structure of marketization index, as explained in the preceding paragraph. The model result is significant when separately measuring the spatial econometric model of institutional variable for economic growth represented by marketization index if other factors remain unchanged. Therefore, the marketization process has an influence of positive correlation on economic growth.

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Selection of the Location of Rural Schools Based on Multiple Attribute Decision Making Method

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Abstract: With the construction of the new socialist countryside becoming the top priority in China, more and more people pay their attention to development of the rural education. It is widely accepted that the rural education is a key point to achieve the construction of the new rural community in China and can further balance the resources of urban and rural education. Thus, how to plan a reasonable layout of rural schools is a big challenge needing to be solved. Hereinto, the key step is to select the location of rural schools especially primary and secondary schools. In this paper, we introduce an objective method i.e. multiple attribute decision making method to deal with the method key step. Here, hesitant fuzzy sets are introduced to express the preference of the decision maker or expert. Moreover, the entropy measure is proposed to determine the weight vector of attribute in order to avoid arbitrary of some subjective ways. In addition, the aggregation operators and score function are proposed to aggregate the hesitant fuzzy sets and generate the ranking order of different locations. Finally, the appropriate location can be selected as mentioned in a case study, which is further discussed to demonstrate the advantages of the proposed method.

Keywords: multiple attribute decision making method, hesitant fuzzy sets, rural schools

1. Introduction

In general, the rural problem has been the focus of all walks of life. Now, the construction of the new socialist countryside has become the top priority in China. In this situation, the construction of the new rural community is implemented rapidly all over the country. Hereinto, it is widely accepted that the rural education is a key point to achieve the mentioned work and provide a way to solve the educational problems in China. To balance the resources of education is a purpose that many people purse, where rural education plays a critical role. However, to balance the resources of urban and rural education is not easy and simple task (Alsubaie et al., 2016). There are many challenges in the process of reaching this aim. More importantly, this aim needs the effort of all walks of life. So, it has been a big problem in academic field needing to be solved.

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"National medium and long-term planning framework for educational reform and development (2010-2010)" was issued and pointed that it is important to reasonably plan the layout of urban and rural schools, shorten the gap between urban education and rural education and build the integration mechanism of urban and rural compulsory education. Now, from the perspective of community construction in China, we should rethink the layout of rural schools in China. Constructing the new rural community is the demand of the integration of urban and rural development, which can improve the quality of rural life and economic development. In addition, it can also contribute to guaranteeing ecological environment. Moreover, it should be noted that the layout of rural schools must obey the following laws: unitary, adaptation, gradualness and optimization. Hereinto, the key step is to select the location of rural schools especially primary and secondary schools.

In this paper, a multiple attribute decision making method is introduced. Firstly, we should obtain the assessments of the decision maker or experts. However, it is often difficult to express their preference exactly for the decision maker (Ashtiani and Azgomi 2016, Lino et al., 2016). In general, uncertain and imprecise are the basic characteristics of decision maker's preferences. In order to deal with this problem, Zadeh (1965) defined the basic concept of fuzzy sets based on the theory of fuzzy mathematics. The main characteristic of fuzzy sets is that: the membership function assigns to each element x in a universe of discourse X a membership in interval [0,1] and the non-membership degree equals one minus the membership degree (Wei, 2012; Hernandez et al., 2016).

Since then, Torra and Narukawa (2009) improved fuzzy sets and proposed hesitant fuzzy sets, which permits the membership into a set presented as several possible values between 0 and 1. Now, it has been a popular method to solve imperfect and vague of decision maker's preferences (Torra, 2010; Wang, 2016). Moreover, the entropy measure is proposed to determine the weight vector of attribute in order to avoid arbitrary of some subjective ways. In addition, the aggregation operators and score function are proposed to aggregate the hesitant fuzzy sets and generate the ranking order of different locations. Finally, the appropriate location can be selected as mentioned in a case study, which is further discussed to demonstrate the advantages of the proposed method.

The rest of the paper is organized as follows: Section 2 introduces the corresponding concepts related to the selection of location about rural primary school in China. Section 3 demonstrates the proposed multiple attribute decision making method. Section 4 uses the proposed method in a case study. Section 5 discusses this paper. Section 6 concludes this paper.

2. The introduction of rural schools in China

In this section, we introduce the corresponding concepts related to the selection of location about rural primary school in China.

Since "Law of Compulsory Education" was issued in China, the layout of primary and secondary schools has been greatly changed many times under the specific historical environment. Now, in the new age, rural situations have also faced many alterations including the following three reasons. Firstly, the children who are suitable for school are gradually decreasing. The specific fertility policy decreasing the fertility rate in

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China is the main reason why this trend has appeared. Secondly, the rural tax reform is a compulsory system vicissitude in the new period, which produces great impact on rural compulsory education. After reforming the rural tax, rural basic education is seriously lack of funding. The number of primary schools decreases and the layout should be further changed. Thirdly, the resources of rural education are limited. For a long time, rural education is lake of infrastructure and good teachers (Pazos et al., 2012). In addition, there are many evidences of waste about equipment in rural primary school.

In 2005, "Several opinions to further balance development of compulsory education" was issued by Ministry of Education. It indicates that the excellent schools should play the important role to drive and radiate other schools. However, what was beyond our expectation is that the number of rural schools and students decreases and that of urban schools and students increases (Yang et al., 2014). Now, there are also many phenomena in the existing rural schools that may bring some negative influences. (1) The ratio of boarders is high and accommodation is crowded. After the mentioned law was issued, school house and some infrastructures are not enough to satisfy the demand of students in the rural schools. (2) The class size in cities is too big to guarantee the quality of education. Many parents send their children to the urban schools, which results in a big gap between the resources in urban education and those in rural education. (3) The social function of rural schools becomes weak. In general, rural schools are the kernel of rural culture and important position to improve rural culture. With the decreasing of rural schools and students, this role of rural schools also becomes weak. (4) The quality of teachers is also questionable. On the one hand, the age structure of rural teachers is not reasonable, where the aging of teachers is serious. With the loss of high-quality teachers, the group of teachers is not stable. On the other hand, the educational level of rural teachers is often low. They are usually lake of modernized ability of education and difficult to adapt the new requirements of modern curriculum. More importantly, the rural teachers are often lack of enthusiasm of innovation. (5) The investment of education is also limited especially in rural education. These problems urgently need to be solved in order to improve the development of rural education. The novel layout of rural school is an important step in the existing challenges. As mentioned in Introduction, the key point is to construct assessment framework to select appropriate sites to program a new layout.

3. The proposed method based on hesitant fuzzy sets

In this section, the concepts of hesitant fuzzy sets and corresponding operational laws are reviewed, then the aggregation operators in hesitant fuzzy context and score function are introduced, respectively. The process of the proposed method is demonstrated in the final.

3.1. The introduction of hesitant fuzzy sets

Since the concept of hesitant fuzzy set was proposed by Torra (2009; 2010), it has attracted much attention. Firstly, we briefly describe the basic concepts of hesitant fuzzy sets as follows.

Definition 1. Given a fixed set $X = \{x_1, x_2, ..., x_n\}$ which is a universe of discourse, then a hesitant fuzzy set H over X is defined as

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$$H = \{< x, h_H(x) > | \, x \in X\}, \qquad (1)$$

where $h_H(x)$ is a set of some values in [0, 1], symbolizing the possible membership degrees of the element x to H. For convenience, we call $h = h_H(x)$ a hesitant fuzzy element and H the set of all hesitant fuzzy elements (Xia and Xu, 2011; Xu and Xia, 2011).

Then, based on the concepts of hesitant fuzzy sets, Torra given some operations related to them, which is defined below.

Definition 2. Let h, h_1 and h_2 be three hesitant fuzzy elements, their basic operations can be defined in the following:

1. $h^c = \bigcup_{\gamma \in h} \{1 - \gamma\}$;
2. $h_1 \bigcup h_2 = \bigcup_{\gamma_1 \in h_1, \gamma_2 \in h_2} \max\{\gamma_1, \gamma_2\}$;
3. $h_1 \bigcap h_2 = \bigcup_{\gamma_1 \in h_1, \gamma_2 \in h_2} \min\{\gamma_1, \gamma_2\}$.

Here, h^c represents the complement of the hesitant fuzzy element h.

Definition 3. Let h be a hesitant fuzzy element, $A_{env}(h)$ as the envelope of h, where $A_{env}(h)$ can be defined as (h^-, 1- h^+), with $h^- = \min\{\gamma \mid \gamma \in h\}$ and $h^+ = \max\{\gamma \mid \gamma \in h\}$. Then, the relationship between hesitant fuzzy elements and envelope can be defined as

1. $A_{env}(h^c) = (A_{env}(h))^c$;
2. $A_{env}(h_1 \bigcup h_2) = A_{env}(h_1) \bigcup A_{env}(h_2)$;
3. $A_{env}(h_1 \bigcap h_2) = A_{env}(h_1) \bigcap A_{env}(h_2)$.

Definition 4. Let h, h_1 and h_2 be three hesitant fuzzy elements, their new basic operational laws are defined by Xia and Xu as follows:

1. $h^\lambda = \bigcup_{\gamma \in h} \{\gamma^\lambda\}$;
2. $\lambda h = \bigcup_{\gamma \in h} \{1 - (1 - \gamma)^\lambda\}$;
3. $h_1 \oplus h_2 = \bigcup_{\gamma_1 \in h_1, \gamma_2 \in h_2} \{\gamma_1 + \gamma_2 - \gamma_1 \gamma_2\}$;
4. $h_1 \otimes h_2 = \bigcup_{\gamma_1 \in h_1, \gamma_2 \in h_2} \{\gamma_1 \gamma_2\}$;
5. $\lambda\left(h^c\right) = \left(h^\lambda\right)^c$;
6. $h_1^c \oplus h_2^c = \left(h_1 \otimes h_2\right)^c$;
7. $h_1^c \otimes h_2^c = \left(h_1 \oplus h_2\right)^c$.

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3.2. The determination of attribute weights

Weight represents the relative importance of each attribute and can be used to balance the role of different attribute. In general, the decision maker gives weight vector by himself. This way is considered as a subjective method to obtain weigh vector of attributes. In this paper, an objective method is introduced in order to avoid arbitrary subjective way (Xu and Zhang, 2013). Thus, the entropy measure with hesitant fuzzy sets is proposed in the following.

Definition 5. An entropy with hesitant fuzzy element h is a function E: $H \to [0,1]$, satisfying the following axiomatic requirements:

1. E(h) = 0, if and only if h = {0} or h = {1};
2. E(h) = 1, if and only if $h_{\sigma(i)} + h_{\sigma(l_h - i+1)} = 1$ for i = 1, 2, ..., l_h;
3. E(h_1) ≤ E(h_2), if $h_{1,\sigma(i)} \le h_{2,\sigma(i)}$ for $h_{2,\sigma(i)} + h_{2,\sigma(l-i+1)} \le 1$ or $h_{1,\sigma(i)} \ge h_{2,\sigma(i)}$ for $h_{2,\sigma(i)} + h_{2,\sigma(l-i+1)} \ge 1$;
4. E(h) ≤ E(h^c).

Then, based on these requirements, the entropy measure with hesitant fuzzy elements are proposed in the following:

$$\mathrm{E}(h_1) = -\frac{1}{l_h \cdot \ln 2}\sum_{i=1}^{l_h}\left(\frac{h_{\sigma(i)} + h_{\sigma(l_h - i+1)}}{2}\ln\frac{h_{\sigma(i)} + h_{\sigma(l_h - i+1)}}{2} + \frac{2 - h_{\sigma(i)} + h_{\sigma(l_h - i+1)}}{2}\ln\frac{2 - h_{\sigma(i)} + h_{\sigma(l_h - i+1)}}{2}\right). \quad (2)$$

Thus, the attribute weights can be determined by the mentioned entropy below.

$$\mathrm{wj} = \frac{1 - E_j}{n - \sum_{j=1}^{n} E_j}. \quad (3)$$

3.3. The hesitant fuzzy aggregation operators

In order to aggregate hesitant fuzzy information, according to Definitions 2 to 4, Xia and Xu (2011) proposed a family of aggregation operators according to hesitant fuzzy sets.

Definition 6. Let h_j(j = 1, 2, ..., n) be a collection of HFSs. The hesitant fuzzy weighted averaging (HFWA) operator is defined as

$$\mathrm{HFWA}(h_1, h_2, ..., h_n) = \overset{n}{\underset{j=1}{\oplus}}(w_j h_j) = \cup_{\gamma_1 \in h_1, \gamma_2 \in h_2, ..., \gamma_n \in h_n}\{1 - \prod_{j=1}^{n}(1-\gamma_j)^{w_j}\}, \quad (4)$$

where $w = (w_1, w_2, ..., w_n)^T$ is the weight vector of h_j(j = 1, 2, ..., n) with 0 ≤ w_j ≤ 1 (j = 1, 2, ..., n) and $\sum_{i=1}^{n} w_j = 1$.

When $w = (1/n, 1/n, ..., 1/n)^T$, the HFWA operator reduces to the hesitant fuzzy averaging (HFA) operator:

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$$\mathrm{HFA}(h_1, h_2, \ldots, h_n) = \bigoplus_{j=1}^{n}\left(\frac{1}{n}h_j\right) = \bigcup_{\gamma_1\in h_1,\gamma_2\in h_2,\ldots,\gamma_n\in h_n}\left\{1-\prod_{j=1}^{n}(1-\gamma_j)^{1/n}\right\}. \tag{5}$$

Definition 7. Let $h_j (j = 1, 2, \ldots, n)$ be a collection of HFSs. The hesitant fuzzy weighted geometric (HFWG) operator is defined as

$$\mathrm{HFWG}(h_1, h_2, \ldots, h_n) = \bigoplus_{j=1}^{n}(h_j^{w_j}) = \bigcup_{\gamma_1\in h_1,\gamma_2\in h_2,\ldots,\gamma_n\in h_n}\left\{\prod_{j=1}^{n}\gamma_j^{w_j}\right\}, \tag{6}$$

where $w = (w_1, w_2, \ldots, w_n)^T$ is the weight vector of $h_j (j = 1, 2, \ldots, n)$ with $0 \le w_j \le 1$ $(j = 1, 2, \ldots, n)$ and $\sum_{i=1}^{n} w_j = 1$.

When $w = (1/n, 1/n, \ldots, 1/n)^T$, the HFWG operator reduces to the hesitant fuzzy geometric (HFG) operator:

$$\mathrm{HFG}(h_1, h_2, \ldots, h_n) = \bigoplus_{j=1}^{n}(h_j^{1/n}) = \bigcup_{\gamma_1\in h_1,\gamma_2\in h_2,\ldots,\gamma_n\in h_n}\left\{\prod_{j=1}^{n}\gamma_j^{1/n}\right\}. \tag{7}$$

To compare two hesitant fuzzy elements, the score function need to be defined.

Definition 8. Let h be a hesitant fuzzy number. The score function of h can be defined as follow:

$$S(h) = \frac{1}{l_h}\sum_{\gamma\in h}\gamma, \tag{8}$$

where l_h denotes the number of the elements in h.

Definition 9. For two hesitant fuzzy number h_1 and h_2, the rule can be designed as:

if $S(h_1) > S(h_2)$, then $h_1 \ge h_2$;

if $S(h_1) = S(h_2)$, then $h_1 = h_2$;

if $S(h_1) < S(h_2)$, then $h_1 \le h_2$.

3.4. The procedure of the proposed method

In this section, a procedure based on mentioned methods is demonstrated including the following six steps, which will be applied in the next section.

Step1. For an evaluation problem, we construct a decision matrix $H = [h_{ij}]_{m\times n}$, where all the assessments $_{ij}$ $(i = 1, 2, \ldots, m; j = 1, 2, \ldots, n)$ are hesitant fuzzy numbers, given by the decision maker. For each alternative A_i $(i = 1, 2, \ldots, m)$, the decision maker is invited to express evaluation or preference according to each attribute C_j $(j = 1, 2, \ldots, n)$ by a hesitant fuzzy number h_{ij} $(i = 1, 2, \ldots, m; j = 1, 2, \ldots, n)$. Then, based on the risk preference of decision maker, a normal decision making matrix can be obtained as follows:

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$$H_{m\times n}=\begin{pmatrix} h_{11} & h_{12} & \cdots & h_{1n} \\ h_{21} & h_{22} & \cdots & h_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ h_{m1} & h_{m2} & \cdots & h_{mn} \end{pmatrix}. \tag{9}$$

Step 2. The decision matrix in Eq.(9) will be transformed into a normalization matrix by the method in the following:

$$\bar{h}=\begin{cases} h_{ij}, & for\,benefit\,\text{attribute} \\ 1-h_{ij}, & for\,\text{cost attribute} \end{cases}. \tag{10}$$

Step 3. The decision maker specifies the attribute weights of the n attributes denoted as $w = (w_1, w_2, ..., w_n)^T$ with $0 \le w_j \le 1$ ($j = 1, 2, ..., n$) and $\sum_{i=1}^{n} w_j = 1$ by using Eq. (3).

Step 4. The hesitant fuzzy aggregation weighted averaging (HFWA) operator denoted as Eq.(4) or the hesitant fuzzy aggregation weighted geometric (HFWG) operator denoted as Eq.(6) are introduced to aggregate the hesitant fuzzy assessments. Then, we can obtain the aggregation results of each alternative in the hesitant fuzzy context.

Step 5. The score function proposed in Definition 8 is used to compare each alternative in decision making matrix.

Step 6. Through different scores of alternative, the ranking order can be obtained using Definition 9. Then, we can select optimal alternative by the largest score.

Step 7. End.

4. Case study

In this section, we take a real case study to demonstrate the applicability and scientific of the proposed method in this paper. In order to help a village select an appropriate location of their new primary school, we firstly invite an expert as the decision maker to implement process of decision making. Four sites are selected by the decision maker as the alternatives including A_1, A_2, A_3, A_4 in this village. Then, the decision maker identifies four attributes denoted as C_1, C_2, C_3, C_4 demonstrated in Table 1.

Attributes	Explanation
C_1	Economic benefits
C_2	Transportation
C_3	Environment
C_4	Culture benefits

Table 1 – Description of the four attributes

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The decision maker gives preference of each alternative on each attribute, respectively. Therefore, a hesitant fuzzy decision matrix $H = [h_{ij}]_{4\times4}$ can be obtained in Table 2. Then, based on the Step 3, the attribute weight can be determined as $w = (0.3, 0.15, 0.25, 0.2)^T$.

	A_1	A_2	A_3	A_4
C_1	{0.5,0.6}	{0.7}	{0.3,0.5}	{0.3,0.4 }
C_2	{0.4,0.6,0.7}	{0.4,0.7,0.8}	{0.3,0.6}	{0.4,0.5}
C_3	{0.4,0.5,0.7}	{0.6,0.7}	{0.2,0.3,0.5}	{0.1, 0.2}
C_4	{0.7,0.8}	{0.9}	{0.2,0.7.0.8}	{0.5, 0.7}

Table 2 – Original hesitant fuzzy decision matrix

Based on Definition 4, the hesitant fuzzy assessments can be aggregated through the hesitant fuzzy aggregation weighted averaging (HFWA) operator. Then, the ranking order of this problem is demonstrated as $A_2 \succ A_1 \succ A_3 \succ A_4$ by using the score function proposed in Step 5. Finally, it is easy to know that A_2 is the optimal location.

5. Discussion

The process of achieving optimization layout of rural primary and secondary schools was not implemented immediately, which needs incessancy and evolutionary efforts. All the problems in China can be regarded as the problems related to farmers who are the base of the population in China. Rural education is related to the development of the education in China. Layout of rural primary and secondary schools as an important aspect needs the appropriate locations. That is the main reason why the assessment method i. e. multiple attribute decision making method is introduced in this paper. Considering objective weight vector of attributes and assessments provided by the decision maker, hesitant fuzzy sets and entropy measure is proposed. Thus, the main contributions of this paper include the following: (1) a new multiple attribute decision making method is introduced in this paper; (2) hesitant fuzzy sets are proposed to express the preference of the decision maker; (3) the entropy measure is developed to determine attribute weights and (4) this paper provides a new way to help the new layout of rural primary and secondary schools in the new period.

6. Conclusion

In this paper, we know that the rural problem has been the focus of all walks of life. In order to build new socialist countryside in China, the rural education is a key point. More importantly, how to plan a reasonable layout of rural schools is a big challenge needing to be solved. Thus, in this paper, we introduce an objective method i.e. multiple attribute decision making method to deal with the method key step. Here, hesitant fuzzy sets are introduced to express the preference of the decision maker or expert. Moreover, the entropy measure is proposed to determine the weight vector of attribute in order to avoid arbitrary of some subjective ways. In addition, the aggregation operators

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and score function are proposed to aggregate the hesitant fuzzy sets and generate the ranking order of different locations. Finally, the appropriate location can be selected as mentioned in a case study, which is further discussed to demonstrate the advantages of the proposed method.

In the future, the mechanism to further improve layout of rural schools may be proposed to achieve the purpose of the new construction of new rural community.

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Research on the Current Situation and Development Countermeasures of Sports Industry Based on Internet Survey—Taking the Winter Sports in Jilin Province as an Example

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Abstract: This paper applies method of documentation, Internet questionnaire survey method, logic analysis, mathematical statistics and other research methods to study the development background, development status, development advantages and disadvantages of ice and snow tourism in Changbai Mountain, and point out the reasons that concept of snow and ice tourism of residents in ski resort is not strong enough, the ideology is biased, propaganda and market influence is not big enough, popularity is not high, all of the above factors have greatly affect the development of tourism in Changbai Mountain, and on this basis, the development countermeasures is proposed. The research content of this paper is of instructive significance for the development of ice and snow tourism industry.

Keywords: sports industry, ice and snow tourism, internet survey, concept of tourism.

1. Introduction

In recent years, ice and snow tourism showing a good momentum of development in China, although Jilin province is rich in ice and snow resources and with favorable geographical conditions, but the development of ice and snow tourism in Heilongjiang Province has always been ahead of Jilin province. The title of "Ice and snow tourism strong province" has long been owned by the Heilongjiang Province. Although Jilin Province is a big province of ice and snow tourism resources, but since the emphasis of Jilin Province on ice and snow tourism is not enough from the beginning, so that Jilin province has not transform from big province of ice and snow tourism resources to ice and snow tourism strong province, even has a far distance. Based on this situation, we should quickly grasp the opportunity, and strive to competing and challenging with a number of ice and snow-rich provinces. In China, Changbai Mountain is a very attractive tourist attraction, also with high popularity, the rapid development of Changbai Mountain tourism economy will lead to the overall development of the city, at the same time the

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region has developed tourism economy, which is difficult to be catch up by other regions. Wanda Group invested RMB 20 billion to develop Changbai Mountain International Tourist Resort, aim at building a tourist attraction integrating skiing, vacation, leisure, entertainment and commerce (Wu et al., 2013). This has given a great impact to the ski resort. Especially for the snow and ice tourism the impact is the greatest. Changbai Mountain Wanda Ski Resort is a more representative ski resort among the large number of ski resorts in Jilin province, thereby its development status can play a guiding role (Fischer et al., 2011; Lucas and Souza, 2016).

The study object of this paper is Changbaishan Wanda ski resort, the purpose of this study is to achieve coordinated development between ice and snow tourism and economy in the Changbai Mountain area and even in Jilin province, we will apply to the Internet questionnaire survey method, logical analysis, mathematical statistics and other research methods to study and analyze related concept of ice and snow tourism concept, as well as the development background, development status, development advantage and disadvantage of ice and snow tourism in the Changbai Mountain, besides to study and analyze specific issues appear in the development process, on this basis, further to put forward development countermeasures.

2. Development status of Wanda ski resort ice and snow tourism in Changbai Mountain

2.1. Ski track conditions

Changbai Mountain Wanda Ski Resort is designed by Canada Ecosign Company, who is designer for five consecutive Olympic Winter Games venues. The area of ski track is 940,000 square meters, with a total length of 30 kilometers, ski resort can service for more than 8,000 people, all the ski track are designed by a senior engineer, comply with international standards. Ski resort is design with veneer U-groove, this design also comply with international standard, the design of the ski track is also variety, with a total of 43 ski tracks, of which there are 20 primary ski track, 14 intermediate ski tracks and 9 Senior ski tracks, the length of the ski tracks is about 30 km. Ski tracks are designed like a maze, so that the whole process of skiing is full of entertaining and fun, freestyle skiers can enjoy the excitement writhing in the air (Wand et al., 2007). For those who are professional skiers, the snow resort also has a piece of heaven and earth for them, while the ski resort designed specifically for children's ski resort, with a professional coaching team, U-site and some snow skills and movements are designated national training base, the snow resort can undertake a variety of international events. Evening lights are set in the snow resort, thereby skiers can also skiing at night, fully meeting the needs of ski lovers. Besides, the ski resort also has a separate ski school, hires some world-class ski instructors, highly professional, by the guidance of professional technical to ensure that the zero-based skiers quickly grasp the essentials, allowing every student to experience technical essentials of action as well as graceful posture. In addition to providing professional ski coaches, VIP visitors will have the opportunity for one-on-one guidance with champion ski instructor, it will significantly improve the level of skiing.

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2.2. Ski resort facilities and skiing competitions

Changbai Mountain Wanda Ski Resort has advanced snowmaker, has complete facilities, with higher grades of catering and other service industries, enough to meet the various needs of skiing tourists (Cuellar et al., 2008). Changbai Mountain Wanda Ski Resort has organized a lot of recreational activities, and has successfully held many competitions, which attracted a lot of people to enjoy and experience the charm of the ski resort, but also attracted a lot of audiences to watch the competitions, in this way promote the development of ice and snow tourism in Changbai Mountain. Ski resort has a total of 19 ski lifts, set in different regions, with the hourly capacity of about 22,000 people.

2.3. Recreational activities of the ski resort

In the ice and snow entertainment area, whether ice engraving or snow sports or snow's two competitive sports, all of this are able to make skiers enjoy the fun except skiing, at the same time to better understand the infinite charm of ice and snow. The recreation activities of the resort are complex and diverse, including: snow ring downhill, snowmobile, horse sledge, dog sled, deer sledge, snow football, ice skating, ice hockey, curling.

3. Survey methods

3.1. Internet Questionnaire Survey

Compared with the traditional questionnaire survey method which is by giving out paper questionnaire, the internet questionnaire survey has the following advantages: (1) It can retrieve the survey results in time, and the respondents only need to logon survey system by internet, to answer and submit, after submitting of the questionnaire it will be included directly by the system, thus the questionnaire will not lose (Mohammad, 2014). (2) The internet questionnaire survey system has the function of automatic analysis and statistics of the questionnaire results, so that the questionnaire surveyors do not need to do much statistical analysis later, which saves a lot of time (Buchta and Dolničar, 2003; Sá et al., 2016). (3) The internet questionnaire survey system can automatically generate the investigation report and the corresponding trend graph, the survey results are at a glance.

According to the current situation and problems of ice and snow tourism in Changbai Mountain, the internet questionnaire survey was carried out on the skiing consumers and managers (Ken-Ichi et al., 2006). The objects of the survey are randomly selected 130 consumers and 10 ski instructors, this will ensure the samples are large enough. Site recovery, improve its validity. A total of 130 consumer questionnaires are issued and 130 are recovered, with an effective recovery rate of 100%.

3.2. Analysis on the survey results

1. The overall characteristics of consumers of Changbai Mountain Wanda Ski Resort

The sex and age structure of the tourists in Changbai Mountain Ski Resort are 74 male tourists account for 64.3% of the total tourists and 41 female tourists account for 35.7%, it is obvious that more male in the tourists. The reason is that skiing is a highly

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stimulating, challenging, and dangerous sport, thus male tourists like better than female tourists. The sex and age structure of skiing tourists in Changbai Mountain are 14.8%, 40.9%, 35.6%, 6.1% and 2.7%, respectively.

Figure 1 is the ranking for the various age groups, in the first place is 21-30 years old, most of this age is youth, whether physical or economic income has certain advantages. In second place is 31-40 years old, this age belongs to the prime of life, with stable economic income. In the third place is under 20 years of age, the crowd at this stage are mostly students, although the physical fitness is an advantage for them, but the economic capacity is limited(Silvana et al., 2016). In fourth place is between 41-50 years of age, the less skiers at this stage is mainly due to their physical fitness are not particularly good; there is a very few skiers over 50 years of age. It can be drawn the conclusion from Figure 2, whether male or female ranked in the first place are concentrated in the 21-30 years old. Thus it is concluded that the age structure of tourists and physical fitness or power have a close relationship, because skiing is an extremely energy consumption sports (Ficarra, 2010).

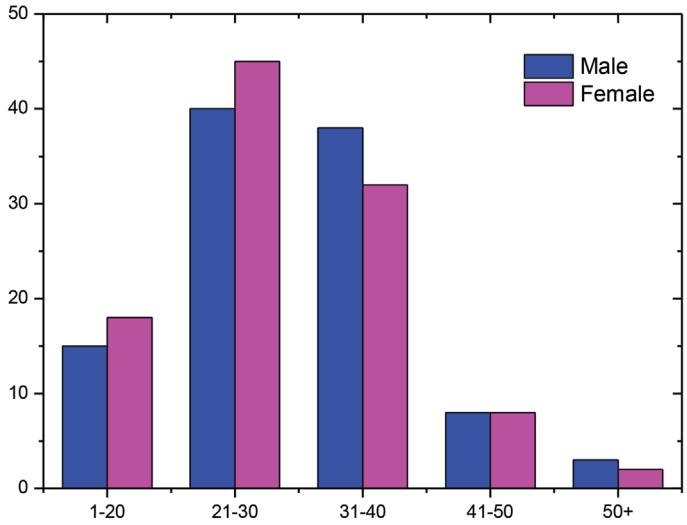

Figure 1 – The proportion of male and female

2. Analysis on the current situation of skiing consumer market development potential

According to the survey of ski instructors from Wanda ski resort, 81% of them believe that the skiing consumer market in Jilin Province has big development potential; 16% of them believe that the development potential is normal, only 3% believe that there is small development potential(see Figure 3), from the survey results can be seen, 81% of them are full of confidence in development prospects, only a few people still have some doubt on the development of the ski resort, which indicates that the development space of ski resort is very Broad.

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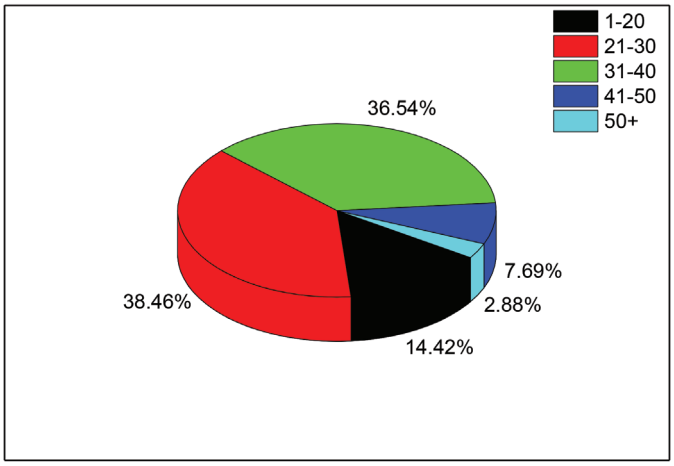

Figure 2 – The proportion of different ages

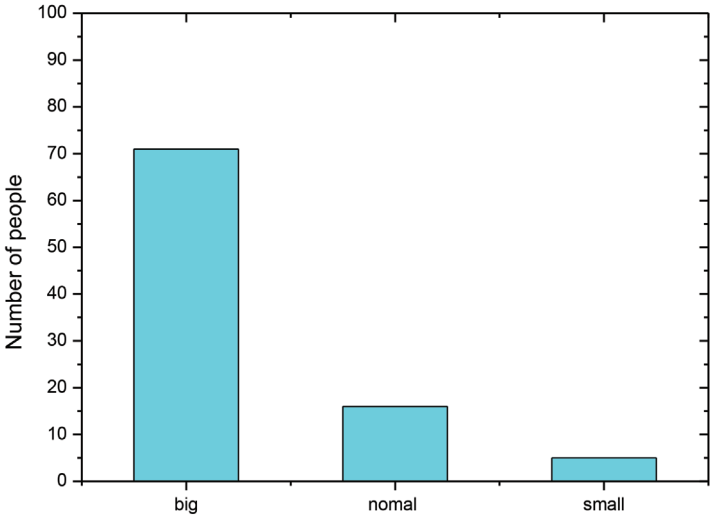

Figure 3 – The investigation and analysis of ski resort development potential

3. Analysis on propaganda before large-scale ski match

The size of the propaganda is an important factor whether the ski products can enter the ski market. Through the investigation (see Figure 4), only 26% of respondents think the propaganda is bigger, 12% think the propaganda is normal, while 62% of respondents don't think there has propaganda . From this set of data can be drawn, Pre-match

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propaganda of Wanda Ski Resort in Changbai Mountain is not big enough. In the initial stage of market development, the extent of propaganda is an important factor which determines whether the ski products can enter the ski market.

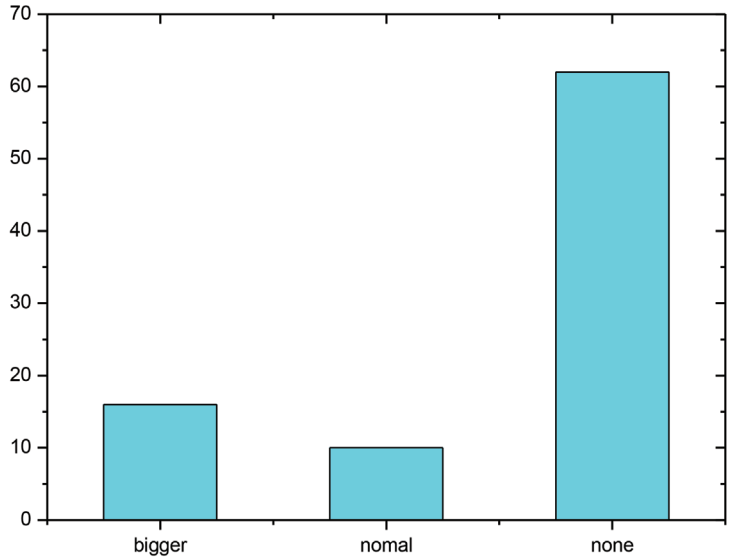

Figure 4 – Analysis on propaganda before large-scale ski match

4. Analysis on the emphasis of local government to ski market

At present, the scale of the skiing competition is continuous growing, mainly because the government takes the lead in organizing and putting in a lot of money, as shown in Figure 5, 62% of the respondents think that the local government paid much attention to development of ski resort, the proportion is 23% that think the emphasis is normal, while 62% of the respondents think the local government paid no attention to the development of ski resort. It can be concluded, in recent years, skiing as an industry, through market development and training, all levels of government has a relatively high attention on the development of the ski market, currently government-led ski competition investment continues to increasing, at the same time the scale is also growing. From the survey can be found, the government's emphasis to the development of the ski market has a great promotion effect on the development of the local ski industry.

5. Analysis on the biggest obstacles in ski market development

Through the investigation on the influence factors of development of the ski resort, as shown in Figure 6: The emphasis from Leadership is ranked first (72%); in the second place is the government's financial support (69%); in the third place is the participant (42%); fourth is the cultural environment and skiing level, each *account for* 60%; fifth is the ski facilities account for 38%, and the last place is traffic situation only account for 4%. According to the above data: the most important is the degree of government's attention,

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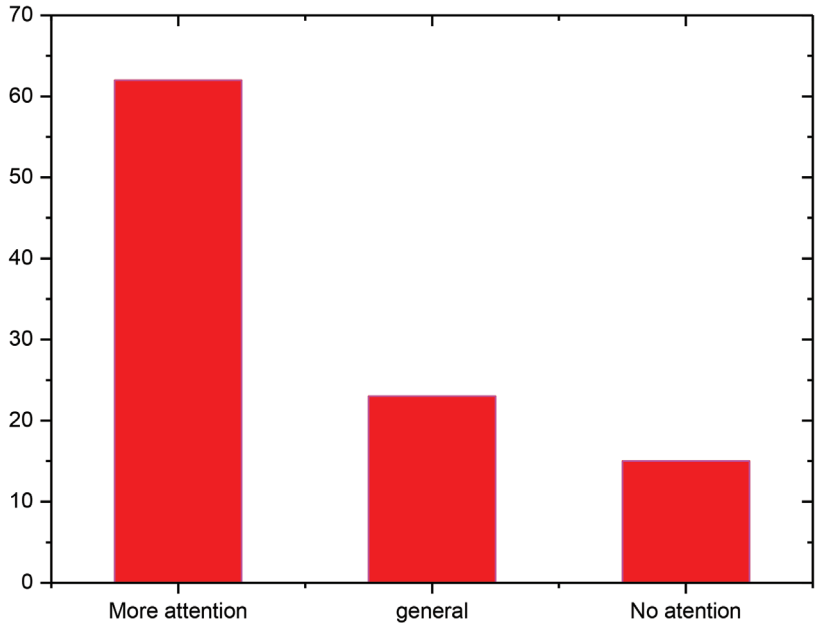

Figure 5 – The emphasis of local government to ski market

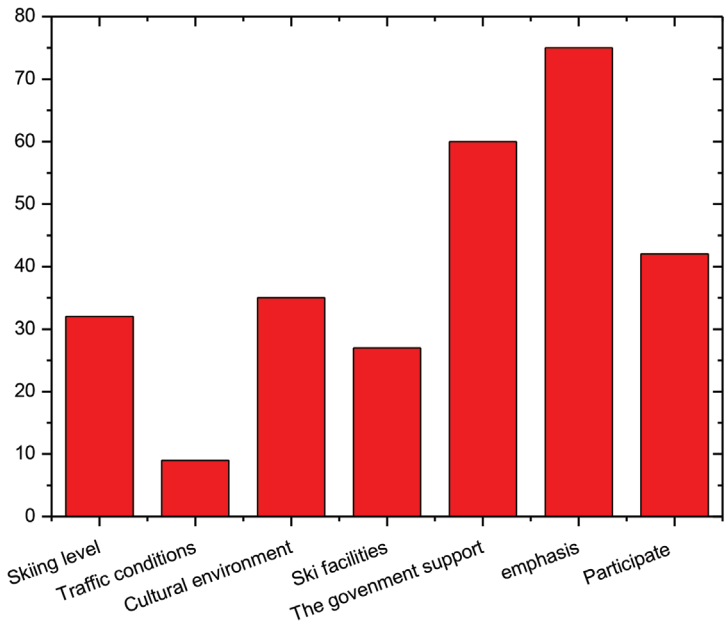

Figure 6 – Analysis on the obstacles in ski market development

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such as: the establishment of the relevant laws and regulations, the investment of fund, policy support and so on. Only with enough attention from government, can the ski market to be activated and stimulated, in this way once businesses obtained benefits, and then businesses will put money back into the market. As long as the injection of social capital, skiing market will be healthy and orderly development. At the same time the number of people involved in and the cultural environment also can't be ignored, it is because if there is no good living environment and many consumers when the product entering into the market, the product will never becomes the commodity. Skiing level also has a certain effect on the ski market, because consumers like to buy some valuable and well-known products, so that the skiing level has a direct impact on consumer purchase interest.

4. Analysis of the existing problems in the ice and snow tourism development of Wanda ski resort in Changbai Mountain

Through the investigation on some of the staff from Changbai Mountain Wanda Ski resort, there have the following existing problems in the development of the ski resort:

1. Skiing price is high, consumption lack of sustainability

On the whole, Changbai Mountain skiing is lack of overall planning on consumption items, coupled with the construction of skiing requires a lot of capital investment. Businessmen are anxious for success, thus they improved skiing prices, it embodying lack of sustainable development strategic thinking. According to information that in many countries in Europe and North America, there are many ordinary consumers have accepted the skiing. In the United States, a person's average daily consumption is around 200 yuan, while consumers have to spend 80-100 yuan per hour, 160 yuan for half a day in Changbai Mountain Wanda Ski Resort, it is about 250 yuan for one day. If just look at one day's consumption, there is not much difference, but the per capita income level and consumption level is low in Changbai Mountain area, therefore this will highlight the high skiing price in Changbai Mountain ski resort(Ali et al., 2016).

2. Ski resort located in remote area, the traffic constraints consumer groups

Due to its own characteristics and the needs of the project, most of the ski resorts are built in suburbs or mountains. It requires for hours or even a day for people arrive at the ski resort, the poor traffic conditions limit passenger flow volume.

3. Ski resort lacks of high-quality talent

Although ice and snow tourism of Wanda Ski Resort in Changbai Mountain has been developing for several years, it still has the problem of shortage of talents, which makes the service of ice and snow tourism is poor. Skiing instructor has many problems, such as the poor professional of skiing instructor, some ski instructors did not undergo systematic training, the skiing level is not very high. For some coaches, even if they can make a simple skiing, but the theoretical level and cultural quality is generally low, all of this will affect the learning of skiers. At the same time, the designer for ice and snow tourism product is very scarce, leading to most of the ice and snow tourism activities are relatively simple in the ski resort.

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4. Lack of local tourists

Ice and snow tourism has developed into a common enterprise grow with the people of Changbai Mountain area, the good development of ice and snow tourism can not only revitalize the local economy, but also improve people's living standards, but the residents of Changbai Mountain area are not actively involved in the development of ice and snow tourism, also haven't improve the understanding of snow and ice tourism, resulting in concentration of enthusiasm into the snow and ice tourism is not enough(Fan et al., 2015).

5. Propaganda is not enough

According to statistics, when the ski resort organized competition or activities, the propaganda of the match is not strong enough, which seriously affected the popularity of the ski resort, the intensity of publicity will also seriously affect the economic development of the ski resort.

5. Management countermeasure of ice and snow tourism in Wanda ski resort in Changbai Mountain area

1. The establishment of institutions, coordinated cooperation

The close co-operation between various departments is an important aspect for the development of ice and snow tourism. If we can get the strong support from financial, cultural, industrial and commercial, legal, power and other departments, the enthusiasm of enterprises can be protected, consider the ice and snow tourism in Jilin Province as the "sunrise industry". The implementation of the development of strategic objectives, use the government as the mainstay, the enterprise as the main body, to achieve scientific, standardized and orderly management. The Government should increase investment in infrastructure, and play the role of government's macro-control, promote the formation of a good economic growth point, as well as create a favorable environment for development. In addition to above that we should increase the supporting for coordinated economy, and guide the ice and snow tourism develop in the direction of industrial, collectivize and large-scale, enable enterprises to get big and strong assistance further to enable enterprises to improve the international competitiveness.

2. The determination of the concept and the formation of features

Adopt characteristics operating into the business process, so as to making skiing with a variety of styles and organic combination with local cultural content, applying the characteristics of culture folk in the ice and snow tourism, and strive to have while other places don't, and other places haven't the characteristics while we have, as long as achieved this, in the true sense can form our own characteristics. Skiing and snow sculpture can be combined, hold characteristics ice and snow tourism festival every year, carry out the ice tourism activities in combination with the popular culture, or strive to undertake large-scale international skiing competition. Each industry in today's society, have transform from resource competition to the direction of product competition, and then transition from product competition to brand competition. Finally, the leading of brand is the end result in the process of market competition.

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3. The strengthen of propaganda and nurturing the market

To develop a complete package of planning programs in the propaganda, with the help all available resources and equipped advanced equipment with modern functions, carry out comprehensive propaganda for skiing culture. The propaganda on the activities should not only to affect the country, but also to achieve a certain effect worldwidely. On the aspect of propaganda activities, to expand strategic propaganda on the different age groups and different consumer groups, increase expand efforts of tourism market at home and abroad, nurture the participation interest of modern youth. For example: we can try to build a snow tourism information website in Jilin Province or in the central television's tourism economic channel for propaganda, we can make snow and ice tourism information into advertisements, register them in newspapers and magazines, give out to various cities, so as to attract more and more ice and snow travel enthusiasts for the skiing resort.

6. Conclusions

The research object of this paper is Wanda ski resort in Changbai mountain area, the main purpose of this paper is to achieve coordinated development of snow travel and economy in Changbai Mountain area and even Jilin Province. It applies method of documentation, Internet questionnaire survey method, logic analysis, mathematical statistics and other research methods, to study and analyze the related concept of ice and snow tourism, as well as the development background, development status, development advantages and disadvantages of ice and snow tourism in the Changbai Mountain, besides to study and analyze specific issues appear in the development process, on this basis, further to put forward development countermeasures.

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Research into the Housing Wealth Effect for Urban Areas in China Base on Big Data

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Abstract: In recent years, with ever-rising land prices, consumption level of China is really weak, which trigger our thinking about real estate wealth effect. This paper is based on real estate wealth effect transmission mechanism and the theory of life cycle hypothesis, by using co-integration test and error correction model to explore the relationship among 2005-2013 per capita consumption of urban residents, per capita disposable income and the average price of commercial housing, which leads to draw the conclusion that the Chinese urban real estate has a negative wealth effect both in the short and long term. Meanwhile, this paper demonstrates the necessity of house prices reasonable regression.

Keywords: real estate wealth effect, co-integration test, error correction model.

1. Introduction

With the year of 1998 as a watershed, China has abandoned the welfare-oriented public housing distribution system, and embraced the era of selling houses to people according to their purchasing power. Since then, the value of housing has recorded an exuberantly ascending proportion in Chinese residents' asset holdings, and has been more and more closely tied to national economy. The wealth effect is the change in spending that accompanies a change in perceived wealth when all other things being equal. Along with the diversification of social wealth composition, changes of physical assets (housing, for example) have triggered changes of wealth levels, ultimately acting on consumer demand. Therefore, such changes will alter the marginal propensity to consume, and further vary the willing of consumer expenditures.

The housing industry is considered as one of the cornerstones of Chinese market. Quick release of living demand during urbanization has become an important engine of domestic demands. Then, does the housing wealth effect really exist? If it does, will it accelerate or suppress consumption? Therefore, to study on the housing wealth effect in China is of great significance.

Researchers at home and abroad have uniformly transformed the issue of the housing wealth effect into the influence of housing price appreciation on consumption per capita. On the basis of empirical research, they have aired their opinions on whether the housing wealth effect exists and the effect size as well.

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Some researchers believe that the wealth effect is not applicable to the housing industry. For example, Elliott divided wealth into financial wealth and non-financial wealth, and found out through research that non-financial wealth did not impact on consumption (Elliott, 1980); based on micro consumer spending data, Hoynes and McFadden studied on the relationship between personal savings rates and housing gains, through which they deemed that households that experienced real housing capital gains did not change their consumption behaviors (Hoynes and McFadden, 1997); with the quarterly data during the period of 2000-2006, Liu conducted empirical research on the impact of housing capitals for urban residents in China on their consumption per capita (Liu, 2007).

Some researchers consider that there exist positive housing wealth effects: Yoshikawa and Ohtake found out that the net influence of real housing price appreciation would raise the consumption of renters and homeowners (Yoshikawa and Ohtake, 1989, Gonçalves et al., 2015). Wu deemed that the increase of housing price was a crucial index that caused the great disparity between the rich and the poor, and would also exert an effect on macro-economic growth (Wu, 2006). Song analyzed the transmission of housing markets' wealth effect and its influence on macro economy (Song, 2007). The result showed that in a short term, the relationship between housing prices and household consumption conformed to Granger causality, as the increase of housing price positively encouraged residents to consume.

However, the rest of researchers believe in negative housing wealth effects. For instance, Zhu Y.H. and Yuan C.J. empirically analyzed the housing wealth effect in Kunming, a southern city in China, and concluded that the rise in price for commercial houses turned out to cause a decrease of urban inhabitants' consumption (Zhu and Yuan, 2010; Fortes et al., 2016). The result of research conducted (Shi and Zeng, 2009) showed that opposite to the expectation, households that experienced a rise in housing price cut down their consumption.

2. Theory and model basis

2.1. The transmission mechanism of the housing wealth effect

Here is the question: how up and down of housing prices impact on residents' expenditures? Direct wealth effect, liquidity constraint effect, and precautionary saving effect for homeowners, budget constraint effect for people without houses to live, as well as substitution effect for potential house purchasers are the main factors.

1. Direct wealth effect. The direct wealth effect includes realized wealth effect and unrealized wealth effect. It mainly means a mechanism in which residents whose overall budget constraint level has ascended due to housing price appreciation broaden their consumption accordingly.
2. Liquidity constraint effect. The liquidity constraint effect is a consumption phenomenon that residents can hardly consume what they expect because of wealth shortage or loan difficulty. When their housing wealth mounts up, or when they have more capitals with mortgage loan from banks, those residents will have a released liquidity constraint such that their consumption spending is enlarged.

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3. Precautionary saving effect. The precautionary saving is saving that occurs in response to uncertainty regarding future income. In the paper, the precautionary saving effect means that housing wealth functions as a precautionary reserve pool where housing wealth and other savings complement each other and make for precautionary reserves. The rise in housing wealth as a household's precautionary saving, if helping the overall precautionary saving hits the upper bound, will incur a decrease of the rest of precautionary saving, and thus the consumption spending increases. Different families set different upper bounds of precautionary savings. A household with lower incomes and less social security (Medicare, education, unemployment insurance, etc.) provided by government will demand higher precautionary savings.
4. Budget constraint effect for non-homeowners
   The cost per month is more for renters whose rents to pay increase. In this case, if the income is unchanging, those renters will cut their consumption spending.
5. Substitution effect for potential house purchasers

The substitution effect mainly targets at potential house purchasers. Negative wealth effect arises when these people that save a large sum of money to buy increasingly expensive buildings constrain consumption.

2.2. life cycle hypothesis

Modiliglianni started from the permanent income hypothesis and proposed the concept of the life cycle hypothesis, whose consumption function supplemented Keynes' theory of consumption function when consumption spending was explained by both disposable incomes and wealth that was the second most influential factor of consumption.

At the optimal consumption point, the consumption is

$$C = \alpha W + \beta Y \tag{1}$$

Where W denotes the true wealth holdings of consumers, and Y represents the current revenue.

Zang undertook in-depth research on the application of consumer function in China (Zang, 1994). His viewpoint that the permanent income hypothesis and the life cycle hypothesis were increasingly applicable to China was verified empirically.

To the author's opinion, along with the gradual improvement of Chinese housing markets, it is suitable to study on the housing wealth effect in China which is theoretically based on the life cycle hypothesis.

3. Empirical analysis

3.1. Variables and data selection

In order to study on the housing wealth effect in China, the relationship among urban dwellers' per capita consumption expenditure (PC, yuan), urban residents' per capita

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disposable income (PY, yuan), and the average price of commercial houses (HP, yuan/square meter) were discussed on the foundation of equation (1).

The paper selected relevant quarterly data from 2005 to 2013 provided by the national statistic base in the National Bureau of Statistics of the People's Republic of China. Among the data, 2005 was the base year for data of nominal urban residents' per capita consumption expending and for data of their current-price per capita disposable income, both of which were deflated by the consumer price index of urban dwellers. Accordingly, that consumption expending per capita and that disposable income per capita were obtained with constant price. The mean price for commercial houses equaled the deflated price by CPI with respect to the sales area and sales amount of those commercial houses in each quarter over the years.

3.2. Descriptive statistics

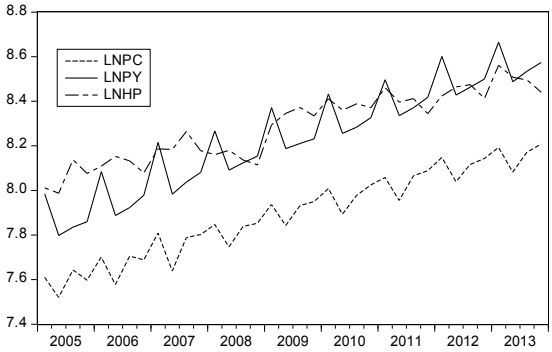

Figure 1 – Time series of ln(PC), ln(PY) and ln(HP)

To lessen the heteroscedastic influence, the paper sought the logarithm of PC, PY, and HY to be ln(PC), ln(PY) and ln(HP), respectively, and drew their time series as shown in Figure 1, such that the changing trend of them was easily observed.

As shown in the figure 1, their curves share a similar tendency of upward development, and there are remarkable seasonal fluctuations for ln(PC) and ln(PY) as a comparison. Actually, during economic analysis, positive seasonal adjustment is always required for economic variables with seasonal behaviors, except when such seasonal fluctuations provide effective information for and significantly result in the changing the law of the system constituted by those economic variables. Given that, direct analysis was conducted on the data of ln(PC) and ln(PY) without data adjustment. The curve of In(HP) exhibits a largely upward trend, except for a slow increase together with a slight fall after rise before and after 2008. This phenomenon shows that the changing trend of In(HP) well reflects the real situation of the subprime crisis in the same year.

3.3. Unit root test

According to statistics (Phillips, 1990), for a pair of time series with respective unit roots and that are independent from each other, when the sample volume is enlarged, the

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regression of one time series on the other will result in a remarkable parameter, namely spurious regressions. Thus, the first step of regression analysis for time series data is to test the null hypothesis of whether a unit root is presented in a time series sample. Given the clear tendency existing in ln(PC), ln(PY) and ln(HP) and that the intercept was non-zero, the augmented Dickey–Fuller test (ADF) was used for the unit-root test in the paper with a model that included a constant and a time trend. The result was shown in Table 1.

variable	ADF test	Pvalue	1 %critical value	5 % critical value	10 % critical value	conclusion
ln(PC)	-0.569617	0.9731	-4.323979	-3.580623	-3.225334	nonstationary
ln(PY)	-3.066321	0.1334	-4.323979	-3.580623	-3.225334	nonstationary
ln(HP)	-3.060633	0.1354	-4.339330	-3.587527	-3.229230	nonstationary

Table 1 – ADF test result

The result in Table 1 shows that the null hypothesis of unit roots presented in ln(PC), ln(PY) and ln(HP) is not rejected at the 95 % confidence level.

Accordingly, a unit-root test on the first-order difference sequence of ln(PC), ln(PY) and ln(HP) was conducted, whose result was shown in Table 2.

The result in Table 2 shows that no unit root is presented in Dln(PC), Dln(PY) and Dln(HP) at the 95 % confidence level, which means that the series Dln(PC), Dln(PY) and Dln(HP) are stationary. All in all, all of the series ln(PC), ln(PY) and ln(HP) are first-order integration.

variable	ADF test	Pvalue	1 %critical value	5 % critical value	10 % critical value	conclusion
Dln(PC)	-3.970407	0.0225	-4.339330	-3.567527	-3.229230	stationary
Dln(PY)	-57.79011	0.0000	-4.273277	-3.557759	-3.212361	stationary
Dln(HP)	-8.552968	0.0000	-4.252879	-3.548490	-3.207094	stationary

Table 2 – ADF test result

3.4. Test and estimation of co-integration

Co-integration analysis is demanded for the series ln(PC), ln(PY) and ln(HP) so as to determine whether they have stable long-run relationships. In terms of test objectives, the co-integration test can be divided into the regression-coefficient-based test (the Johansen test, for example) and the regression-residual-based test (the Engle–Granger test, for instance). The Johansen test that is based on vector auto regression (VAR) permits more than one co-integrating relationship, and hence is more generally applicable than the Engle–Granger test for unit roots in the residuals from a single (estimated) co-integrating relationship. Therefore, the Johansen test was used for co-integration analysis in the paper. The lag order of VAR was selected according to the

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principle of AIC and SC. There is no probability value (P value) that simultaneously renders SC and AIC minimal. When P=4, the value of SC is minimum; while when P+5, the value of AIC is minimum. Considering that difference, the likelihood ratio statistics (LR) was employed to determine the P value, with the characteristics of seasonal data as an auxiliary reference. Therefore, the lag term was decided as 4. According to Pantual criteria, a co-integrating model with linear deterministic composition and that included a constant and a time trend was used for co-integration test on ln(PC), ln(PY) and ln(HP). The result is shown in Table 3.

Null hypothesis	eigenvalue	Trace statistics	5 %critical value	Pvalue.**
No cointegrating relationship *	0.549575	43.90339	42.91525	0.0397
At most one cointegrating relationship	0.362998	18.38134	25.87211	0.3189
At most two cointegrating relationship	0.116120	3.949904	12.51798	0.7494

Table 3 – Test of trace statistics for lnPC, lnPY and lnHP

The test results in Table 3 demonstrate that there is one co-integrating relationship among variables at the 95 % confidence level. Therefore, we deem it that ln(PC), ln(PY) and ln(HP) have stable long-run relationship. The corresponding error was recorded as ECM_t. The co-integration model was established as

$$ECM_t = \ln(PC_t) - 0.572768\ln(PY_t) + 0.523511\ln(HP_t) - 7.530731$$

There are stable co-integrating relationships among ln(PC), ln(PY), and ln(HP) over a long horizon. Every 1 % increase of commercial housing price equals a 0.523511 % decrease of urban residents' per capita consumption expending. In the long run, house price appreciation exerts constraint effect on the growth of urban dwellers' per capita consumption expenditure. Every 1 % increase of urban residents' per capita disposable income equals a 0.572768 % increase of urban residents' per capita consumption expending, which complies with economics theory. What's more, the rise in per capita disposable income exerts more positive influence on per capita consumption expending than that by the same magnitude of rise in mean commercial housing price.

3.5. Vector error correction(VEC) model

The VEC model was obtained by introducing error correction term to the proposed model. Below is the discussion of short-run mutual influence between InPC, InPY, and InHP with the VEC model.

To serve for the research focus of the housing wealth effect in urban areas in China, the paper highlighted the analysis of short-term formula of InPC. The short-run model of InPC obtained from vector auto regression on InPY and InHP is

$$DlnPC_t = -0.232952ECMt\text{-}1 + 0.346296DlnPC_{t-1}$$

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$+0.268924DlnPC_{t-2} -0.082299\ DlnPC_{t-3}$

$+0.315742DlnPY_{t-1}+0.153404DlnPY_{t-2}$ $(R^2=0.974626)$

$+0.018972DlnPY_{t-3}-0.217821DlnHP_{t-1}$

$-0.090523DlnHP_{t-2}+0.019512DlnHP_{t-3}$

$+0.064619$

In the short term, with respect to the per capita consumption expending itself, the first-lagged, second-lagged, and third-lagged coefficients of the growth rate of consumption expenditure are positive, while the coefficient of error correction term in the cointegration equation is negative. Therefore, when per capita consumption expending ascends, the error correction mechanism will reduce or converge the change of future consumption expenditure. In the short run, the growth rate of consumption expenditure is positively influenced by the growth rate of per capita disposable income, and is negatively acted on by the growth rate of mean commercial housing price. Despite the positive third-lagged coefficient of housing price growth rate, its absolute value is far smaller than that of the first-lagged coefficient and the second-lagged coefficient. Therefore, the housing price level negatively impacts on per capita consumption growth rate in the short term.

4. Conclusions

Based on the quarterly relevant data from 2005 to 2013, by using the co-integration theory and the error correction model, the paper computes the long-term housing wealth effect in urban areas in China, whose value is obtained as -0.523511. This means that every 1 % increase of commercial housing price equals a 0.523511 % decrease of urban residents' per capita consumption expending, which shows that the housing of urban areas in China has negative wealth effect on urban residents in the long run. The same rule goes for the short-term phenomenon. In combination with the transmission mechanism of housing wealth effects, the paper analyzed the relevant causes:

The effective respondents to the housing wealth effect are limited to current homeowners. If the research expands to cover all urban residents, it is necessary to conduct classified discussion according to the status and number of houses owned. For urban households with more than one house property, apart from the house to live in, the rest functions as investments. In such case, housing price appreciation will incur a rise in rents or in the future cash reliable value, both of which add up to their wealth, so that encouraging their consumption behaviors. For those with only one house that is sure to satisfy their living demands, the increasing housing price will promote some precautionary savings, which exerts little influence on the consumption behavior. Urban residents without any house to live in are classified into renters and potential house purchasers. For renters, a rise in housing price increases their rents to pay and further constrains their consumption. For potential house purchasers, negative wealth effect arises when these people that save a large sum of money to buy increasingly expensive buildings constrain consumption.

To be concluded, the author suggests that there is a necessity to ensure proper regression in housing prices. Most of Chinese population is low-to-moderate income

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citizens who have tremendous rigid demands to purchase houses. Houses with too high price will "extort" money from them during their whole life. Any mode of living, no matter by renting, by purchasing with loans, or by purchasing with disposable income, will cost them more such that forcing them to increase saving amounts and cut consumptions. In the long term, to guarantee rational regression in housing prices provides an effective solution to the problem of seriously insufficient consumption across the country, because domestic residents will spend more disposable income on non-housing consumption.

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Research on Acceptance Effect of Ideological and Political Education among College Students Based on Network Media

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Abstract: Network media is the fifth media providing information service to audience based on new technologies of digital technology, internet technology, technology (human machine interface), mobile communication technology and three networks convergence etc. Make innovation for the means of developing ideological and political education practice activities by taking network media as environment and carrier; how to improve the acceptance effect of ideological and political education among college students based on network media has become an important issue that draws the wide attention and needs to be solved urgently. This paper has described the realistic significance of research on acceptance effect of ideological and political education among college students based on network media by starting from analyzing the practical problems and through checking literature material from summarizing the meaning, features and current development situation of network media. At the same time, following problems of acceptance effect of ideological and political education among college students at cognitive level, attitude level and behavior level have been attained through questionnaire survey and interview method, make reasons analysis on this basis and propose countermeasures for improving the acceptance effect of ideological and political education based on network media.

Keywords: Network media, Political education, Acceptance effect of ideological.

1. Introduction

Ideological and political education is the center for Communist Party of China to accomplish central task during each period and promote comprehensive development of people (Zheng, 2014). No matter in the past, at present or in the future, it plays an undoubted role. It refers to that society and social group use certain ideas, political views and moral norms to implement purposeful, planned and organized influence on members and make them form social practice activity of ideological and moral characters that meet the needs of certain society or certain class (Pan & Tu, 2011).

For contemporary China in social transition period, changes not only take place in the object and object composition of ideological and political education, the concept of these

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education objects change, the demand of people for ideological and political education also changes (Dong, 2010). With the coming of knowledge economy era, the progress of globalization has been speeded up, which may possibly aggravate the contradiction. Knowledge economy which takes the knowledge with continuous innovation as basis is a knowledge-intensive and intelligent new economic type and its features are rich information content and highly free information communication (Yongyue & Jian, 2010; Gonçalves et al., 2016). In such an open information society, various kinds of domestic and foreign influence has inseparability in space, continuity in time, vastness in distribution, diversification in communication channels, vividness in form and reality in content etc. Therefore, ideological and political education needs to adapt to society development and the progress of times, people oriented, puts emphasis of research on acceptance under the premise of fully understanding and emphasizing network media technology, tries to make innovations for the concept of ideological and political education and way of thinking on original basis to dilute contradiction and improve effect gradually (Winter, 2002; Maritza et al., 2016).

2. Challenges bring about by network media technology to the ideological and political education among college students

2.1. Disorder of information requires strengthening positive guidance

The so-called disorder of information refers to that network media information is mixed with good and bad, right and wrong information. After the reform and opening up in China, various western thoughts, values and ways of life affect us continuously with adoption of network media (Li and Zhang, 2006). Western countries also make use of network media to strengthen ideological penetration to our country, all kinds of information, culture and ideas are complicated. As ideological and political education worker, they need to have solid political stand and guide college students to set up correct outlook on life, outlook on world and values (Zhang et al., 2015). First, ideological and political education workers need to guide students to make correct understanding of all kinds of non-Marx thoughts and avoid them to be induced. Second, it needs to instruct students to improve the ability of identifying information and adopt scientific methods to select valuable information. More importantly, it needs to strengthen positive guidance, offer good guidance to students, make them draw on advantages and avoid disadvantages to avoid the influence of bad information (Lan and Peng, 2015)

2.2. The equality of subject and object requires insisting on people-oriented

The propagation mode of traditional media is one point to one point or one point to several points, which lacks interaction, makes the object of education in passive acceptance state all the time, difficult to make feedbacks and causes the relation inequality between subject and object. The propagation mode of network media can not only realize one point to one point but also one point to several points or even several points to several points, information communication is more abundant and extensive, communication method is more convenient with very strong interaction. In network media environment, everyone is self-media, can become the subject of education and then realize ideological and political education relationship between main bodies. It

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requires that ideological and political education workers need to insist on the "people-oriented" education philosophy, which is good for the subject to play its subjective role, improves the passive acceptance of object caused by the instillation of traditional ideological and political education and then promotes to improve the acceptance effect of ideological and political education.

2.3. The rapid update of technology needs to improve work level continuously

The rapid development of network media technology is an opportunity of ideological and political education work, but is a challenge for ideological and political education workers. College students are easy to accept new things and they need to advance with the times in the master and application of network media technology, which requires ideological and political education workers need to strengthen own learning and training, set up the idea of lifelong learning, timely understand and master the latest education information and network media technology, update education mode, enrich education method, expand education channels and improve work level continuously. In this way, they can follow the step of rapid update of network media technology and implement ideological and political education activities with high efficiency.

3. Current situation of acceptance effect of ideological and political education among college students based on network media and analysis

3.1. Technical methods of investigation

This research has selected college students from two provinces as investigation objects. Release the questionnaire started from, judgment sampling method of non-probability sampling has been adopted, questionnaires have been sent out and questionnaires have been collected, in which there are effective questionnaires and the effective return rate is. During sampling, allocation problems of school, major, gender, grade etc. have been considered and the basic situation of samples is as shown in the table 1 .

Project	Group	Number	Composition(%)
Gender	Male	404	44.2
	Female	507	55.5
Grade	Grade one	256	28
	Second grade	263	31
	Third grade	241	26
	Fourth grade	189	13
Professional	Humanities	217	33
	Medical	28	3.5
	Engineering	115	12.4
	Social science	90	8.9

Table 1 – The basic situation of the 911 participants

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3.2. Demonstration for the acceptance effect of ideological and political education based on network media

1. Current situation for the acceptance of college students for network media

The main purpose of college students using network media is entertainment; followed by information and source of material and then study and communication as well as making friends. (as shown in the table 2)

Purpose	Frequency	Total(%)
Source	725	82.2
Learning	625	71.2
Entertainment	845	85.4
Communication	623	72.4
Shopping	469	54.8
Job	165	18.6
Other	54	11.5

Table 2 – The purpose of college students using new media

The table 3 has shown that in the question of "when you want to attain information, will you choose network media or traditional media under most situations?" most of students choose network, film and TV media, multimedia computer and other network media; only few students select newspapers, radio, magazine, television and other traditional medias.

Media	Frequency	Composition(%)
Traditional media	114	12.5
Network media	698	74.2
Not sure	121	13.3
Total	933	100.0

Table 3 – The media selected to obtain information in most cases

Problem	Frequency	Composition(%)
Ignore	158	19.5
Indifference	125	13.8
Exposure to privacy	134	13.2
Vulgar	75	7.5
Impetuous	89	9.7

Table 4 – The main problems of the new media in the interpersonal aspects

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In the question of "what are the main problems of network media in interpersonal aspects?" most of students believe that network media has nearly all the problems of virtualization, indifference, openness, vulgarization and flippancy etc. in interpersonal aspect (as shown in the table 4).

As shown in the table 5, in the question of "what are the main problems faced by our network media now?" College students believe that the outstanding problems of our network media in development process are imperfect laws and regulations, network congestion and information complexity.

main problem	frequency	Composition(%)
Imperfect laws	292	32.4
lack of coordination	195	20.5
Low penetration	145	15.7
Information confused	285	31.5

Table 5 – The main problems faced by Chinese new media now

Investigation results have show Table ,6 that at present, college students have high cognition degree for network media, they make extensive use of various network media functions of network media and mobile digital media and the using frequency is high. The extensive application of network media strengthens the psychological dependence of acceptance subjects and they can use network media at any time and in any place like waiting for cars, queuing and dining. Most of people can control the time and frequency of using network media within the reasonable range, but there are few college students lacking self-government ability and addict to it and even can't control it.

Form	Frequency	Composition(%)
Campus network	307	33.8
SMS platform	97	10.6
Campus posters	207	22.7
campus BBS	65	7.5
Other	235	25.8

Table 6 – The form published inside and outside school information

2. Current situation of ideological and political education among college students based on network media

Investigation results of "Though what forms does your school release inside and outside school information?" have shown Table 7,that the channels "homepage of campus

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network and homepage of links of various school departments" release the most information, accounting for about one third; followed by "delivery by teachers and class committee or pay attention to entity poster"; there are also results show that part of colleges and universities implement "campus smart card" and release information through its information platform; other channels release less information. There are also some colleges and universities use above various channels to release information and they have a lot of propaganda means.

Entry	Frequency	Composition(%)
Many people focus on	115	12.6
Only members attention	218	23.5
Don't know	578	65.8

Table 7 – Does the school publish political propaganda in red website

Statistical results from the table 8 have shown that over college students do not know if the school has red website; few college students know that the school has red website but they do not care about it; only teachers and party members know and pay attention to the red website.

The website has opened on, but investigation has found out that over sixty percent of college students in Liaoning province have not heard of this website; there are about one third college students hear about the website but they seldom login in; there are less than one tenth college students hear about and pay attention to it frequently.

Use case	Frequency	Composition(%)
proper use	510	56
Rarely use	185	20
Almost no	88	9.7
Don't know	135	14.5

Table 8 – The situation of new media used to teach political theory courses

As shown in the following table 9, the investigation results for "whether the political theory course teaching of your school adopts network media technology" have shown that some college students approve to use multimedia properly in the political theory class, some college students think that the class adopts less multimedia; few students do not care about this problem or believe that this media has not been adopted to assist teaching.

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Form	Frequency	Composition(%)
Friends to discuss	245	27.3
Widely discussed	175	19.5
Attention not to discuss	415	45.8
Don't focus on	85	8.5

Table 9 – School activities, information or discussion published on new media

3. Current situation for the acceptance effect of ideological and political education among college students based on network media

For "notification and information of school activities released on network media", nearly one half students to select silent attention but not participate in discussion; there are another one half students pay active attention to this information and participate in discussion and they release own opinions actively, among students participated in discussion, a lot of people will choose to stay with friends and few people will not consider about the discussed circle and range, as shown in table 10.

Pay attention to case	Frequency	Composition(%)
Often focus on	106	11.5
Little attention	456	50.8
Don't focus on	325	38.7

Table 10 – The situation of college students attending to school party-building network or red website list

The table 11 has shown that there are less college students paying attention to party construction website or red website, only accounting for one tenth.

They seldom pay attention to this kind of website due to "strong ideology, looks boring, do not have high political pursuit, not need to pay attention to", "do not have time, very busy" and "does not know this kind of website" etc.

Why	Frequency	Frequency(%)
Politics is thick	160	17.5
Content of boring	370	40.6
Don't focus on individual	135	14.5
A bit busy	145	15.8
Don't know	106	11.9

Table 11 – The reason of little or no attention to politics calss web site

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3.3. Analysis of the acceptance effect of ideological and political education among college students based on network media

1. Cognitive-level effect and reasons analysis

The investigation results have shown that make ideological and political education through network media, college students do not have high cognition for the ideological and political education content and cognitive "reverse" problem exists to some extent. College students do not have high cognition degree for network media, but they use network media more for entertainment. In school, they are used to accept ideological and political education in way of class meeting or participating in activities etc, because the group atmosphere can help the students to get rid of the lonely psychological feeling.

2. Attitude-level effect and reasons analysis

Investigation results have shown that the acceptance attitude for ideological and political education content carried by network media is negative or even conflicting. Because college students are in a transition period changing from a student to professional worker, their intelligence development level is relatively mature but their feelings and emotions are with instability and fluctuation. They have shallow social practice experience and life experience and their understanding of reality is from the indirect experience from books or network, which makes them have shallow understanding of many problems and the emotions come fast and disappear fast.

4. Countermeasures for improving the acceptance effect of ideological and political education based on network media

4.1. Promote the effective application of network media in ideological and political class

There are various ways of promoting the effective application of network media in ideological and political class, such as collecting related case application of ideological and political education as well as class teaching of ideological and political class released by network media. As an optimization method of ideological and political education, case teaching method is on the contrary to the traditional indoctrination education method and it is with unique advanced significance. Case teaching method is a dynamic, open and collectively discussed teaching mode, which takes cases as media communication information, changes the teaching method of teachers from cramming education and teacher talk only to inspiration and guidance and makes the learning method of students change from passive acceptance to active exploration. It can create an equal and harmonious emotion atmosphere, realize the value of ideological and political education in the analysis of conflict problems and improve the acceptance effect of ideological and political education.

4.2. Strengthen the "campus network" and "red website" construction in colleges and universities

Expanding the thinking of education subjects and strengthening the construction of "red website" in colleges and universities is the essential engineering for improving the

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acceptance effect of ideological and political education. Educators need to adhere to the principle of "carrying forward to main melody and advocating diversity" and strive to build up high-quality ideological and political education website: first, it needs to be guided by Marxism-Leninism, Mao Zedong thought, Deng Xiaoping theory, important thought of "Three Representatives" and scientific outlook on development, promote the basic line and policy of the party and play the guidance role of politics, thought and policy of network; second, create a lively, happy and health network environment through implementing colorful and healthy network cultural activities, make people educated in vivid and intuitive and resist the influence of bad information.

4.3. Improve the network moral cultivation of college students

To cultivate the network moral cultivation of college students, first, it needs to teach "Ideological, Moral and Legal Culture", "Introduction of Mao Zedong Thought", "Marx Doctrine Principle" and other theory courses with characteristics, make use of network media resource to expand teaching ideas, create education context, enrich teaching method and innovate education mode, attract college students to change from passive acceptance of education to active acquisition of knowledge and realize self education. Second, introduce daily moral education work to website and other platforms to promote communication, make use of online simulation practice and other activities to strengthen the perceptual knowledge of students and then realize the change of ideological and political education from explicit education to implicit education and improve the acceptance effect of ideological and political education.

5. References

It is believed in this paper that how to adopt network media in ideological and political education activity scientifically and reasonably and taking the improvement for the acceptance effect of ideological and political education as the final purpose needs to start from four aspects: first, optimize the basic factor of ideological and political education activity-connotation and optimization strategy of ideological and political education, promote the reasonable application of network media in ideological and political class; second, strengthen network communication "gatekeeper" for ideological and political education-strengthen the construction for technical team of ideological and political education and put emphasis on the selection of "opinion leader" of campus network ideological and political education; third, set up network media campus-strengthen the construction of "campus network" and "red network" and expand the channels for ideological and political education; fourth, strengthen network media literacy education for college students-strengthen legal system education for network media of college students, improve network moral cultivation of college students and enhance the "self-discipline" consciousness and "self-government" spirit of college students.

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Kinematics Analysis on Contact Zone of Wind Turbine Main Bearing

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Abstract: Establish the kinematics model of contact zone of wind turbine main bearing, establish the entrainment velocity model of roller-raceway contact zone and roller-flange contact zone. Based on the kinematics model, calculated a certain type of MW wind turbine main bearing used in practical application and get the kinematics features of bearing's internal contact zone. Finally, use ANSYS/LS-DYNA to analysis the kinematics characteristics of complete main bearing. Extract velocity-time curve of the contact zone between roller big end and raceway, the contact zone between roller small end and raceway and the contact zone between roller large end and flange, verify the correctness of the theoretical model.

Keywords: Wind Turbine Main Bearing; Tapered Roller Bearing; Roller-Raceway Contact; Large end-Flange Contact

1. Introduction

With the rapid development of wind power equipment, the research on the key core components of wind power equipment becomes more and more important. Double-row tapered roller wind turbine main bearing as a key component of rotating machinery, its friction performance directly affects the performance and fatigue life of wind turbine (Feng Q., 2010; Rovense et al., 2016; Wang, 2016; Salvini, 2016). The kinematic factors of the contact area between the tapered roller and raceway, the contact area between the roller and flange are the important factors that affect the bearing's friction performance (Gao, 2014; Miramontes et al., 2016).

This paper is based on the actual working conditions of wind turbine main bearing, according to the geometric model and the kinematics principle, analysis the kinematics characteristics of roller-raceway contact pair and roller-flange contact pair. Establish the kinematics model of the average velocity at the roller-raceway contact point and the entrainment velocity at the roller-flange contact point, use LS-DYNA to analysis the

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kinematics characteristics of wind turbine main bearing and verify the correctness of the theoretical model.

2. Kinematics Model of Contact Pair

The wind turbine main bearing used to support the axial fan hub and the generator rotor, is the core of wind power equipment supporting components. The outer ring is connected to the rotor blade hub and generator rotor by bolts, the inner ring is bolted to the fan nacelle base, thus forming the special working condition of inner ring fixed and outer ring rotation (Yang X., 2009). As the main bearing in the operation of the wind speed of about 10 to 20 rpm, are low-speed bearings, so you can build the bearing kinematics model when ignoring the effects of inertia and centrifugal force (Deng S., 2014).

2.1. Geometric and Motion Model

The wind turbine main bearing structure with large cone angle double-row tapered roller bearings, and ordinary tapered roller bearings, is different from the ordinary tapered roller bearing. The outer cone angle can reach 45°, which can bear a greater axial and radial combined load and a large overturning moment (He J., 2009). Figure 1 shows the simplified movement of the main bearing.

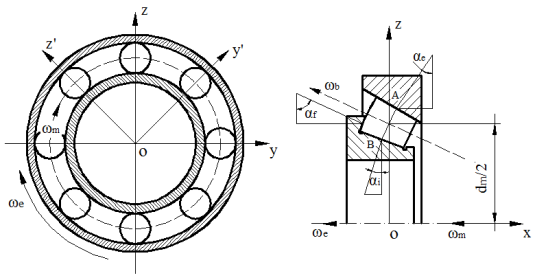

Figure 1 –Simplify Movement Relationship of Main Bearing

Where d_m is the bearing nominal diameter, α_e is the contact angle of roller and outer ring, α_i is the contact angle of roller and inner ring, α_f is the contact angle of roller and flange.

The movement relationship shown in Figure 1 is explained as follows:

1. The inner ring is fixed. The outer ring rotates counterclockwise about the x axis and its speed is ω_e with negative direction.
2. The cage and roller components rotates about the x axis, the speed is ω_m. According to the speed of the inner and outer ring may be along the x-axis positive or negative, this condition should be along the negative.
3. The angular rotation speed of roller is ω_m. and the revolution speed is ω_b. According to the actual conditions of wind power main bearing, can determine direction of ω_b shown in Figure 1.

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2.2. Average Speed Model of Roller-raceway Contact Zone

The average surface speed of roller-raceway contact zone, u, is an important parameter for lubrication analysis (Dowson, 1997). For the wind turbine main bearing, which outer ring is rotating and inner ring is fixed; the average surface speed can be obtained by the raceway control theory

$$u = n_R \frac{D}{2} \tag{1}$$

Where D is the roller diameter of contact zone, N_R is the roller speed, and

$$\begin{cases} n_R = \dfrac{d_m}{2D}(1-\gamma_o)(1+\gamma_o)n_o \\ \gamma_o = \dfrac{D\cos\alpha_e}{d_m} \end{cases} \tag{2}$$

where n_o is the outer ring speed.

2.3. The Entrainment Velocity Model of Roller-flange Contact

When the wind turbine main bearing is in the actual operation, the inner ring is fixed and the outer ring is rotating. Assume that the outer angular speed isω_e, the contact between the roller and the raceway is pure rolling. According to non-slip conditions, at the point of contact, the roller has the same linear velocity as the raceway surface. The absolute linear velocity of point A in Figure 1 is

$$V_A = \omega_e\left(\frac{d_m}{2} + \frac{D_{w1}+D_{w2}}{2}\cos\frac{\alpha_i+\alpha_e}{2}\right) \tag{3}$$

Where D_{w1} is the small end roller diameter, D_{w1} is the big end roller diameter.

Since the inner ring is stationary, the absolute linear velocity of point B is V_B=0. The absolute velocity of the centroid of the rolling body is

$$V_E = \frac{1}{2}\ (V_A - V_E)\quad \frac{1}{2}\omega_e\left(\frac{d_m}{2} + \frac{D_{w1}+D_{w2}}{2}\cos\frac{\alpha_i+\alpha_e}{2}\right) \tag{4}$$

The centroid velocity of the rolling element can be expressed as

$$V_E = \frac{1}{2}\mathrm{d}_m\omega_m \tag{5}$$

The revolving speed of the steel ball for the cage is

$$\omega_\mathrm{m} = \frac{\omega_e}{d_m}\left(\frac{d_m}{2} + \frac{D_{w1}+D_{w2}}{2}\cos\frac{\alpha_i+\alpha_e}{2}\right) \tag{6}$$

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The relative linear velocities of the raceway and the rolling in the moving system of point A respectively are

$$V_A^{\mathrm{t}} = (\frac{\mathrm{d}_m}{2} + \frac{D_{w1} + D_{w2}}{2}\cos\frac{\alpha_i + \alpha_e}{2})(\omega_e - \omega_m) \tag{7}$$

$$V_A^{\mathrm{b}} = \frac{D_{w1} + D_{w2}}{2}\omega_b \tag{8}$$

According to non-slip conditions, $V_A^{\mathrm{t}} = V_A^b$.

Thus the roller angular rotation velocity is

$$\omega_{\mathrm{b}} = \frac{d_m}{2(D_{w1} + D_{w2})}(1 - \gamma^2)\omega_e \tag{9}$$

where

$$\gamma = \frac{D_{w1} + D_{w2}}{d_m}\cos\frac{\alpha_i + \alpha_e}{2} \tag{10}$$

For tapered roller with spherical end surface, the absolute linear velocity u_1 at the contact point P can be expressed as the sum of the linear velocity and the frame velocity of the tapered roller relative to the cage (Hu L., 2013). That is

$$u_1 = \omega_b R\sin[\frac{1}{2}(\alpha_i + \alpha_e) + \alpha_f - \frac{\pi}{2}] + \omega_m R_P \tag{11}$$

Where R is the roller ball end curvature radius, R_p is the radius from the center of rotation of the main bearing to the contact point P between the roller ball end face and the flange.

Since the inner ring is at rest, the absolute linear velocity at the point of contact P for the inner rib, u_2=0. Therefore, the entrainment speed of the contact point lubrication analysis is

$$\mathrm{u}_e = \frac{u_1 + u_2}{2} = \frac{1}{2}\omega_b R\sin[\frac{\alpha_i + \alpha_e}{2} + \alpha_f - \frac{\pi}{2}] + \frac{\omega_m R_P}{2} \tag{12}$$

3. Application Example

The kinematic analysis of contact pairs of the main bearing is very important for the wind turbine in engineering practice. It directly affects the lubrication and service performance of the bearing (Zhang, 2016). The concrete engineering practical example selected in this paper is a certain type of MW wind turbine main bearing. The engineering diagram shown in Figure 2, bearing outer ring cone angle is 45 °, outer diameter is 2420mm,

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inner direct is 1750mm, the maximum bearing overall height is 360mm. Bearing inside ring and outside ring have the host connected to other parts, lubrication using grease. The other main parameters are shown in Table 1.

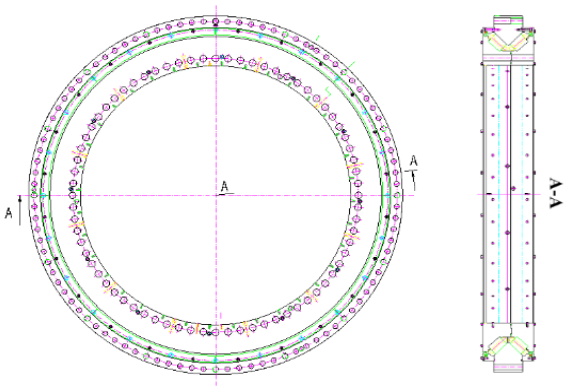

Figure 2 –A Certain Type of MW Wind Turbine Main Bearing

structure form	large cone angle double-row tapered roller bearing	
installation method	Inner ring and outer ring use bolt connection	
working speed	20rpm	
lubrication way	grease lubrication, self-lubricating	
self-lubricating	external diameter	2420mm
	inner diameter	1750mm
	width	360mm
	number of single-row rollers	85
	outer circle contact angle	45°
	inner circle contact angle	42.4°
	flange contact angle	47.275°
	roller small end diameter	65.16mm
	roller big end diameter	69.7mm

Table 1 – Main Parameters of Main Bearing

From the above kinematics model we can be obtained: when wind turbine main bearing work in the above operating conditions, the entrainment velocity of the contact between roller small end and raceway is 1.56m/s, the entrainment velocity of the contact between roller big end and raceway is 1.65m/s, the entrainment velocity of the contact between roller end and flange is 9.41m/s.

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4. Analysis of Bearing Whole Kinematics Simulation

As can be seen in the foregoing analysis, the entrainment velocity of roller-raceway contact and roller-flange contact are the main parameters of the main bearing lubrication friction analysis. In this paper, the entrainment velocity at the contact point is calculated by theoretical model, using ANSYS/LS-DYNA to analysis the relative motion relationship of the bearing internal key points, verify the correctness of the theoretical model.

In recent years, with the rapid development of computer technology, explicit dynamics simulation technology has been widely used in the field of rolling bearing analysis. The explicit algorithm LS-DYNA is based on the central difference method, the integral step size at each moment is controlled by the stability condition of the current configuration, the effect of dynamic contact instantaneous response discontinuity on the calculation results is small. The overall stiffness matrix is not formed during the calculation, and the elastic term is embedded in the internal force. When the mass matrix and damping matrix are diagonal matrix, matrix inversion is not needed, which is very meaningful for nonlinear analysis (Zhang, 2007).

4.1. Ansys/LS-Dyna Model Creation

Based on reasonable simplification of wind turbine main bearing, DYNA kinematic simulation analysis model is established. Because the main bearing is double-row tapered roller bearing, the structure and material properties of the two columns rollers are the same. Under the running conditions in this analysis, the bearing condition and the motion of two columns rollers are exactly the same. Therefore, in order to save the computing time, only one of them is modeled. Since the main purpose of this paper is to analyze the kinematic characteristics of the main bearing under the load, stress and strain distribution and other dynamic factors, the main bearing are negligible in this analysis. Therefore, the main bearing in the simulation modeling process is assumed as follows:

1. Neglecting the influence of main bearing chamfer, clearance, bolt connecting hole and lubricating oil hole on the dynamic performance during bearing running;
2. The outer ring of the main bearing is connected with the wind wheel hub and the outer rotor of the generator through bolts. The inner ring is connected to the fan nacelle fixing base by bolts. Therefore, the inner surface of the inner ring and the outer surface of the outer ring are set as the rigid surface;
3. Neglecting the influence of the working environment of the main bearing such as temperature, humidity, support rigidity and cleanliness on the bearing performance during the simulation operation time.
4. Assume that during the simulation period, the performance of the lubricant of the bearing remain unchanged, such as density, viscosity, etc.
5. Ignoring the effect of bearing seals, dust cover, lubrication devices and other parts on the bearing motion performance .

Based on the above assumptions, the kinematic analysis model of wind turbine main bearing is established. The modeling and meshing are shown in Figure 3.

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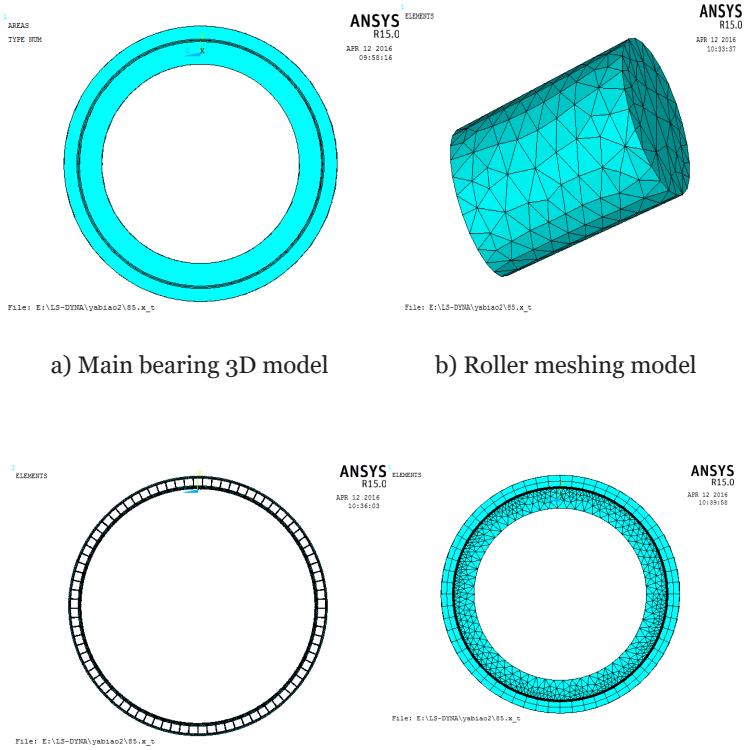

a) Main bearing 3D model

b) Roller meshing model

c) Cage 3D model

d) Main bearing whole meshing model

Figure 3 –Kinematics Analysis model of main bearing

4.2. Material Parameter Definition

The materials of inner ring, outer ring and rollers of the wind turbine main bearing are bearing steel. In the bearing work process, the deformation of the various components is small under the load, are within the scope of elastic deformation of materials. So in the finite element analysis, the main bearing inner and outer rings and rollers are set to elastomers. Since the inner surface of the inner ring is connected to the rigid shaft and the outer surface of the outer ring is connected to the bearing seat, the inner surface of the inner ring and the outer surface of the outer ring are set as the rigid surface. The corresponding material model parameters are shown in Table 2.

4.3. Model and Load Setting

In the implicit contact analysis, the contact between the two objects through the contact element to simulate. But there is no contact element in the explicit dynamic analysis. Explicit dynamic analysis can get a true simulation of the actual contact only needs to define the contact surface, contact type and contact-related parameters. Explicit dynamic analysis ensures that the contact between the two objects does not occur interference,

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name	material density/kgm³	elastic modulus/Pa	poisson ratio
Outer ring	7830	2.06×10^{11}	0.3
Inner ring	7830	2.06×10^{11}	0.3
cage	8545	2.06×10^{11}	0.24
roller	7830	2.06×10^{11}	0.3

Table 2 – Material Parameters of Main Bearing

and consider the relative movement of the friction force in the process of calculating the contact interface.

According to the actual contact condition of the main bearing, there are roller - inner raceway, roller - outer raceway and roller - cage mutual contact; Since it can't determine the specific contact area of the bearing during operation, these three contacts are all set to area-area automatic contact pairs.The contact model is set as shown in Figure 4. The applied load and the bearing rotational speed are defined according to the previous example. Select the running time of 0.1s.

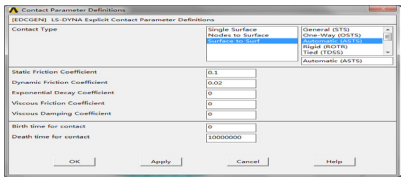
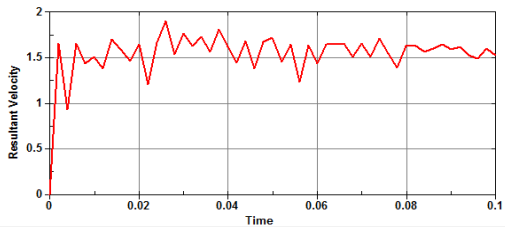


Figure 4 – Contact Model Definition of Main Bearing Kinematics Analysis

4.4. Kinematics Simulation Result Analysis

The kinematic analysis of the main bearing is carried out on the basis of the above definition. Select three units of the contact zone between roller big end and raceway, the contact zone between roller small end and raceway and the contact zone between roller large end and flange, obtain the simulation results of the entrainment velocity at roller-track contact and roller-rib contact. The results are shown in Figure 5.



a) Contact Zone Entrainment Velocity between Roller Big End and Raceway

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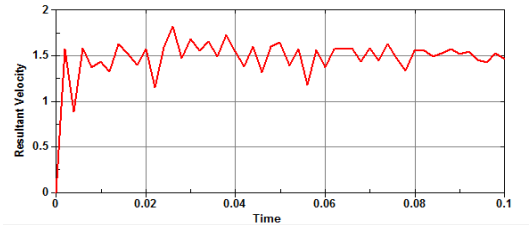
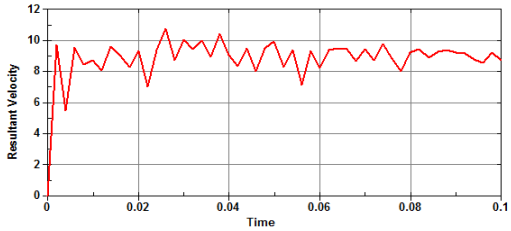


b) Contact Zone Entrainment Velocity between Roller Small End and Raceway



c) Contact Zone Entrainment Velocity between Roller Big End and Flange

Figure 5 – Entrainment Velocity of Main Bearing Contact Areas

From the foregoing theoretical calculation can be obtained: under the above analysis speed, the entrainment velocity of the contact between roller big end and raceway is 1.56m/s; the entrainment velocity of the contact between roller small end and raceway is 1.65m/s; the entrainment velocity of the contact between roller large end and flange is 9.41m/s. Figure 5 can be seen that the main bearing kinematics simulation results and the theoretical results are basically consistent, which prove the feasibility of the aforementioned main bearing kinematics theoretical model.

5. Conclusions

According to the large cone angle wind turbine main bearing, this paper analyses and studies the kinematic relationship of the inner contact area of the bearing, establish the kinematic model of the average contact speed of roller-raceway contact and the entrainment velocity of roller-flange contact point. Based on the kinematics model, calculated a certain type of MW wind turbine main bearing used in practical application and get the kinematics features of bearing's internal contact zone. Finally, use ANSYS/LS-DYNA to analysis the kinematics characteristics of complete main bearing. Extract velocity-time curve of the contact units, verify the correctness of the theoretical model. This paper studies the main bearing inner contact area of the movement relationship, which is of great reference value for the analysis of the motion of wind turbine main bearing and the subsequent analysis of oil film and lubrication analysis.

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The Research on the Security Evaluation of the Electronic Commerce based on the Cloud Computing Environment

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Abstract: The security problem is an important core issue in the development of the electronic commerce. With the rapid development of e-commerce, the circulation of the information flow, the logistics flow and the cash flow has been more and more electronic. The combination of the cloud computing and the e-commerce promotes the rapid development of the electronic commerce. However, the electronic commerce in the cloud computing environment faces many new security risks. In this paper, we study the security evaluation of the electronic commerce under the cloud computing environment. We propose an improved DEA-AHP method and use the method to evaluate the security of the electronic commerce. The experimental results verify the reliability of the method.

Keywords: Cloud Computing, Electronic Commerce, Security Evaluation

1. Introduction

With the overall popularity of the Internet and its rapid development, the e-commerce has become a new trading mode (Rahayu and Day, 2015). Due to the convenience of the e-commerce, it has the broad prospects for the development and been more and more attention of the world (Qu et al., 2015). However, the transaction model of the e-commerce is the Internet transaction. Therefore, the e-commerce changes people's business model while the security problem has become the focus of people (Zhang et al., 2012; Sá et al., 2016). At present, a major problem which is obstacle to the development of the electronic commerce is the security problem.

In recent years, with the concept of the cloud computing, the computer development has also entered a new stage (Ratten, 2016; Fortes et al., 2016). The combination of the cloud computing and the electronic commerce is driving the development of the electronic commerce. The cloud computing center adopts the way of the centralized management. It is more likely to become the focus of the hacker attacks. The ultra large scale, the unprecedented openness and the complexity of the cloud environment make the security of the cloud more severe than the traditional network environment. For the ordinary users, compared with the traditional security risk organization environment, it has increased. Therefore, the electronic commerce security problem in the cloud computing

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environment has been widely concerned by scholars. The AHP method and the DEA method are the two important parts of the evaluation method. AHP method is easy to be affected by the subjective influence of the decision makers. DEA method is easy to ignore the decision maker's preference (Tseng and Lee, 2016). Therefore, we combine the two methods and can solve the above question. In this paper, we establish the evaluation index and put forward the improved DEA-AHP method. We use this method to evaluate the e-commerce security issues in the cloud computing environment.

2. Establishment of the evaluation index

In order to evaluate the security of the electronic commerce under the cloud computing environment, we need to establish the corresponding evaluation index. The establishment of the evaluation index must follow the principle of the systematic, the scientific and the comprehensive. The security evaluation index of the e-commerce under the specific cloud computing environment is shown in the following table.

The first order index	The second order index	The third order index
The security evaluation index of the e-commerce under the cloud computing environment	Reliability	Transaction security
		Firewall security
		Antivirus software security
		Misuse or abuse of cloud computing
		Sharing technical problems
		System safety
		Network operation security
	Confidentiality	Data transmission risk
		Data storage risk
		User privacy disclosure risk
	Logistics Security	Transportation safety
		Storage security
		Distribution safety
	Cloud service provider	Continuous service Guarantee for cloud service providers
		Cloud service provider's emergency response capability
		Integrity of cloud service provider
		Availability of cloud service providers
	Physical security	Management system security
		Site safety
		Equipment safety
	Other	Laws and regulations
		Electronic money
		Relevant policies

Table 1 – The security evaluation index of the e-commerce under the cloud computing environment

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3. DEA method

The data envelopment analysis is short for DEA. It was proposed by the famous operations research scientist Charnel and Cooper. The method is a non-parametric estimation method that uses to evaluate whether the decision unit of the multiple input and multiple output is effective or not (Shwartz et al., 2016). The method adopts the change right to evaluate the decision unit based on the input and output observation data (Mirdehghan and Fukuyama, 2016). From the appearance of the DEA model which is the most important representative model, it has formed the basic integrity theory, method and the model. The steps of the DEA method are shown in the following figure.

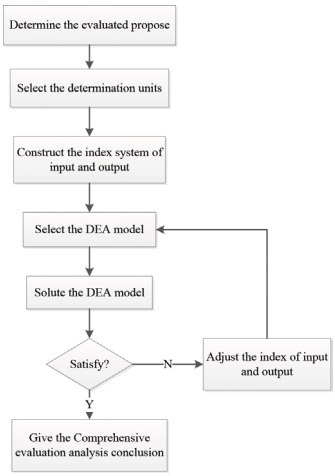

Figure 1 – The steps of the DEA method

C^2R model is also called the scale return model. It is also the most basic and the most important model. The basic principle is that we assume that there is n decision unit $DMU_j\left(j=1,2,\cdots,n\right)$. The input and the output vector is as follows.

$$X_j=\left(x_1,x_2,\cdots,x_{mj}\right)^T>0, j=1,2,\cdots,n \tag{1}$$

$$Y_j=\left(y_1,y_2,\cdots,y_{kj}\right)^T>0, j=1,2,\cdots,n \tag{2}$$

The matrix is shown in the following table.

We assume the weight of x_j is v_j. The weight of the y_j is u_j. We assume that the input weight vector is $v=(v_1, v_2,...,v_m)^T$. The output weight vector is $u=(u_1, u_2,...,u_s)^T$. We take the input variable and the output variable as the variables. Then, we determine them according to some principles during the process of the analysis. We evaluate the decision unit i_0.

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The decision unit	0	1	2	...	n
input	x_0	x_1	x_2	...	x_n
output	y_0	y_1	y_2	...	y_n

Table 2 – The input and the output table of the decision unit

$$h_j = \frac{u^T y_j}{v^T x_j} = \frac{\sum_{k=1}^{s} u_k y_{kj}}{\sum_{i=1}^{m} v_i x_{ij}}, j = 1,2,\cdots,n \tag{3}$$

h_j is the efficiency evaluation index of the j decision unit DMU_j. We can take the weight coefficients v and u and make $h_j \leq 1$, $j = 1, 2,...n$. Then, we do the efficiency evaluation index of the j decision unit. If the h_{j0} is bigger, DMU_{j0} can use the less input to get the more output.

The C^2R model is,

$$\max \frac{\sum_{k=1}^{s} u_k y_{kj0}}{\sum_{i=1}^{m} v_i x_{ij0}} \tag{4}$$

$$\begin{aligned} & S.T. \\ & \frac{\sum_{k=1}^{s} u_k y_{kj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, j - 1,2,\cdots,n \\ & u_k \geq 0, k = 1,2,\cdots,s \\ & v_j \geq 0, i = 1,2,\cdots,m \end{aligned} \tag{5}$$

According to charnes-Cooper transformation,

$$\begin{cases} t = \dfrac{1}{v^T x_0} \\ \omega = tv \\ \mu = tu \end{cases} \tag{6}$$

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We can get a linear programming model.

$$P_{C^2R}=\begin{cases}\max \mu^T y_0=\bar{V}_p \\ S.T. \\ \omega^T x_j-\mu^T y_j\geq 0, j=1,2,\cdots,n \\ \omega^T x_0=1 \\ \omega\geq 0,\mu\geq 0\end{cases} \tag{7}$$

In the usual applications, it often appears the same or the similar efficiency indexes. In order to solve this problem, we introduce a virtual decision unit to increase the difference between the effective decision making units. For the same or similar multiple efficiency evaluation indices scheme,

$$x_j=\min_{1\leq j\leq n}\{x_{ij}\}(i=1,2,\cdots,n) \tag{8}$$

$$y_r=\min_{1\leq j\leq n}\{y_{rj}\}(i=1,2,\cdots,s) \tag{9}$$

$$X_{n+1}=(x_1,x_2,\cdots,x_m)^T \tag{10}$$

$$Y_{n+1}=(y_1,y_2,\cdots,y_s)^T \tag{11}$$

We make X_{n+1} and Y_{n+1} as the virtual decision making unit of the decision unit. We incorporate X_{n+1} and Y_{n+1} into n decision units. Then we can get the new evaluation model.

$$P_{C^2R}=\begin{cases}\max \mu^T y_0=\bar{V}_p \\ S.T. \\ \omega^T x_j-\mu^T y_j\geq 0, j=1,2,\cdots,n,n+1 \\ \omega^T x_0=1 \\ \omega\geq 0,\mu\geq 0\end{cases} \tag{12}$$

4. The improved DEA-AHP model

Because the evaluation results of the DEA method is totally dependent on the objective index of the evaluation method. However, it doesn't consider the preference of the

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decision maker. The DEA method gives little information for the effective decision unit. Therefore, we consider using the AHP method to add to the DEA method. Because the AHP method has influenced by the subjective factors, the feature determines that the method is lack of the strict objectivity. In order to reflect the preference of the decision makers to the various evaluation indexes and make the evaluation results more comprehensive, we propose an improved AHP method.

In the traditional AHP method, we know

$$a_{ij} > 0, a_{ij} = \frac{1}{a_{ji}}, a_{ii} = 1 (i, j = 1, 2, \cdots, n) \tag{13}$$

We call the matrix A as the positive reciprocal matrix.

If the positive reciprocal matrix A is the consistency matrix

$$\forall i, j, k = 1, 2, \cdots, n, a_{ij} = a_{ik} a_{kj} \tag{14}$$

We sum the above type and can get,

$$a_{ij} = \frac{1}{n} \sum_{k=1}^{n} a_{ik} a_{kj} \tag{15}$$

When the above function is not established, we can obtain that the matrix A is not the consistency matrix. Therefore, the function (15) is the condition of the consistency matrix.

If the matrix A does not satisfy the consistency, we use $B = (b_{ij})_{n \times n}$ as the correction matrix of the matrix A. If the matrix A is the consistency matrix, $B = A$. The definition of b_{ij} is as follows.

$$b_{ij} = \begin{cases} \frac{1}{n} \sum_{k=1}^{n} a_{ik} a_{kj} & i < j \\ 1 \quad i = j \\ \frac{1}{b_{ij}} & i > j \end{cases} \tag{16}$$

The steps of the improved DEA-AHP method are as follows.

The first step is to establish the security evaluation system of the e-commerce under the cloud computing environment.

The second step is to determine the input indicators and the output indicators for each layer.

The third step is to calculate the weight of each index by using the improved AHP method.

The fourth step is to classify the indicators. Then, we establish the system evaluation unit set according to each index. After that, we classify and calculate the input and

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output index. Finally, we use the data envelopment analysis method to obtain the optimal value.

The fifth step is to calculate the final evaluation results according to the weight and the optimal value.

5. Experiment

In order to test the security research of the e-commerce in the cloud computing environment, we select the four e-commerce companies to conduct the security assessment. Firstly, we calculate the index weights of the security evaluation of the e-commerce in the cloud computing environment. The calculation results are shown in the following table.

The second order index	The weight of the second order index	The third order index	The weight of the third order index
Reliability	0.24	Transaction security	0.22
		Firewall security	0.12
		Antivirus software security	0.12
		Cloud computing, misuse or abuse	0.14
		The sharing of technical problems	0.13
		system safety	0.18
		The safe operation of the network	0.09
Confidentiality	0.18	Data transmission risk	0.33
		The risk of data storage	0.33
		User privacy risks	0.33
Logistics Safety	0.13	Transportation safety	0.33
		Safe storage	0.33
		Safe delivery	0.33
Cloud service provider	0.22	The cloud service provider's security service continuity.	0.38
		The emergency ability of cloud service providers	0.17
		The integrity of the cloud service provider service	0.24
		Availability of cloud service providers	0.21
Physical security	0.15	Management system security	0.32
		Site safety	0.23
		Equipment safety	0.45
other	0.08	Laws and regulations	0.53
		Electronic money	0.21
		Relevant policies	0.26

Table 3 – The index weight of the security evaluation of the e-commerce in the cloud computing environment

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According to the improved DEA-AHP method, we can obtain the calculation results. The specific results are shown in the following table.

weight	DMU1	DMU2	DMU3	DMU4
0.24	1	0.63	0.81	1
0.18	1	0.65	0.59	0.48
0.13	1	1	0.73	0.80
0.22	1	0.57	0.82	0.46
0.15	1	0.47	0.75	0.43
0.08	1	0.78	0.78	0.34
σ_j	1	0.6565	0.7508	0.6233
order	1	3	2	4

Table 4 – The calculation results

From the above table, we can see that the security order of the four e-commerce enterprises is as follows.

$$DMU1 > DMU3 > DMU2 > DMU4$$

6. Conclusion

The combination of e-commerce and the cloud computing is an important direction for the development of the e-commerce. Due to the characteristics of the e-commerce and the cloud computing, the security of the electronic commerce under the cloud computing environment has been widely concerned by people. In this paper, firstly, we establish the security evaluation index of the e-commerce under the cloud computing environment. Then, we apply the improved DEA-AHP method to improve the security of the e-commerce. The evaluation result is accurate and reliable.

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Research on Evaluation of Business Model Based on Internet Travel Service Enterprises

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Abstract: This paper constructs the business model of internet travel service and analyzes its evolution law. And the Ctrip.com is taken as an example to validate the proposed business model. The research results show that the evaluation model elements of Internet travel service business model are composed of value group, product and service, resource allocation and profit pattern, on the basis of this, the internal and external resources of enterprise are integrated, ultimately realize the development strategy of the online tourism profit. The evolution cycle of the business model of online travel enterprises is the repeat alternately of the construction process and structure process of business model. The structure process of the business model includes the emergence of new business profit pattern, the competition between old and new business model and the disintegration of the old business model. Ctrip.com is taken as an example to analyze its business model from the above four aspects. In the development process of Ctrip.com, the operation revenue source gradually shows a trend of diversified development, since 2010, the company takes the initiative to change, increases exploitation in two new directions, namely tourism vacation and business travel management, so as to realize sustainable development of enterprises. The research conclusion can be used as a theoretical reference for the development of online tourism enterprises.

Keywords: internet travel service, business model, evolution law, element composition.

1. Introduction

In recent years, tourism has become an important pillar industry to promote China's economic growth, the increasing number of mobile tourism population have greatly contributed to the regional economic development (Chesbrough, 2002). At the same time, due to the development of the Internet, the scale of Internet travel service is also expanded rapidly (Reuver et al., 2009). Figure 1 shows the scale of China's Internet travel service market from 2005 to 2016. It can be seen from the figure that before 2012, the market share of China's online tourism industry has been in rapid growing period, and the growth rate of the annual turnover is basically maintained at 30%, since 2013 Internet travel turnover growth has slowed down, but also maintained at 23% or more (Frías et al., 2008). It can be concluded that the Internet travel service industry has broad development prospects, besides it has changed the original pattern of the tourism

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industry, China's huge potential Internet travel consumer groups will become the market main force for supporting the Internet travel service industry (Mutch, 1995; Maritza et al., 2016).

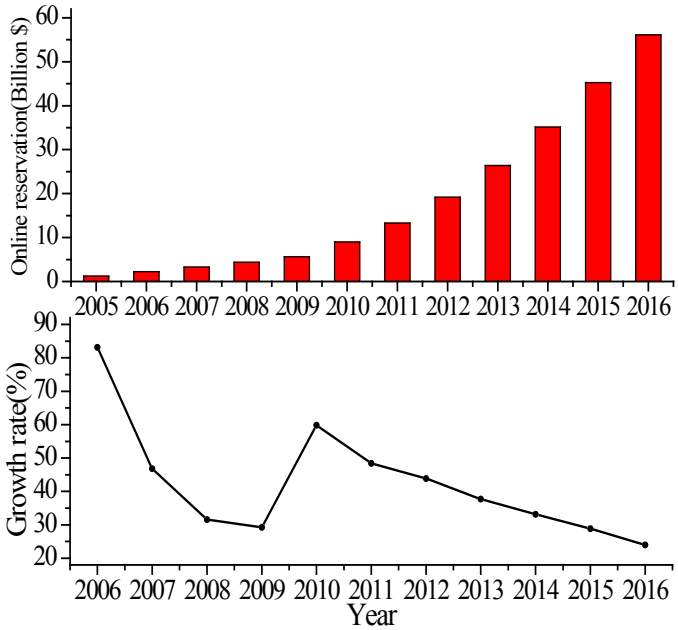

Figure 1 – The market scale of online travel reservation in China

Internet travel service has the characteristics of low resource consumption, strong capability of independent innovation, high risk and high expected return. As an emerging business model, Internet travel service lack of more integrated theoretical framework and practical application. At present, the study of Internet travel service mainly including the classification of Internet travel service (Hongbumm et al., 2009); network marketing of Internet travel website (Ho and Lee 2007); evaluation of Internet travel site (Kim et al., 2007), the main concern focused on the application of evaluation model in tourism website, the evaluation of website business travel and evaluation of the tourism website; Business conditions of Internet travel service (Buhalis, 1998); and the successful experience and development trend of the Internet travel service, the application of information technology in the tourism industry, tourism, e-commerce, tourism information management system and business model of Internet travel service and so on.

This paper emphatically analyzes the evolution process of Internet travel service business model, analyzes the dynamic mechanism and law of changes (Rainer and Hans, 2001). Business model of Internet travel service is constructed and its evolution law is analyzed,

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and the business model is validated by taking Ctrip.com as an example. The conclusion can be used as a theoretical reference for the development of online tourism enterprises.

2. The evolution of business model of Internet travel service

2.1. Evaluation model of business model

Internet travel service is using the Internet e-commerce as its media, to form a new type of tourism enterprise operation pattern on the basis of construction of information technology (Lee et al., 2007). The evaluation model of Internet travel service business model constructed in this paper mainly includes value group, product and service, resource allocation and profit pattern. On this basis, the integration of internal and external resources of the enterprises is carried out, finally to realize the development strategy for online tourism industry to gain excess profits. As shown in figure 2 (Chen and Chiyeh 2004).

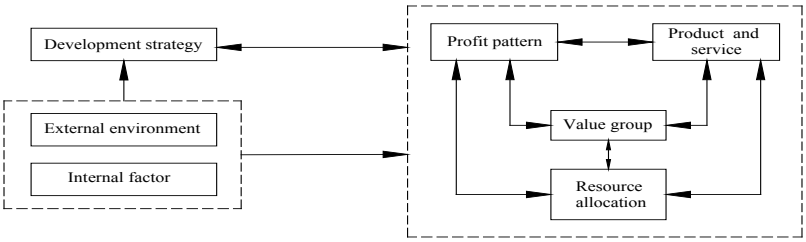

Figure 2 – The business model of online travel service

Value group is the service and profit targets that the Internet travel service enterprises have chose (Morrison and Leary, 2005). Through the segmentation of the market and the potential profit target, it not only provides the product and service with the feedback information to facilitate the enterprise to improve and innovate, but also provides client resources for the "resource allocation", and finally creates more profits for the enterprise (Connor, 2001). Therefore, it can be said that the value group is the most basic structure elements for construction of the evaluation model of business model.

Product and service is the core interests that Internet travel service enterprises can provide to the value group, mainly including three elements, that is value positioning, target market and enterprise capacity (Pan and Fesenmaier, 2006). The product and service of an enterprise is linked to the value group through marketing, further to be optimized through customer feedback. Product and service is based on resource allocation and accepting the resources provided by them (Hsientang et al., 2005).

Resource allocation refers to the industrial chain of enterprise allocation or the internal and external resources which can be transformed into more competitive product and service, by providing the product and service with its own characteristics, create more profit points for value group based on resource allocation (Bennett, 1993). Resource

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allocation is an extremely important link of online travel enterprises, to integrate the whole industry chain involves basic necessities of life, entertainment and shopping as one, only to maximize the advantages of the resources, can the enterprise win in the fierce competition in the market (Mahadevan, 2000).

Profit pattern refers to the Internet tourism enterprises through providing competitive product and service to certain value group, and with continuous upgrading of the resource allocation, eventually realization of operating revenue. General business revenue of Internet travel services enterprises mainly includes online advertising, website click rate and extraction of commissions and so on.

2.2. The evolution law of business model

The evolution of the business model of Internet tourism enterprises can be described as the development process of "the generation of business model creativity—the formation of structure—innovation and evolution"(Gamble, 1988). The construction of business model includes the following aspects, namely, adopt consumer demand as the core, fully aware of the resources and competitiveness in internal and external market, establish value capture mechanism or profit pattern and timely capture the market information. The construction of structure of business model generally need to go through the process that generation of creativity, structured design of pattern, testing and evaluation of the formed business model, and ultimately to achieve the scale of the model (Sheldon, 2004).

The development of Internet tourism enterprises has a life cycle. When the enterprises develop into a bottleneck or enter into downturn period, by the methods of restructuring the business model and changing the transaction structure, the enterprises can escape from the original life cycle and enter a new cycle (Buhalis, 1998). The life cycle of online tourism enterprises can be divided into the initial stage, scale revenue incremental stage, scale revenue diminishing stage, merger integration stage, monopoly revenue incremental stage and monopoly revenue diminishing stage. The existing researches show that the reconstruction of online tourism enterprises mainly appears in the initial stage, scale revenue diminishing stage and monopoly revenue diminishing stage. When the enterprise is in the initial stage, due to the small scale of resources and the briefness of organizational structure, in facing of market difficulties, corresponding the encountered resistance will be relatively small; When the enterprise from high-speed development into scale revenue diminishing stage, by converting the form of cost, reducing the proportion of assets to sales revenue, reducing fixed costs and other methods to achieve the flexibility of enterprise funds, and ultimately re-achieve the scale revenue incremental; While for the enterprises entering into monopoly revenue diminishing stage, if they don't have rich product line, then by restructuring the business model as well as the pursuit of new growth point to make enterprises to re-profit.

The evolution cycle of the business model of online travel enterprises is the repeat alternately of the construction process and structure process of the business model. The structure process of the business model includes the emergence of new business profit pattern, the competition between old and new business model and the disintegration of the old business model. While the new business model re-carry out the generation of pattern creativity, the formation pattern structure, testing and evaluation of business

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model, and ultimately to achieve the scale of the model.. Internet travel services enterprises continuous developing in the process, broaden the market space of Internet travel services, at the same time provide more consumption options and travel experience for tourist, thereby create more value for tourism industry.

3. Instance analysis

Taking the Ctrip.com as an example, the evolution of the business model proposed in this paper is verified. Ctrip.com was founded in 1999, listed on NASDAQ in 2003, the development has mainly experienced the initial development, start and big development these three stages. Today, Ctrip's business mainly includes hotel reservations, air ticket reservations, vacation products, business travel services, vehicle leasing and other services. Ctrip's business model is shown in Figure 3.

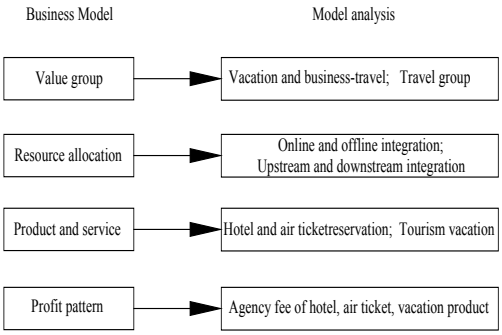

Figure 3 – Structure analysis of business model of ctrip.com

The value group that Ctrip.com arming at mainly is holiday travel and business travelers, including tourism groups, among them business travelers accounted for 88% of the total number of tourists, other types of tourists accounted for 12%.

Regarding to resource allocation, Ctrip.com mainly through integration of online and offline as well as tourism upstream and downstream, so as to strengthening the competition. For the internal allocation of the enterprise by enhancing the full coverage of services before, during and after travel, further to enhances the service methods for value group; In terms of external resource allocation, by strengthening the cooperation between hotels, tourist attractions and airlines, achieve the control and cooperation on tourism upstream and downstream.

In terms of Product and service, Ctrip.com has strengthen the online travel services, product introductions and other functions for tourists, covering travel agencies, hotels, restaurants, entertainment, shopping, transportation and other comprehensive information, as well as provide booking, reservations , group reservations, ordering and other services. In the composition of the business of Ctrip.com, hotel reservations, air

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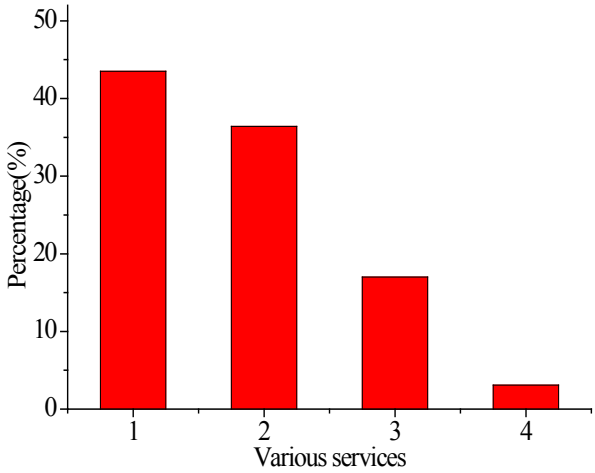
ticket reservations and tourism vacation accounted for the vast majority of the share, among which hotel reservations accounted for 44%; air ticket reservations accounted for 37%; tourism vacation accounted for 17% , other business income accounted for only 2% of overall revenue, as shown in Figure 4. With Ctrip's vigorously develop the layout of industrial diversification, the share of tourism products and business travel management are growing, therefore the enterprise achieves sustainable development.



1. Hotel reservations 2. Air ticket reservations 3. Tourism vacation 4. Others

Figure 4 – Business structure of ctrip.com

In terms of Profit pattern, since Ctrip listed in 2003, the company continues to developing, the overall operating revenue continues to rising, Figure 5 is change curve of Ctrip's operation revenue and growth rate from 2006 to 2015. As can be seen from the figure, from 2006 to 2010 Ctrip's operation revenue has remained at high growth state, with an average growth rate of 53.6%; from 2010 to 2013, due to the slow transition and product is single, a rapid decline in annual revenue, the growth rate is only between 20% to 30%; after 2013, operating revenue re-emerges a significant increase, with annual growth rate of 38% or more. Ctrip's overall operation revenue shows a high-speed growth trend, it reflects the strong demand for China's online travel market from the side.

In the course of development of Ctrip.com, sources of operation revenue have a diversified development. It can be seen from the annual report of Ctrip.com in recent years, that different from the Ctrip's single hotel reservation and ticket reservations during the first decade of the 21st century, at the beginning of 2010, the company take the initiative to change, increase exploitation on the two new direction that is tourism and business travel management. In 2010, China's domestic travel expenses

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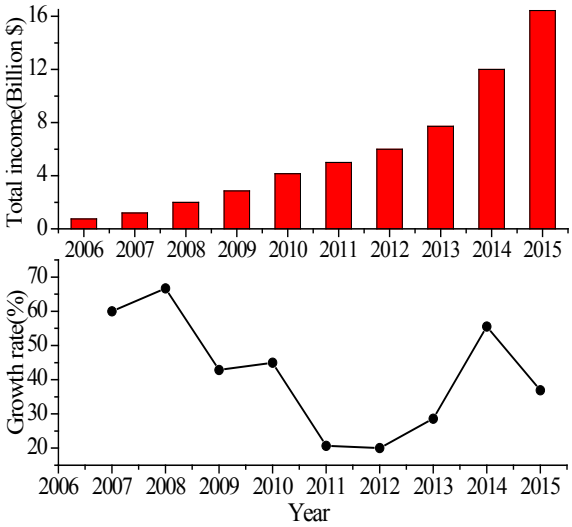

Figure 5 – Operating revenue of ctrip.com in 2006-2015

increased by about 17% compared with 2009. Under the background of slowing down of Ctrip's main business growth, the company has made new business growth point through exploiting business travel management. Tourism vacation and business travel management accounted for 38% of total revenues in 2014, compared with 15% in 2009, and total revenues in 2014 increased approximately 900 million dollars compared with in 2009, indicating a significant efficiency in the company's transition , Ctrip.com gradually changes from the "travel reservation service provider" to "one-stop comprehensive tourism service provider".

4. Conclusions

This paper constructs the business model of internet travel service and analyzes its evolution law, and takes Ctrip.com as an example to verify the business model. The conclusions are as follows:

1. The evaluation model elements of Internet travel service business model consists of four parts: value group, product and service, resource allocation and profit pattern. On this basis, the internal and external resources of enterprise are integrated, ultimately realize the development strategy of the online tourism profit. The life cycle of online tourism enterprises can be divided into the initial stage, scale revenue incremental stage, scale revenue diminishing stage, merger integration stage, monopoly revenue incremental stage and monopoly revenue diminishing stage. The evolution cycle of the business model of online travel enterprises is the repeat alternately of the construction process and structure process of the business model. The structure process of the business model includes the emergence of new business profit pattern, the competition between old and new business model and the disintegration of the old business model.

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2. Take Ctrip.com as an example, in term of four aspects: value group, product and service, resource allocation and profit pattern to analyze its business model. In the development process of Ctrip.com, the operation revenue source gradually shows a trend of diversified development. Different from the Ctrip's single hotel reservation and ticket reservations during the first decade of the 21st century, since 2010, the company takes the initiative to change, increases exploitation in two new directions, namely tourism vacation and business travel management, so as to realize sustainable development of enterprises. On the whole the operation revenue of Ctrip.com is in the high-speed growth trends.

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Evaluation On Talent Attractiveness in Xinjiang Based on Data Mining

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Abstract: Being the primary resource of development, talent is the main driving force of the regional economy in Xinjiang. Based on the actual situation of talents in the autonomous region, this paper constructs the evaluation index system of talent attractiveness in Xinjiang, and applied the data mining method to evaluate the talent competitiveness of Xinjiang. According to the research, the overall talent competitiveness in Xinjiang increases rapidly from 2005 to 2014. However, Xinjiang still lacks attractiveness to talents as it still lags far behind than the developed areas in eastern China. In the future, Xinjiang should speed up the establishment and perfection of talent cultivation, introduction, utilization and management, aiming at promoting the rapid regional development through the systematic training system of scientific and technological talents.

Keywords: data mining; set pair analysis; talent attractiveness; evaluation

1. Introduction

In today's society, the economic competition between different countries or regions boils down to the talent competition for talent plays the leading role in the economic development. As a result, talent is the key to the leapfrog economic development in Xinjiang. In recent years, thanks to China's development of the west regions and the continuous support to the development of Xinjiang, a large number of talents has poured into Xinjiang and promoted the construction and development of Xinjiang. However, Xinjiang still has many disadvantages in talent competition due to its special natural environment, geographical location, economic and social factors (Zhan, 2014; Fortes et al., 2016). To a certain extent, the difficulty in talent introduction and the severe loss of talent have restricted the development of Xinjiang. It has become a hot topic that a feasible way should be found to attract, cultivate and keep talents, thereby promoting the development of talent resource in Xinjiang. Therefore, this paper explores the current state, studies the changing trend, and analyzes the main restricting factors of talent attractiveness in Xinjiang. The research has important practical significance and theoretical value.

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2. Literature review

In foreign countries, the experts mainly focus on the aspects of talent flow and talent attractiveness. (1) In terms of talent flow, most foreign scholars emphasize on the talent flow factors, and establish many models on the issue. Typical talent flow models include the participative decision-making model (Simon, 1958), the internal relationship model (Mobley, 1982), etc. Generally speaking, these traditional flow models believe that the talents tend to leave the current job and look for new ones when they are dissatisfied with the current work situation. Lee and Mitchell (1994) establishes multi-path expansion model, which breaks through the single-path talent flow mode of traditional models. (2) In terms of talent attractiveness, the foreign scholars focus on how industrial agglomeration attracts talents and how regional development affects the talent gathering. Some experts hold that high and new technology industry has huge attractiveness to talents, and the inter-firm trading activities and division of knowledge in production can endogenously generate vertical talent gathering mode (Scott & Storper, 1987). Some experts claim that the successful cases and development opportunities brought by industrial agglomeration play an important role in attracting quality talents (Poter, 1998). In addition, `some other experts look into the influencing factors of talent attractiveness, and point out that the main factors are internal and external economies of scale, local government policies, and wage levels (Palivos and Wang, 2008).

In China, domestic experts have done much research on the issue and yielded some representative results. (1) In terms of talent attractiveness, the scholars discuss about the talent attractiveness of state-owned enterprises (Xiong and Zhang, 2002), universities (Wang Keqiang, Yang Jian et al., 2005), industrial clusters (Zhou et al., 2009) and returned overseas students (Shao and Luo, 2010), and put forward corresponding countermeasures. (2) In terms of the evaluation of talent attractiveness, some scholars, in light of the characteristics of the knowledge economy, advocates that the talent development environment determines the ability to attract talent (Zhang and Zha, 2002). Some experts analyze the factors influencing the talent flow (Zhu and Lu, 2003). In addition, some other scholars construct the evaluation index system of talent attractiveness, and make empirical analysis (Wang and Hu, 2007; Gao, 2012; Chen and Song, 2014).

Based on the above review, there is a lack of research on talent attractiveness in western China, especially in Xinjiang, in spite of the fruitful research on talent attractiveness. Trying to overcome the limitation, this paper constructs a set of evaluation index system to measure the talent attractiveness in light of the characteristics and status quo of talent resource in Xinjiang, and makes a quantitative evaluation and analysis of the issue by the data mining and analysis. The research aims at providing a theoretical guidance for Xinjiang to improve the work of attracting talents.

3. Overview of the research area

Located in northwest China, Xinjiang lies deep in the hinterland of the Eurasian continent. It covers an area of 1.66 million square kilometers between 34°25′~48°10′ north latitude and 73°40′~96°18′ east longitude. The total population of Xinjiang is 22,9847 million by the end of 2014. In recent years, the Chinese government has formulated a series of policies to speed up the development in Xinjiang, such as selecting talents and

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arranging them to work in Xinjiang, training cadres from Xinjiang and providing them practice opportunities in other inland provinces, and introducing talents of advanced professional titles, to name but a few. Despite the favorable decisions and arrangements, Xinjiang still feature a fragile basis of talent development, the weak inflow of talents and the severe shortage of high-level talents.

4. The construction of evaluation index system and the determination of evaluation method

4.1.The establishment of evaluation index system

Talent attractiveness hinges on the comprehensive environment of talent development. In reference to the talent statistical indices of National Bureau of Statistics of China, the talent is defined as: he/she who holds a junior college degree or above, junior professional titles, and professional technical positions.

In reference to relevant research (Gao, 2012; Chen and Song, 2014), this paper constructs the evaluation index system of talent competitiveness in Xinjiang from the perspectives of economic development, social life, education & technology, and career development by selecting some representative and operable evaluation indexes; in the meantime, this paper stratifies and methodizes the evaluation index system through the application of hierarchical decomposition so as to identify the indices and their interrelationships. See Table 1 for details.

4.2. Establishment of the set pair analysis and evaluation method based on data mining

4.2.1. Set pair analysis and evaluation method

Data mining is an automatically searching process for hidden information with special relations out of a large amount of data. Based on the analysis of the existing literatures (Su and Zhang, 2010; Gonçalves et al., 2015), this paper constructs a set pair analysis and evaluation method based on data mining to analyze and evaluate the talent competitiveness of Xinjiang in an objective manner.

1) Building the evaluation matrix

Assume that n objects to be evaluated constitute the set $E=\{e_1,e_2,...,e_n\}$ and e_n is the nth. Every object to be evaluated has m evaluation indices $F=\{f_1 f_2,...,f_m\}$, and f_m refers to the m th index. The value of the evaluation index is recorded as d_{ij} (i =1,2,..., n ; j =1,2,..., m). Then in line with set pair analysis method, a multi-target evaluation matrix Q is got:

$$Q=\begin{bmatrix} d_{11} & d_{12} & \dots & d_{1n} \\ d_{21} & d_{22} & \dots & d_{2n} \\ \dots & \dots & \dots & \dots \\ d_{m1} & d_{m2} & \dots & d_{mn} \end{bmatrix} \quad (1)$$

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Target layer	System layer	Weight	Index layer	Unit	Weight
Talent competitiveness	*Economic development status*	0.1492	Per capita GDP	yuan	0.0651
			GDP growth rate	%	0.0308
			The proportion of the tertiary industry in GDP	%	0.0534
	Social living environment	0.3968	Per capital disposal income of urban residents	yuan	0.0646
			Engel's coefficient of urban residents	%	0.0533
			The number of health technical personnel in every ten thousand people	-	0.0744
			The number of beds in medical institutions for every ten thousand people	-	0.0592
			Per capital park green areas	m^2	0.0421
			Green coverage in built-up area	%	0.0454
			Harmless treatment rate of domestic garbage	%	0.0577
	Education & science environment	0.2894	Education investment as a percent of GDP	%	0.0377
			The number of institutions of higher learning	-	0.1151
			The total investment in science and technology	10^8 yuan	0.0598
			Number of authorized patent applications	-	0.0768
	Career development status	0.1646	The proportion of the tertiary industry employment	%	0.0292
			Urban registered unemployment rate at the end of the year	%	0.0960
			Technology market turnover	10^8 yuan	0.0395

Table 1 – Xinjiang talent resources competitiveness evaluation index system

Based on the matrix Q, the evaluation indices are compared and chosen to decide the optimal evaluation set $U=[d_{u1},d_{u2},...,d_{un}]^T$ made up of optimal evaluation indices in all evaluation plans. In a similar way, the worst evaluation set is obtained as $V=[d_{v1},d_{v2},...,d_{vn}]^T$. d_{uj} is the evaluation index value ranking c_{pk} in the optimal evaluation set $U=[d_{u1},d_{u2},...,d_{un}]^T$, which is the optimal one during $\left[v_p,u_p\right]$ in the matrix Q, while d_{vj} is the evaluation index value ranking c_{pk} in the worst evaluation set $V=[d_{v1},d_{v2},...,d_{vn}]^T$, which is the worst one during $\left[v_p,u_p\right]$ in the matrix Q.

By comparing the evaluation index value w_p and the corresponding index value d_{uj} in the optimal set $U=[d_{u1},d_{u2},...,d_{un}]^T$, the similar degree matrix A of objects and the set $\left[U,V\right]$ without weights can be got:

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$$A=\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix} \tag{2}$$

By comparing the evaluation index value w_p and the corresponding index value d_{vj} in the worst set $V=[d_{v1},d_{v2},...,d_{vn}]^T$, the opposite degree matrix A of objects and the set $[U,V]$ without weights can be got:

$$B=\begin{bmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \dots & \dots & \dots & \dots \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{bmatrix} \tag{3}$$

In the matrix A and B, $\begin{cases} a_{pk}=\dfrac{u_p v_p}{d_{pk}(u_p+v_p)} \\ c_{pk}=\dfrac{d_{pk}}{u_p+v_p} \end{cases}$, with b_{ij} as the similar degree and the opposite degree of the object evaluated f_m and the set $[U,V]$.

If d_{ij} imposes positive influence on the evaluation result,

$$\begin{cases} a_{ij}=\dfrac{d_{ij}}{d_{uj}+d_{vj}} \\ b_{ij}=\dfrac{d_{uj}d_{vj}}{d_{ij}(d_{uj}+d_{vj})} \end{cases} \tag{4}$$

If d_{ij} imposes negative influence on the evaluation result,

$$\begin{cases} a_{ij}=\dfrac{d_{uj}d_{vj}}{d_{ij}(d_{uj}+d_{vj})} \\ b_{ij}=\dfrac{d_{ij}}{d_{uj}+d_{vj}} \end{cases} \tag{5}$$

2) Building the evaluation model

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Combined weights of all evaluation indices $W=(w_1,w_2,...,w_m)$ and the similar degree matrix A , the weighted similar degree matrix A_w of the objects and the set $[U,V]$ can be obtained as follows:

$$A_w = W \times A = (w_1 \quad w_2 \ ... \ w_m) \times \begin{bmatrix} a_{11} & a_{12} & ... & a_{1n} \\ a_{21} & a_{22} & ... & a_{2n} \\ ... & ... & ... & ... \\ a_{m1} & a_{m2} & ... & a_{mn} \end{bmatrix} = (a_1, a_2, ... \ a_n) \tag{6}$$

Similarly, the weighted opposite degree matrix B_w of the objects and the set $[U,V]$ can be obtained as follows:

$$B_w = W \times B = (w_1 \quad w_2 \ ... \ w_m) \times \begin{bmatrix} b_{11} & b_{12} & ... & b_{1n} \\ b_{21} & b_{22} & ... & b_{2n} \\ ... & ... & ... & ... \\ b_{m1} & b_{m2} & ... & b_{mn} \end{bmatrix} = (b_1, b_2, ... \ b_n) \tag{7}$$

a_j in the formula (6) is the similar degree of the j th object and the set $[U,V]$ and b_j in the formula (7) the opposite degree of the j th object and the set $[U,V]$.

3. Calculating the relative closeness degree

The relative closeness degree r_j of the jth object and the optimal evaluation set $U=[d_{u1},d_{u2},...,d_{un}]^T$ is calculated as:

$$r_j = \frac{a_j}{a_j + b_j} \tag{8}$$

Then the relative closeness degree matrix R of the objects evaluated can be got:

$$R = (r_1, r_2, ..., r_m) \tag{9}$$

r_j refers to the closeness degree of the object evaluated and the optimal evaluation set $U=\left(d_{u1} \quad d_{u2} \ ... \ d_{un}\right)^T$, which means the bigger r_j is, the closer the object is to the optimal plan. In this way, the plan ranks higher among all plans evaluated.

4. In multi-layer comprehensive evaluation, every layer uses the evaluation result of the next layer till that of the highest layer. Finally, based on all this, the comprehensive evaluation can be made.

4.2.2. Methods of weighting evaluation indices

The entropy evaluation method is to assess the practical value in line with the information loaded by the evaluation index to ensure the credibility of the evaluation result. Thus, this paper used entropy method to evaluate index weighting.

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4.3. Data source

Data in this paper mainly comes from Xinjiang Statistical Yearbook 2006-2015, Xinjiang Environmental Condition Bulletin 2006-2015 and Xinjiang Environmental Condition Annual Report 2015.

5. Evaluation results and analysis

After determining the weight of each evaluation index by the entropy method, the author obtains the system layer (social development, social life, education & science, and career development) evaluation results of Xinjiang talent competitiveness evaluation index system by the set pair analysis and evaluation formulas (1)-(9) and in light of the source data of each evaluation index of Xinjiang talent competitiveness. See Table 2 for details.

	Economic development status	Social life environment	Education & science environment	Career development status
2005	0.5328	0.3922	0.3056	0.6100
2006	0.5651	0.3899	0.3550	0.6111
2007	0.5971	0.4223	0.4190	0.6058
2008	0.6529	0.4797	0.4343	0.5953
2009	0.4669	0.5163	0.4770	0.4334
2010	0.7434	0.5436	0.5281	0.5037
2011	0.7720	0.5785	0.5566	0.4995
2012	0.7734	0.5967	0.6179	0.5377
2013	0.7955	0.6089	0.6830	0.4895
2014	0.7968	0.6235	0.7015	0.4742

Table 2 – Subsystem evaluation results of Xinjiang talent competitiveness

First, the economic development in the system layer reflects the talent attractiveness of the regional economic development. Figure 1 can be obtained on the basis of Table 2.

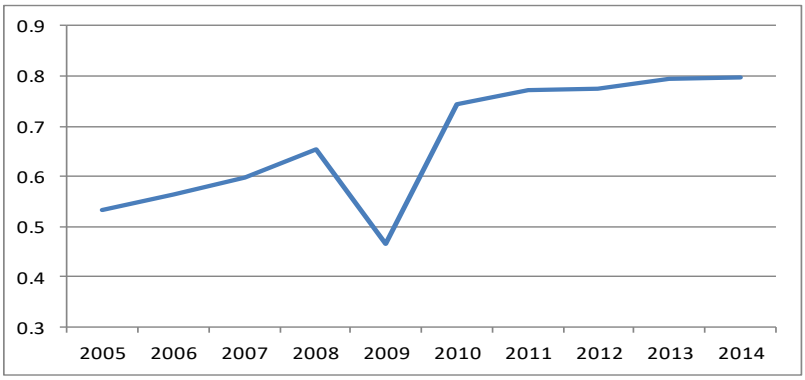

Figure 1 – The evaluation results of economic development status in the system layer

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Figure 1 shows that the economy of Xinjiang develops rapidly from 2005 to 2014. The best economic development status appears in 2014 and the worst appears in 2009. That is because the economy of Xinjiang is severely impacted by the global economic crisis in 2009. However, since 2010, the economy has recovered rapidly with the average GDP growth rate above 16% between 2010 and 2014. The results indicate that Xinjiang has a solid economic foundation and a good momentum of development, which is attractive to talents.

Second, the author examines the social life environment of Xinjiang in the system layer in accordance with Table 2. See Figure 2 for details.

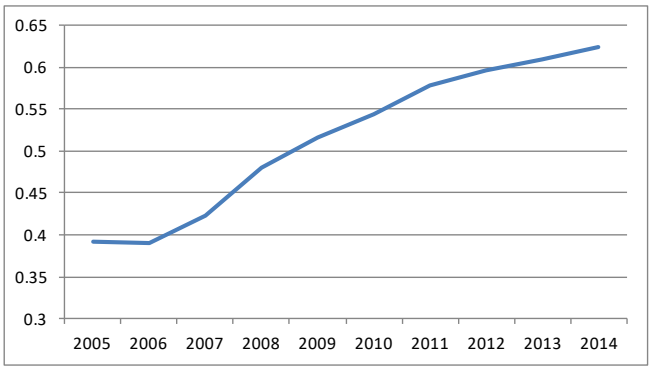

Figure 2 – The evaluation results of social life environment in the system layer

Figure 2 shows the evaluation results of social life environment in the system layer. The results show that the social life environment, an index of talent attractiveness, of Xinjiang develops fairly well from 2005 to 2014. In that period of time, the following indices develop rather rapidly: the per capital disposal income of urban residents, the number of health technical personnel in every ten thousand people, and per capital park green areas. In contrast, the Engel's coefficient of urban residents has declined year by year. The results indicate that Xinjiang has a good social development foundation and the people enjoy a high living standard.

Then, the author examines the education & science environment of Xinjiang in the system layer in accordance with Table 2. See Figure 3 for details.

Figure 3 shows that the education & science environment score of talent attractiveness of Xinjiang climbs straight up from 2005 to 2014. The highest score 0.7015 appears in 2014 and the lowest score 0.3056 appears in 2005. This indicates that, after years of development and constant external aids, the following indices increase rapidly: the education investment as a percent of GDP, the total investment in science and technology, and the number of institutions of higher learning. Besides, Xinjiang has made obvious progress in the education & science environment.

Finally, the author examines the career development status of Xinjiang in the system layer. See Figure 4 for details.

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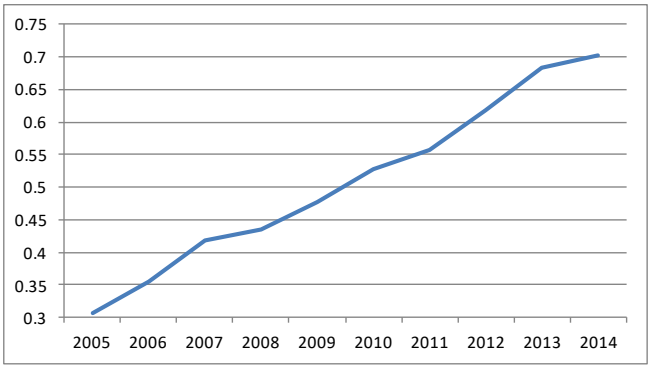

Figure 3 – The evaluation results of education & science environment in the system layer

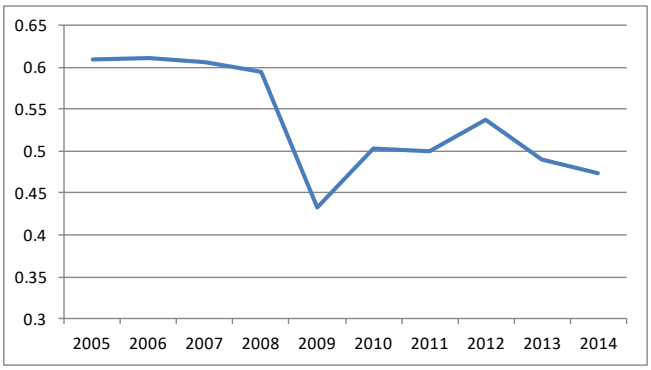

Figure 4 – The evaluation results of career development status

Figure 4 shows that the career development environment score of talent attractiveness of Xinjiang fluctuates greatly from 2005 to 2014. Generally speaking, the score has declined year by year. The highest score 0.6111 appears in 2006 and the lowest score 0.4334 appears in 2009. This is because the region has weak scientific innovation ability, few scientific innovation achievements and low technical market turnover, although it boasts a good momentum of regional economic development, a steady growth in the proportion of the tertiary industry employment, and a gradual decline in urban registered unemployment rate at the end of the year.

After obtaining the evaluation results of social development, social life, education & science, and career development, the four elements in the system layer of Xinjiang talent competitiveness between 2005 and 2014, the author apply the set pair analysis again to acquire the comprehensive evaluation result of Xinjiang talent competitiveness between 2005 and 2014. See Table 3 for details.

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2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0.3975	0.4209	0.4624	0.4981	0.4733	0.5459	0.5676	0.5939	0.6055	0.6110

Table 3 – The comprehensive evaluation result of Xinjiang talent competitiveness

Figure 5 is obtained after a comprehensive arrangement according to Table 3.

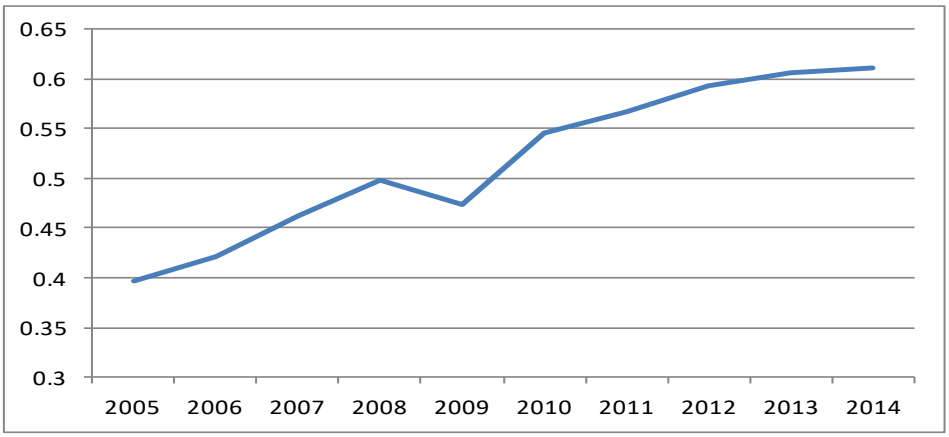

Figure 5 – The comprehensive talent competitiveness in Xinjiang

According to Table 3 and Figure 5, the comprehensive talent competitiveness in Xinjiang fluctuates by small amplitude between 2005 and 2014. Although the talent competitiveness increases rapidly, the region still lags far behind than the developed areas in eastern China (Gao, 2012). There is still a big room for improvement of talent competitiveness in Xinjiang. In 2005-2014, the comprehensive talent competitiveness reaches its maximum value of 0.611 in 2014, and its minimum value of 0.3975 in 2005. There is an obvious difference between the maximum and the minimum values. The fluctuation is closed related to the economic development environment in 2009.

6. Conclusion

As the fundamental driver of innovation, talent is an importance driving force of economic development. This paper constructs the evaluation index system of talent attractiveness in Xinjiang, and uses the set pair analysis in data mining to evaluate and analyze the talent competitiveness of Xinjiang between 2005 and 2014. The findings are as follows: From 2005 to 2014, the comprehensive talent competitiveness in Xinjiang increases rapidly; however, the region still lags far behind than the developed areas in eastern China, leaving a big room for improvement of talent competitiveness in Xinjiang. Among the subsystems of talent competitiveness, economic development status, social life environment and education & science environment have increased steadily, while career development status goes in the opposite trend.

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Therefore, to further improve the talent attractiveness, Xinjiang should establish a flexible mechanism for the introduction of high-level scientific talents, establish a systematic training system of scientific innovation talents, and strive to build a high-level talent team suitable for Xinjiang's socioeconomic development. With these mechanisms in place, it is possible for the region to realize leapfrog economic and social development.

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A New Investment Strategy and Reinsurance Based on Computer Algorithm

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Abstract: With the rapid development of the insurance industry, the optimal investment and reinsurance strategy of insurance company have become a financial hot spot. This paper is aimed at seeking an optimal investment and reinsurance strategy that can maximize the expected utility of wealth. For approaching this issue, we set four prerequisites that firstly, the jump-spread risk process used to model the surplus and the scale reinsurance for compensation. Secondly, the insurance company can invest the surplus in the risk-free asset. Thirdly, the risky asset whose volatility is described by a CEV model, and the last one is we use HJB equation to solve this continuous control and dynamic programming problem. However, investment cost charges in the actual, especially when there is frequent trading, it can be a great deal. Based on it, we take the transaction cost into account when making risky investments. This paper is used as a complement of insurance investment field.

Keywords: computer algorithm, investment strategy, investment reinsurance

1. Introduction

With China's booming economy, all walks of life are faced with increasing competitive pressure, the insurance company is no exception. Intense competition has cut down the profit margins. So investment in surplus become a trend. Through proper surplus investment strategy, insurance company can improve their solvency. At the same time, to reduce the risk for investment and large claims, the company must take a certain reinsurance arrangements to enable the lowest ruin probability and own the biggest expected wealth utility. Therefore, how to arrange investment and proportional reinsurance have been a problem to each insurance company when participating in investment activities, and also a research hot spot of finance.

Related problems about the insurance company's surplus investment and reinsurance arrangements had been studied in a lot of literatures as following: Aimed at the optimal investment problem: Markowitz (1952) established portfolio risk model, and raised the capital asset pricing model (CAPM). It provided a feasible quantitative means for the trade-off between risk and return, significantly promoted the development of the portfolio theory.

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Another important model in financial and economic fields is the B-S model which were established by Black and Scholes (1973). It had become one of the most important options pricing models. However, the presumption and hypothesis of using B-S model divorced from reality. Blattberg and Gonedes (1974), Scott (1987) found that stock volatility wasn't a constant as assumed. In consequence, the CEV model which showing the volatility was changing with the time. It was proposed for derivative pricing by Cox and Ross.

Aimed at the study of insurance company, Browne (2000) firstly studied the insurance investment problem in the diffused preference market. Bai and Guo (2008) concluded the investment and reinsurance strategy achieving the biggest wealth utility specific to the diffused preference market model. Hipp and Plum (2000, 2003) studied the problem of the optimal investment of insurance funds. Lin and Qian (2008) supposed a circumstance that there was one risk-free asset and kinds of risky assets in the financial market, and they got the optimal investment strategy with the minimum ruin probability under the classical compound Poisson risk model. Lin and Yang (2010) who took the investment and reinsurance influence on barrier strategy into account and got optimal investment strategy making the maximum expect boundary dividend. In the process of research, these scholars established B-S model to represent the risk asset prices. However Qin (2007) compared the CEV model with the B-S model under an empirical analysis about option pricing, and found that the former can describe the stock pricing preferably. Although Gu (2010) studied the optimal reinsurance and investment problems under the CEV model, unfortunately he did not consider the transaction cost.

Actually, the investment is a transaction-costed process, especially when there is frequent trading, it costs a lot. So in the study of risk investment, we should consider the transaction cost. In line with the objective for combining the theory with reality, this paper learns various models, and strives to analogy the correlation coefficient of the actual market to make the model more closely to reality. We consider the CEV model with transaction costs, and combine both together when study the optimal investment and reinsurance in the insurance company (Fortes et al., 2016; Lino et al., 2016).

2. Models and hypothesis

2.1. Hypothesis

Security market is a market with weak form of efficiency, allowing cross trade of derivative securities. There is no risk-free arbitrage opportunities and risk-free interest rate r is constant, and only a risk-free asset (bonds) and a risky assets (stock) in financial market. In addition to the transaction costs, there is no friction in market; There are transaction costs but no dividends, and transaction cost is proportional to the value of stock. Namely, when the stock price is s, the transaction cost is $|K|S$, $K>0$ represents buying, and $K<0$ represents selling; Assuming that all the processes and the random variables are defined in complete probabilistic metric space (Ω,χ,P).

2.2. Model

Considering the jump diffusion risk model according to formula (1), and the surplus of insurance company is described as:

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$$R(t) = x + ct - \sum_{k=1}^{N(t)} Y_k + \beta W^{(0)}(t), t \geq 0 \tag{1}$$

Assuming that the proportional reinsurance level for insurance company at a point moment t is $1 - p(t)$. $p(t)$ is known as the risk exposure. At the same time, the insurance company will accordingly pay some premium to the reinsurance company. we denote it as $(1-p)c_1$. The c_1 is the premium income in every unit of time paid to the reinsurance company. Under the strategy of proportional reinsurance $p(t)$, the wealth of the insurance company process can be expressed as:

$$R(t,p) = x + [c - (1 - p(t))c_1] + \beta W^{(0)}(t) - p(t)\sum_{k=1}^{N(t)} Y_k, t \geq 0 \tag{2}$$

To meet the net-profit condition simultaneously:

$$c - (1-p)c_1 - p\lambda\psi > 0 \tag{3}$$

$B(t)$ is the risk-free asset price at a point moment t and meets the ODE (ordinary differential equation):

$$dB(t) = rB(t)dt \tag{4}$$

Peculiarly, $r > 0$ is the risk-free interest rate. Assuming that the price of risk asset is $S(t)$ .As previously stated, the volatility of risky asset is described by a CEV model.

So,

$$dS(t) = S(t)[\mu dt + \sigma S^{\omega}(t) dW^{(1)}(t)], S(t=0) = S_0 \tag{5}$$

$\pi(t)$ is the proportion to risky assets at a point moment , the rest is the proportion investment in the risk-free asset. Assigning $\alpha(t) = (p(t), \pi(t))$ to the investment and reinsurance strategy at a point moment t. At this moment, the wealth process $R(t, \alpha(t))$ of company, can be represented as:

$$dR(t,\pm) = \grave{A}(t)R(t,a)\, {dS(t)}/{S(t)} + [1 - \grave{A}(t)]R(t,\pm)\frac{dB(t)}{B(t)}\, {dB(t)}/{B(t)} + dR(t,p) \tag{6}$$

Then taking the transaction cost into account, and supposing ,

$$dR(t,\alpha) = [c - (1 - p(t))c_1 + r + (\mu - \mu k - r)\pi(t)R(t,\alpha)]dt + \beta dW^{(0)}(t)$$

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$$+\sigma(1-k)\pi(t)R(t,\alpha)S^{\omega}(t)dW^{(1)}(t)-p(t)d\sum_{k=1}^{N(t)}Y_k \tag{7}$$

$$R(0)=x\geq 0 \tag{8}$$

The moment generating function of claim size y is:

$$h(r)=E[e^{rY}]=\int_0^{\infty}e^{ry}dG(y) \tag{9}$$

Insurance companies want to maximize the final wealth of value. The utility function is supposed as $u(x)$. $V(t,x)$ is as the expected utility at a point moment t when surplus is x, strategy is α. So, the maximum utility achieved at time T is:

$$V_{\alpha}(T,x)=\underset{\alpha\in\Phi}{SUP}E[u(R(T,\alpha))\,|\,R(t,\alpha)=x] \tag{10}$$

For the $u(x)$ is a convex function, there is only one optimal investment and reinsurance strategy marked as $\alpha^{*}=(t^{*},\pi^{*})$ which achieving the maximum expected utility.

From the theory of Fleming and Soner (1993), the valuation function $V(t,x)$ satisfies the hamilton-jacobi-bellman equation.

So,

$$0=\sup_{\alpha\in\Phi}\{V'_t+[c-(1-p)c_1+r+(\mu-\mu k-r)\pi x]V'_x+\tfrac{1}{2}\beta^2V''_{xx}+\lambda\int_0^{\infty}[V(t,x-py)-V(t,x)]G(dy)\} \tag{11}$$

The edge condition is:

$$V(T,x)=u(x) \tag{12}$$

Adopting the standard method given by Fleming and Soner, the followings are obtained:

If $\alpha^{*}=(p^{*},\pi^{*})$ satisfies:

$$0=\sup\{V'_t+[c-(1-p^{*})c_1+r+(\mu-\mu k-r)\pi^{*}x]V'_x+\frac{1}{2}\beta^2V''_{xx}+\lambda\int_0^{\infty}[V(t,x-p^{*}y)-V(t,x)]G(dy)\} \tag{13}$$

Then $\alpha^{*}=(p^{*},\pi^{*})$ is the optimal strategy.

3. The Optimization and Improvement of the Algorithm

Setting the utility function :

$$u(x)=-\frac{1}{q}e^{-qx} \tag{14}$$

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By formula (11) we can directly figure out the optimal policy:

$$\pi^* = -\frac{\mu V'_x}{\sigma^2 V''_{xx}} \tag{15}$$

And an equation:

$$0 = \sup_{\alpha\in\Phi}\{V'_t + [c-(1-p)c_1 + r + (\mu-\mu k - r)(-\frac{\mu V'_x}{\sigma^2 V''_{xx}})x]V'_x + \frac{1}{2}\beta^2 V''_{xx} + \lambda\int_0^\infty [V(t,x-py) - V(t,x)]G(dy)\} \tag{16}$$

Assuming the value function possess as the following form:

$$V(t,x) = -\frac{1}{q}e^{-q[a(t)(x-b(t))]} \tag{17}$$

By the boundary conditions, $V(T,x) = u(x)$, we work out that

$$a(T) = 1, b(T) = 0 \tag{18}$$

Moreover :

$$V'_t = -q[a'(t)(x-b(t)) - a(t)b'(t)]V \tag{19}$$

$$V'_x = -qa(t)V \tag{20}$$

$$V''_{xx} = q^2 a^2(t)V \tag{21}$$

$$V(t,x-py) - V(t,x) = [e^{pqa(t)y} - 1]V \tag{22}$$

Substitute these into formula (16) and after organization:

$$\sup_{\alpha\in\Phi}\{\phi(p)\} = \sup_{\alpha\in\Phi}\{a(t)b'(t) - a'(t)(x-b(t)) + [c-(1-p)c_1 + r + (\mu-\mu k - r)\frac{\mu}{\sigma^2 qa(t)}x]a(t)\}$$

$$+\frac{q}{2}\beta^2 a^2(t) + \frac{\lambda}{q}\int_0^\infty [e^{pqa(t)y} - 1]G(dy)\} = 0 \tag{23}$$

Make the derived function $\phi(p)$ equal to zero,

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Then:

$$c_1 - \lambda \int_0^{\infty} y e^{pqa(t)y} G(dy) = 0 \tag{24}$$

On account of the reinsurance scale p ($0 \le p \le 1$), we should also find out the existential condition of the optimal reinsurance strategy p^*. Substitute p^* into formula (23),

$$0 = [\frac{\mu(\mu - \mu k - r)}{\sigma^2 q} - a'(t)]x + [b'(t) + \frac{a'(t)b(t)}{a(t)} + c - (1-p)c_1 + r + \frac{q}{2}\beta^2 a(t) + \frac{\lambda}{qa(t)}\int_0^{\infty}(e^{pqa(t)y} - 1)G(dy)]a(t) \tag{25}$$

Substitute $a(t)$ into formula (23), then,

$$c_1 - \lambda \int_0^{\infty} y e^{pqy[\frac{\mu(\mu k + r - \mu)}{\sigma^2 q}(T-t)+1]} G(dy) = 0 \tag{26}$$

4. Experiment results and analysis

4.1. Experiment Results

According to Li and Lin (2006),

When $c_1 \ge \lambda \int_0^{\infty} y e^{pqy[\frac{\mu(\mu k + r - \mu)}{\sigma^2 q}(T-t)+1]} G(dy)$, $p^* = 1$. Namely, the insurance company do not undertake reinsurance strategy.

The optimal reinsurance strategy:

$$\pi^* = \frac{\mu}{\mu(\mu k + r - \mu)(T-t) + q} \tag{27}$$

The value function:

$$V(t,x) = -\frac{1}{q} e^{-q[\frac{\mu(\mu k + r - \mu)}{\sigma^2 q}(T-t)+1](x - b(t))} \tag{28}$$

4.2. Data Analysis

This part calculates numerical results to illustrate influence on the optimal investment and reinsurance strategy by transaction cost, and other important parameters. More specifically, we assign other variables by control variable method, and use the MATLAB to calculate the following results:

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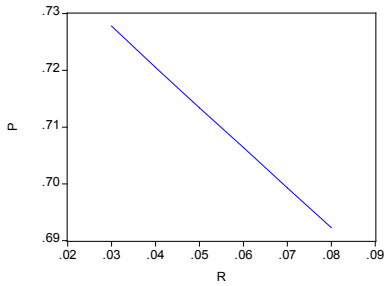

Figure 1 – The relationship between P^* and risk-free interest rate

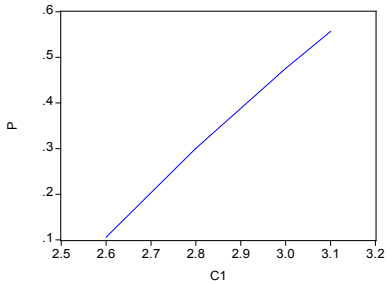

Figure 2 – The relationship between P^* and Premium rate

From the Figure 1, we can see the optimal reinsurance strategy P^* is the decreasing function of risk-free interest rate. Because the bigger risk-free return, the greater spending on reinsurance for a company which will lead to a smaller P^*.

From the Figure 2, we can see P^* is the increasing function of premium rate. The increase of premium rate implies the increased cost of reinsurance. Facing with the increased reinsurance rate, an insurance company tends to take on much hazard, then the risk exposure added.

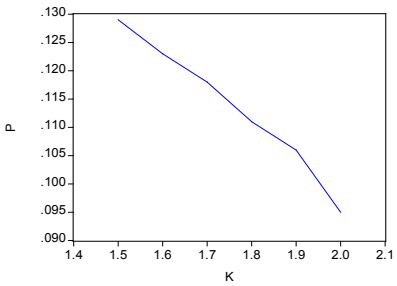

Figure 3 – The relationship between π^* and transaction cost

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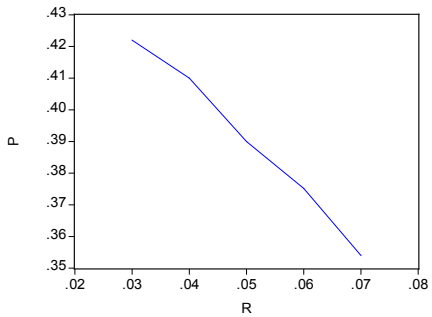

Figure 4 – The relationship between π^* and risk-free rate

From the Figure 3, we can see the optimal investment strategy (π^*) is the decreasing function of transaction cost. Because of the rising transaction costs of risk assets, an insurance company is more willing to invest on risk-free asset.

From the Figure 4, we can see π^* is the decreasing function of risk-free rate. Because the increased expectation of future earnings under free-risk make an insurance company adds spending on risk-free asset.

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Research on Price Adjustment in Engineering Settlement under Quantity Bill Valuation Based on Building Information Modeling Technology

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Pages: 172–183

Abstract: China is to further enhance the level of construction industry information, and use Building Information Modeling(hereafter BIM) technology in engineering management. In this background, the calculation formula for prince adjustment in engineering settlement under the quantity bill valuation is proposed. The influence factors of price adjustment are discussed based on engineering practice. The risk clauses should be agreed upon based on the principle of risk sharing. Besides, the two parties must reach a consensus concerning the influence factors of price adjustment by sticking to the principles of comprehensiveness and concreteness. During the contract fulfillment stage, matters such as engineering change, price fluctuations, project site visa, valuation and payment must be properly handled in strict accordance with the contract. The importance of project site visa is highlighted as a timely record of all changes made. The purpose is to achieve the fine management of the project price adjustment in BIM.

Keywords: Building Information Modeling, price adjustment, contract.

1. Introduction

BIM is widely used in project management, but engineering project construction is affected by numerous factors, and the final settlement price is generally different from the price agreed upon in the initial contract. That is why price adjustment is inevitable in engineering settlement. Because the contract price adjustment is influenced by human factors, BIM cannot achieve the fine management of the price adjustment. Construction Contract for Construction Project (Model Form) (GF-2013-0201) (hereafter referred to as the Construction Contract) and 2013 Construction Engineering Quantity List Valuation Standard (GB50500-2013) (hereafter referred to as the 2013 version of Valuation Standard) provide a more detailed specification on price adjustment in engineering settlement, for both the developer and the contractor. It is clearly stipulated that the quantity bill valuation must be adopted for construction project funded by state-owned capital, while quantity bill valuation is recommended for those funded by non-state-owned capital. Quantity bill valuation has already become the mainstream mode

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of valuation, and we will discuss the topic of price adjustment in engineering settlement under quantity bill valuation (Lino et al., 2016).

Under this valuation mode, a variety of factors causing the changes of contract price should be considered. The overall calculation formula used for the settlement price is: settlement price=contract price+price adjustment related to imperfection of the quantity bill+price adjustment related to price changes+price adjustment related to engineering change+price adjustment related to project site visa+price adjustment related to claim for compensation+price adjustment caused by other factors.

Whether it is reasonable to adjust the price and how to adjust the price are usually the major causes of disputes for the developer and contractor. Price adjustment is closely related to the form of contract and the clauses of the contract, and any adjustment to be made should be based on the contract agreement between the two parties.

Below is a discussion on the influence factors of price adjustment according to the overall calculation formula used for settlement price. To avoid the disputes upon engineering settlement, both parties must be scrupulous with contract signing and implementation (Miramontes et al., 2016).

2. Risk Clauses Agreed upon Based on the Principle of Risk Sharing

Under the quantity bill valuation mode, quantity-related risk is undertaken by the developer, while the price-related risk is undertaken by the contractor within a reasonable range. But beyond this range, the risk will be transferred to the developer; however, the risks associated with construction techniques and management are borne by the contractor. These are the basic principles of risk sharing that should be respected when signing the contract.

2.1. Price Adjustment Related to Imperfection of Quantity Bill

2.1.1. Inconsistency of Characteristics of the Construction Project and Missing Items in the Quantity Bill

According to the Valuation Standard in 2013, quantity bill must be presented as part of the bidding documents. Its accuracy (of quantity) and integrity (no missing items) are within the scope of bidder' s responsibility. Some contracts say that "any missing items in the quantity bill, if not recognized by the developer, are deemed included in the unit price of other items or in the addup. This does not conform to the requirement in the Valuation Standard in 2013.

If the characteristics of the projects in the drawing and those in the quantity bill are inconsistent when the project is under construction, which leads to changes in the engineering cost, the new integrated unit price must be determined. The method for this step is specified in Section 3.1 Engineering Change.

If there are missing terms in the quantity bill, the method for determining the integrated unit price for the newly added items in described in Section 3.1.

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2.1.2. Deviation of the Quantity Described in the Quantity Bill from the Actual Quantity

1. Quantity

Under the unit price contract, the actual quantity should be determined upon settlement and the final price is calculated on this basis, and some contracts do include this specification. But whether this specification is included or not, settlement based on the actual quantity is the compulsory clause in the Valuation Standard in 2013. It is improper that "adjustment is only made to the amount of quantity beyond ±3% of the predetermined quantity", as in some contracts.

Under the lump sum contract charged by the quantity bill as specified in clause 8.3.1 in Valuation Standard in 2013, settlement must be based on actual quantity. But in accordance with the clause 8.3.2, under the lump sum contract with quota pricing, settlement must be based on the quantity in the contract excluding the amount of quantity allowed to be adjusted.

2. Integrated unit price

Within a certain range of quantity deviation, no adjustment is allowed for the integrated unit price. Beyond this range, the integrated unit price of the exceeding quantity can be adjusted. The specific range is agreed upon in the contract. Table 1 shows an example of price adjustment by presupposing that the range allowed to be adjusted is ±15%.

Actual quantity Q_1	**Quantity after adjustment: based on the actual quantity**	**Integrated unit price P_1 after adjustment**	**Final settlement price after adjustment**	**Explanations on the adjusted price**
$Q_1 << 0.85Q_0$	Q_1	Increase as agreed upon by the two parties through negotiation	Q_1P_1	Adjustment of integrated unit price for the quantity below $0.85Q_0$
$0.85Q_0 \le Q_1 \le 1.15 Q_0$	Q_1	P_0 (no adjustment)	Q_1P_0	
$Q_1 >> 1.15Q_0$	Q_1	Decrease as agreed upon by the two parties through negotiation	$1.15Q_0P_0 + (Q_1 - 1.15Q_0) P_1$	Adjustment of integrated unit price for the quantity above $1.15Q_0$

Note: The quantity provided in the quantity bill used for bidding is Q_0, the integrated unit price in the quantity bill is P_0.

Table 1 – Price adjustment for the quantity beyond the specified range

2.2. Price Adjustment Related to Price Changes

2.2.1. Changes of Laws, Regulations and Policies

Changes of engineering costs caused by transitions of laws, regulations and policies should be accommodated by changing the settlement prices, such as electricity, water

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and fuels, whose prices are limited by the government. Any price changes related to these respects must be borne by the developer, according to the clause 9.2.1 in Valuation Standard in 2013.

2.2.2. Changes of the Market Price

In case of changes in the market prices of manpower, construction materials, engineering facilities and machine shift, the contract should stipulate the risk spectrum and the price range beyond which adjustment is to be made. Here risk spectrum consists of the materials, manpower and machineries with considerable fluctuations of market prices, including steel, concrete, timber, cement, doors and windows, and cables. The risk range is generally from ±3% to ±6%.

Example 1: Under one contract, the risk spectrum for the integrated unit price is as follows: the contractor should completely undertake the technological and managerial risks, as well as the risks of material price fluctuation with ±5%, the risks of machinery use within ±10%, and all risks associated with overhead and profits. The developer should be informed of the price changes within this risk spectrum by the contractor within 7 days, and the new prices are set with the developer's approval.

The contracts must not use the terms "all risks" and "infinite risks" to refer to the potential risks. Some bidding documents say that "unless the proprietor makes the request of modifying the design and changing the construction materials, all budget prices, once submitted and approved, must not be adjusted for fluctuations of policies and market factors". However, this clause is not based on the principle of risk sharing.

To adjust the prices in response to fluctuations in market prices, price index method and cost information method are commonly used, especially the former. Below is an application of the cost information method within the ±5% risk range.

1. Fluctuations in material prices

The baseline unit price of the reinforcing bars is 4000 yuan. Table 2 presents other information.

2. Fluctuations in machinery prices: The adjustment method is the same as with adjustment for fluctuations in material prices.

3. Fluctuations in manpower prices.

The adjustment method for fluctuations in manpower prices is similar to that for the fluctuations in material prices, except for different amplitude of adjustment. The baseline unit manpower price is 80, and Table 3 presents other information.

Example 2: It is stipulated in the contract that ① no adjustment for fluctuations in market prices of any materials except the cables is allowed. Setting the adjustment threshold to above or equal to ±5% for the cables, the amplitude of adjustment for the price difference beyond this threshold is determined using the following formula: the amplitude of adjustment=monthly information price in actual purchase during the construction period-monthly information price in the tender list ×(1±5%); ②Setting the adjustment threshold to above or equal to ±5% for the manpower, the amplitude

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Unit price in the bidding document (yuan)	Adjustment principle	Risk range (yuan)	Range of unit price now allowed for adjustment (yuan)	Unit price during the construction period (yuan)	Adjustment to be made or not (yuan)	Amplitude of adjustment: price difference for the exceeding amount (yuan)	Unit price after adjustment (yuan)
3500 (below the baseline unit price)	Determine the increase based on the baseline unit price	4000×5% = 200	No adjustment allowed in the range of 4000 to 4200	4300	4300-4000=300 > 200 Adjustment needed and increase determined	300-200 = 100	3500+100 = 3600
				4100	No adjustment made	0	3500
	Determine the decrease based on the baseline unit price	3500× (-5%) = -175	No adjustment allowed in the range of 3825 to 4000	3900	No adjustment made	0	3500
				3800	3800 - 4000 = -200 < -175 Adjustment needed and decrease determined	-200 + 175 = -25	3500-25=3475
				3000	3000-4000 = -1000 < -175 Adjustment needed and decrease determined	-1000 +175= -825	3500-825=2675
4500 (above the baseline unit price)	Determine the increase based on the tender price	4500×5% =225	No adjustment allowed in the range of 4000 to 4225	5000	5000-4000 =1000 > 225 Adjustment needed and increase determined	1000-225 =775	4500+775 = 5275
				4300	4300-4000 =300 > 225 Adjustment needed and increase determined	300-225=75	4500+75 = 4575
				4100	No adjustment made	0	4500
	Determine the decrease based on the baseline unit price	4000×(-5%)=-200	No adjustment allowed in the range of 3800 to 4000	3900	No adjustment made	0	4500
				3500	3500-4000 = -500 < -200 Adjustment needed and decrease determined	-500+200 = -300	4500-300=4200

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Unit price in the bidding document (yuan)	Adjustment principle	Risk range (yuan)	Range of unit price now allowed for adjustment (yuan)	Unit price during the construction period (yuan)	Adjustment to be made or not (yuan)	Amplitude of adjustment: price difference for the exceeding amount (yuan)	Unit price after adjustment (yuan)
4000 (equal to the baseline unit price)	4000 (equal to the baseline unit price)	Determine the increase based on the baseline unit price	4000×(±5%) =±200	No adjustment allowed in the range of 3800 to 4200	4300	4300-4000=300 > > 200 Adjustment needed and increase determined	300-200=100
					4100	No adjustment made	0
					3900	No adjustment made	0
					3600	3600-4000 = -400 < < -200 Adjustment needed and decrease determined	-400 + 200 = -200

Note: The above adjustments are based on the local information prices. The monthly information prices determined based on the tender list are the baseline unit prices, and the monthly information prices in actual purchase are the market unit prices during the construction period.

Table 2 – Price adjustment for fluctuations of the materials' market prices

of adjustment for price difference beyond this threshold is determined using the following formula: amplitude of adjustment=information price of manpower during the construction period (for structuring, decoration and installing separately)-monthly information price in the tender list. The information price in the construction period is the arithmetic average of the information price released by the local engineering cost supervision authorities. If the upper and lower limits of the information price are given, the median value is taken; otherwise, the market price certified by the developer is used.

The difference between the stipulation in the above example and the calculation in Table 2 is no matter which is higher, tender price or baseline unit price, the increase and decrease are both based on the baseline unit price (i.e., monthly information price in the bidder list).

4. Provisional estimate

Once the provisional estimates of the unit prices of materials and engineering facilities contained in the tender quantity bill are certified, the integrated unit price can only replace the provisional estimates; no adjustments shall be made to the integrated unit price for the overhead or profits.

Example 3: It is stipulated in a tender document that all provisional estimates of the material prices are budget prices and the provisional estimates of the materials

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Tenderunit price (yuan)	Adjustment principle	Risk range (yuan)	Range of unit price now allowed for adjustment (yuan)	Unit price during the construction period (yuan)	Adjustment to be made or not (yuan)	Amplitude of adjustment: price difference for the exceeding amount (yuan)	Unit price after adjustment (yuan)
90 (above the baseline)	Determine the increase based on the tender price	90×5%=4.5	No adjustment allowed in the range of 80-84.5	100	100-80 =20 > > 4.5 Adjustment needed and increase determined	20	90+20 =110
				88	88-80 =8 > > 4 Adjustment needed and increase determined	8	90+8=98
				82	No adjustment made	0	90
	Determine the decrease based on the tender price	8×(-5%) =-4	No adjustment allowed in the range of 76-80	78	No adjustment made	0	90
				72	72 - 80 = -8 < < -4 Adjustment needed and decrease determined	-8	90-8=82

Note: Only the situation where the unit manpower price is above the baseline unit price is discussed here. For other situations (below or equal to the baseline unit price), refer to the table of Price adjustment in response to fluctuations of the materials'market prices, with the "Amplitude of adjustment" replaced by "the whole price difference".

Table 3 – Price adjustment for fluctuations in manpower price

and machinery are counted as the integrated unit price for each bidder in the tender stage. The provisional estimates of the materials must be certified by the contractor. Final settlement should be based on the certified purchase prices with price difference considered; however, only the amount corresponding to the price difference is taxed, excluding the overhead or profits.

3. Identify the Influence Factors of Price Adjustment Based on the Principle of Comprehensiveness and Concreteness

As analyzed above, any potential factors that may influence the settlement price must be included in the contract: advance payment, time of payment and method of deductions; quantity measurement, and method, amount and time of progress payment; influence factors and method of adjustment of project cost, as well as the procedures and time of

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payment; claim for compensation and procedures, amount conformation and time of payment; content and scope of pricing risks borne and method of adjustment for the risk beyond this range; completion settlement system, validation, payment and time.

To avoid any disputes upon settlement, any potential factors that may influence the settlement price must be considered before signing the contract, with a specification on the adjustment procedures and amounts. Apart from the price adjustment related to imperfection of the quantity bill and price changes, price adjustment may be also needed due to the following reasons.

3.1. Price Adjustment Related to Engineering Change

In case of any changes in the priced items or its quantity due to engineering change, adjustments should be made based on the following principles: If the items in the quantity bill are related to the purpose of engineering change, the integrated unit price of this item is used; if the quantity of this item in the original quantity bill deviates from the new quantity by over 15% because of engineering change, adjustment of the unit price of the item shall be done according to Table 1. If the item related to engineering change is not included in the original quantity bill, the unit price of this item shall be determined reasonably. If the item is included in the original quantity bill and neither are there similar items priced in the quantity bill, the integrated unit price of the item shall be proposed by the contractor and submitted for approval by the developer.

If similar items cannot be found in the original quantity bill, they can be looked up in the local quotas, such as the price of manpower, materials and machinery.

The integrated unit price of the item is calculated as follows: local quota for manpower cost+unit price of materials+quotas for other materials (excluding the material concerned) + local quotas for machinery related to this item + overhead + profit × (1-floating rate of the quoted price) where floating rate of the quoted price = (1-bid price/ tender control price) × 100%.

Unit price of the materials is the price released by the local engineering cost supervision authorities (if not available, the price is acquired by market survey).

If the construction plan has been altered and the step item costs have changed, the contractor shall submit the revision of the construction plan for the approval by the developer. The step item costs shall be adjusted as follows: the same adjustment method for step item costs calculated by unit price as above; or by multiplying the actual amount of adjustment by the floating rate of quoted price for step item costs calculated by gross price (or coefficient).

3.2. Price Adjustment Related to Project Site Visa

Some matters inconsistent with the engineering contract or not having been agreed upon in the contract may appear in the construction stage. The two parties shall record the matters to prepare the project site visa, as defined in Valuation Standard in 2013. Other designations are given from one region to another, including project visa, project negotiation and technical authorization sheet.

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Developer can make orders on the odd items beyond the scope of contract and other works outside the scope of the contractor's responsibilities. The contractor shall submit the project site visa concerning these matters within 7 days. The contractor shall not begin to work unless the submitted project site visa is approved by the developer.

3.3. Price Adjustment Related to Claim for Compensation

Price adjustment related to claim for compensation depends on the condition and procedures of the claim for compensation.

4. Execute the Contract Process Following the Stipulated Conventions

Table 4 shows the stipulated conventions for handling different matters in the contract implementation stage. Stipulated conventions should be fully respected by both parties to avoid disputes.

Stipulated conventions	Engineering change, price fluctuation	Project site visa	Claim for compensation	Quantity measurement and payment	Completion settlement
Proposition	Beneficiary submits the contract price adjustment report to another party within 14 days after price adjustment	Contractor submits the project site visa to the developer within 7 days after receiving the developer's orders	Claimant submits the notice of claim to another within 28 days after the occurrence of the claimed accidents	Contractor submits the report on the quantity already finished in the current stage to the developer in pursuance to the contract	Contractor submits the completion settlement document while submitting the application for acceptance
Check	The other party checks the report and make opinions within 14 days after reception	Developer checks the project site visa within 48 hours after reception	The party receiving the notice shall make reply within 28 days	The developer checks the report within 7 days	Developer checks the document within 28 days
Re-check	The beneficiary re-check the opinions made by the another party within 14 days			Contractor submits the written opinions to the developer within 7 days after receiving the quantity measurement notice, and the developer re-checks it within 7 days	Contractor makes revision and submits the document within 28 days after receiving the opinions from the developer; developer rechecks it within 28 days; if there is no conflicting opinions, the two parties shall sign within 7 days

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Stipulated conventions	Engineering change, price fluctuation	Project site visa	Claim for compensation	Quantity measurement and payment	Completion settlement
Submitting the payment application		Contractor commences the task after the developer has confirmed; the price list related to the additional task shall be submitted to the developer within 7 days after completing the new tasks		Contractor submits the application for payment on the quantity already finished within 7 days after checking of the quantity	Contractor submits the settlement payment application to the developer
Check		The developer checks the price list within 2 days		Developer checks the application and presents the certificate for progress payment	Developer checks the application within 7 days and presents the certificate for settlement payment
Payment	Increase (decrease) the contract prices on the basis of the progress payment	Pay the additional sum along with the progress payment	The claim amount shall be paid as the additional contract price along with the progress payment	Developer makes the progress payment within 14 days	Develop makes the settlement payment within 14 days

Table 4 – Stipulated conventions for handling different matters

Below is an illustration of how the stipulated conventions work in the stage of quantity measurement and payment.

Example 4: It is stipulated in a contract that the contractor submits the report on the quantity already finished in the current month on the 25th of every month. The developer checks the report (quantity measurement) within 7 days. The contractor shall submit the application for progress payment to the developer within 7 days after the checking of the quantity, which specifies the amount entitled to the contractor in the current month: ① costs related to engineering change and project site visa are excluded, until the approval of the engineering change amount; therefore this additional amount shall be paid in the following month along with the progress payment; ② Price adjustments for the materials and machinery submitted by the contractor are not covered in the interim payment, but are settled in the final settlement.

The developer checks the payment application submitted by the contractor and presents the payment certificate within 7 days after reception. Then the developer makes the progress payment which is 70% of the settlement amount of the previous month within 7 days after presenting the payment certificate.

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Progress payment can be made either on a monthly basis or phase by phase. Payment on a monthly basis in coincidence with the cycle of quantity measurement is described in example 6, and phased payment is described in example 7.

Example 5: Phased payment is agreed upon under a contract: 40% of the contract price (excluding the tentative amount) shall be paid when 50% of the quantity is already finished within 28 days after presenting the certificate for progress payment; a total of 72% of the contract price (excluding the tentative amount) shall be paid when 90% of the quantity is already finished; a total of 80% of the contract price (excluding the tentative amount) shall be paid after the project is considered quality upon final acceptance; a total of 95% of the contract price shall be paid after final acceptance. The remaining amount shall be paid after the expiration of the warranty period.

5. Prepare Project Site Visa Based on Project Progress

In case of any of the matters below, the contractor shall issue the project site visa for the developer's approval, as the proofs for potential price adjustment regarding the matters:

1. Oral orders made by the developer: Contractor shall present the written form of the orders.
2. Written notice issued by the developer: Contractor shall prepare a report on the manpower, materials and machinery required to finish the new task and submit the report to the developer.
3. The actual construction process is different from the description in the contract.
4. The developer does not provide the site, materials or machinery needed for the construction, or cuts off the water and electricity, leading to suspension of the construction.
5. Due to fluctuations in the market price of the construction materials, the contractor proposes the new purchase quantity and unit price.

Matters dealt in the project site visa are usually closely related to price adjustment. To avoid the disputes, post hoc visa and centralization preparation of site visa before acceptance must be avoided.

6. Conclusions

Project construction is influenced by numerous factors, leading to different settlement price as is estimated in the contract. BIM cannot achieve the fine management of the price adjustment To avoid disputes, the developer and contractor should be fully scrupulous in the contract signing and fulfillment stage. In anticipation of potential price adjustment, the risk clauses shall be formulated based on the principle of risk sharing along with a detailed specification of risk spectrum and amplitude of adjustment. Besides, the influence factors of price adjustment shall be specified as comprehensive and concrete as possible. Based on the calculation formula for settlement price, any potential influence factors of settlement price shall be considered and the adjustment method and amplitude shall be specified in the contract. Price adjustment related to engineering change, price fluctuation and project site visa, as well as quantity measurement and payment must be implemented in strict accordance with the stipulated conventions in the contract.

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The importance of project site visa as a recording of construction dynamics should be highlighted. All these measures are very important to avoid disputes. The purpose is to achieve the fine management of the project price adjustment in BIM.

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Research on Effectiveness of Mobile English Teaching Software to Listening Learning of College Students

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Abstract: In this paper, the present situation of current college English listening course and the existing problems are analyzed, and the feasibility of using mobile technology to support the English listening course is obtained through questionnaire survey. Based on the actual situation of English listening teaching, the overall design, database design, interface design and detailed design of Android platform-based software are provided, and the realizing method and effectiveness of the main functional modules are also offered.

Keywords: mobile English teaching, software development, listening learning, college students study, effective study method.

1. Introduction

Listening is the premise and key of language learning. Without the listening ability, the communication will not happen. Listening practice is helpful for fostering the English communicative competence of students. With the mature of mobile computing technology, the mobile learning has become an important learning way. Mobile smart phones can break the time and space limit, creating a free environment for learners with regard to listening and reading learning (Chang, 2011). Mobile learning can help college students to have additional practice time, playing an important role for improve the comprehensive ability of college students in English listening. Therefore, this research is important both theoretically and practically.

The present situation of current college English listening course and the existing problems are analyzed, and the feasibility of using mobile technology to support the English listening course is obtained through questionnaire survey (Gilakjani and Ahmadi, 2011; Maritza et al., 2016). Based on the actual situation of English listening teaching, the overall design, database design, interface design and detailed design of Android platform-based software are provided, and the realizing method and effectiveness of the main functional modules are also offered.

The R&D of mobile English learning software with carrier of smart phones cannot only facilitate the mobile learning theory, but also help to cultivate the self-study ability and

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individualized learning habit, moreover, it enables the students having more interest in English study, and as a result their English listening ability will be improved greatly.

2. Analysis on Influencing Factors of Listening Ability of College Students

2.1. Pronunciation

Pronunciation is more than the basis for improving English listening, but it plays the primary role during listening comprehension process. This is because that our brain first receives the pronunciation information (Mai, 2001; Vázquez et al., 2016). This kind of information, regardless of its types such as words, phrases, or sentences, is composed of phonemes, syllables and other relevant grammatical knowledge. Students need to understand the information before making right judgment. However, some students are poor in understanding the basic pronunciation knowledge, lacking in knowledge of unstressed syllable, stress syllable and plosive of some words and phrases, therefore, they cannot do well in listening comprehension (Hsu et al., 2014).

2.2. Vocabulary

It is a misunderstanding in the long listening training history that the listening volume is in proportional to the listening comprehension ability, which causes that the listening frequency are emphasized excessively during listening practice. This method can improve the listening level through changing the mechanical memory into permanent memory in human brain (Hsu et al., 2013). However, it is proved that the listening ability is a part of comprehensive ability of a person in English, and the listening capacity cannot be separated from vocabulary, which is also the rule of language study. A complete essay is constituted by paragraphs which are composed of sentences which are formed by words (Hwang et al., 2014).

2.3. Grammar

Grammar seems somewhat boring during English study, however, it helps the learner to analyze the key points and understand the general idea. The skillful use of grammar knowledge becomes the core for improving listening capacity. Providing when then sentence is longer and more complex, it is more difficult for understanding (Zhang, 2012). Students can fully understand the simple sentence through vocabulary accumulation, however, it is nearly impossible to overcome the listening difficulties of complex sentence like object clause and attributive clause based on the grammar knowledge.

2.4. Reading

People accumulate knowledge mainly through reading as it is not only a learning means but also a quality of excellent language learner. People can improve the reading comprehension ability only by obtaining enough language knowledge (Yamada et al., 2011). The increase of listening comprehension relies on a large amount of knowledge because that listening focuses on testing the semantic understanding of the learner. The right thinking judgment is based on knowledge accumulation and thinking flexibility.

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It is important to accumulate mass knowledge for improving listening comprehension, therefore, students need to read more and carry out regular listening skills during listening training.

2.5. Skills

Except for knowledge accumulation, the listening training also relies on the listening skills. The optimal listening effectiveness can be gained through the certain listening method. Vandergrift has put forward three listening strategies based on the research of O'Malley and Chamot. First is the metacognitive strategy, which refers to the learning activities planned by the learner, including planning activities and monitoring activities. Second is the cognitive strategy, and it is the process consisting of absorbing materials, processing, and handling information(Bidabadi and Yamat, 2012). Third is the affective strategy, including the emotional regulation and control of learners. Therefore, only through timely solution of problems existing in listening process and correction of process fault can reach the ideal listening effectiveness.

3. Analysis on Customer Demand

3.1. Research results

After making survey to the students on the most difficult part in English learning process, we get the following data: 26% students choose listening as the most difficult while 16% choose reading, 45% choose translation, and 13% choose writing as shown in Figure 1. The data shows that listening is secondary difficult among all problems, proving that some problems exist in teaching and learning of English listening. According to the questionnaire survey, almost all students think listening is "important" or "very important", and nearly no student thinks listening is "unimportant", which means that all students understand the importance of listening during English learning.

Among the college students who accept the survey, they have much different opinions on the satisfactory degree of their listening ability, in which 10% students are very satisfied, 29% are satisfied, 45% or near a half of them thick just so-so, and 16% are not satisfied as

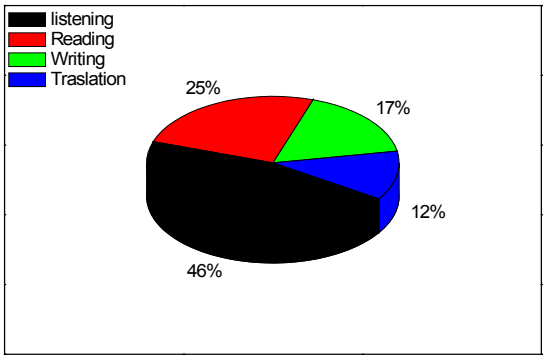

Figure 1 – Survey for college students' English learning difficulties

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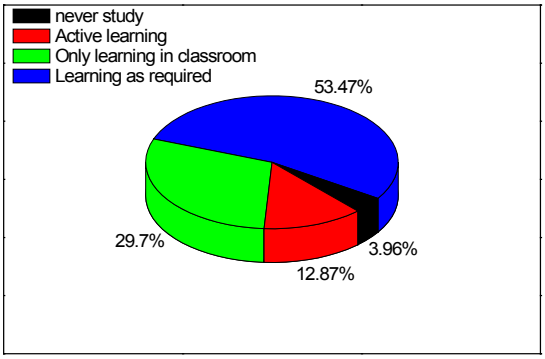

Figure 2 – College students' English listening study state statistical investigations

shown in Figure 2. According to the survey result, most of students are not satisfactory on their listening abilities. Many students use MP3, MP4 or Internet during listening learning after classes. The data in recent years indicates that the mobile phone has played a more and more important role during English listening study, having become the development tendency in the future. Students tend to read more, do more exercises, or making more dialogue practices in order to improve English listening ability.

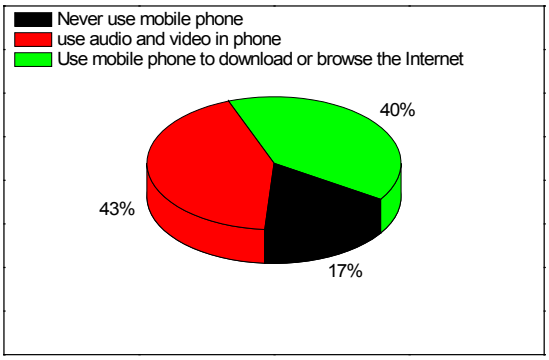

Figure 3 – College students' learning English listening to use mobile phones

We made a survey on use condition of mobile English learning software of college students, founding that 19% have never used this learning means, 39% have used videos and radios in mobile phone to learn English, and 42% have learned English through using the loaded or native English learning software in mobile phone or viewing the Internet information as shown in Figure 3 (Chen, 2011). It is indicated that although the learning function of mobile phone is under successive promotion process, this way has been spread widely among students relying on its portability, fashion and timely information updating, playing an important role in English listening learning.

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3.2. Analysis of systematic functions

In this essay, the software R&D is carried out based on the English learning abilities of learners. The author has drawn the general outline of the system based on the questionnaire survey combined with the English listening teaching rules. Firstly, the software should adapt to environmental changes and also should be practical, with the main goal to promote effective listening learning.

For those reasons, the software is designed, with technical and theoretical conditions comprehensively considered in combination with the guidance theory of college English listening teaching and listening learning strategies, to design and arrange learning contents, motivate learner's self-learning interest in all directions from several parts - looking up words, word learning, word dictation and listening tests and improve mobile listening learning quality(Lei, 2012). With existing experience for reference, the software is correctly positioned and the main functions are as follows:

1. Personalized learning

The software is mainly to build an independent learning space, which can satisfy learners' item selection, learning steps, self-examination and self-discipline.

2. Local learning and online learning

The called local learning mainly refers to that learners learn through books and the called online learning mainly refers to that learners use online resources to enrich their knowledge and improve their own quality(Kim, 2003).

3. Ability testing

Considering that learners should know their actual conditions to improve their learning abilities, the system provides a test section for learners to know and develop themselves.

4. Design of Android Platform-based College English Learning Software

4.1. Basic structure of Android software

Android, with Java as the development language and with an open authorization mode, is also in the same starting line with software development, so it is favored by most developers. Android has four levels of system architecture, from the higher to the lower respectively Application, Application Framework, Libraries, RunTime and Linux Kernel, as shown in Figure 4.

At the time of developing Android applications, we can use iS and Java general libraries provided by Android Framework. The paper mainly introduces key problems of developing applications based on Android platform.

1. Android interface building

①Activity (Android.app.Activity) should inherit the Activity class and implement the methods of Activity when achieving its own activity in applications. Set the layout file in the activity with the method of setContentView ().

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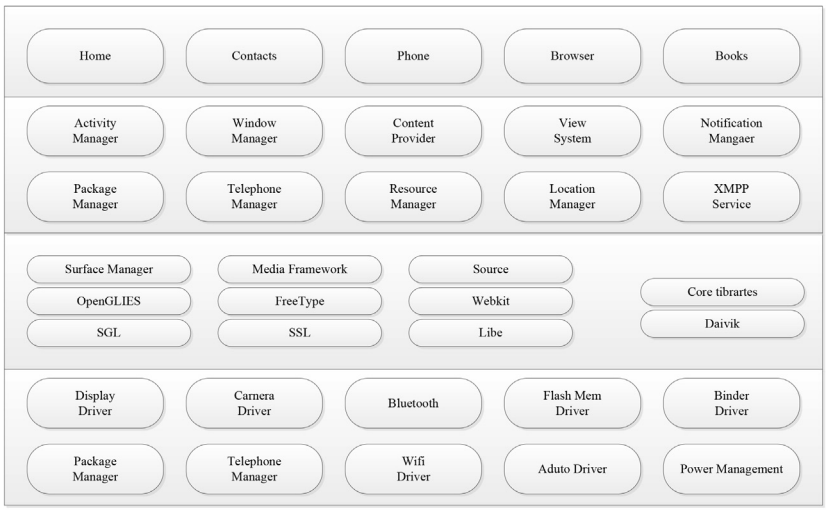

Figure 4 – Android platform framework

②View (Android.view.View) used in programs inherits View class generally in layout files and program applications are transferred through Id values.

See Figure 5 for Android screen and its content program structure.

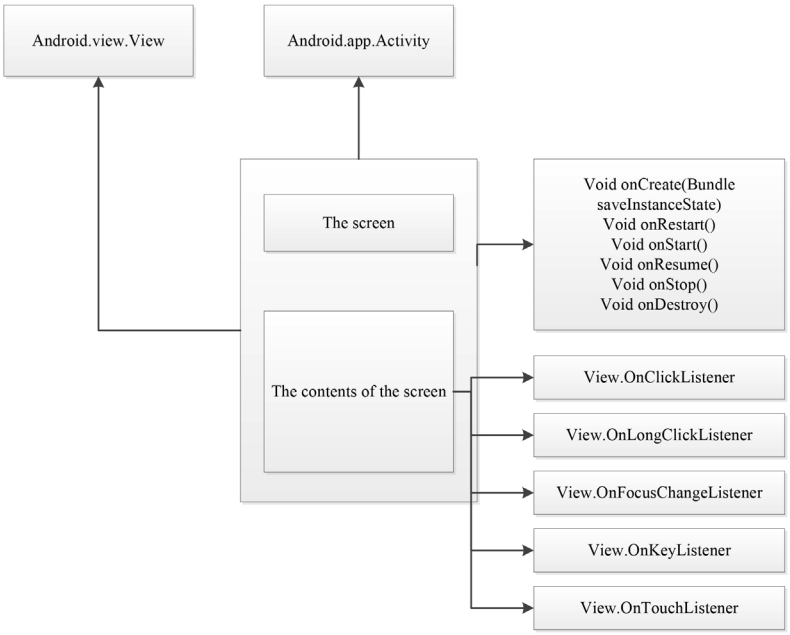

Figure 5 – The Android screen and its content in the program structure

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2. Resource acquisition and utilization

Resources refer to files without codes and the program references the resources through the codes. On the Android platform, file resources in different formats such as XML, JPEG and PNG can be used. These resources can give the corresponding analysis and can be compiled as binary files at the time of program run. This method has an advantage that these resources can be loaded quickly. During program development, developers can use resources classes to achieve access to the resources; for example, examples of resource classes can be obtained with the method of context. getResourees().

During project development, we can store resources to be used in the res directory and the resources will be compiled by Android with apt and a wrapper class R will be created. When we need to use relevant resources in the program, we can introduce R class and obtain ID of the corresponding resource for resource application(Lee and Yorick, 2011).

4.2.System design objectives

The overall objective of the Android platform-based college English learning software system is to provide convenience for college students to use their own flextime to learn English through the Android platform-based college English learning software.

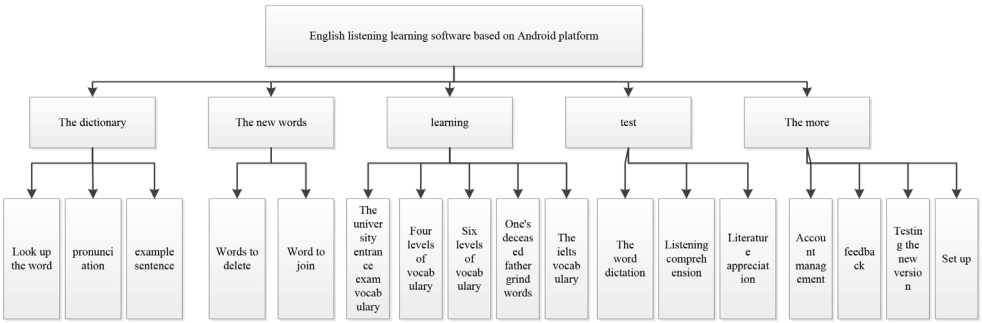

Figure 6 – Function module

1. To look up words online, provide Chinese interpretation and pronunciation and add new words;
2. To carry out listening training online or offline;
3. To memorize words through the new word file;
4. To learn words as there are English and Chinese words, pronunciation, phonetic symbols, example sentences and their explanations in the world learning part;
5. To practice reading and listening skills with the articles in the beautiful essay part

See Figure 6 for concrete design of five function modules of Buding (Pudding) English software.

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4.3. Database design of Android platform-based college English learning software

SQLite, as embedded database, provide convenience for learners to achieve personalized learning. Due to the Android platform integrated with SQLite and occupying small memory and supporting SQL, each program can use SQLite database, thus to provide richer learning resources for learners to achieve offline learning. In the paper, a learning test module and word query module are designed to meet learners' demands to learn without limit of network no matter where they are through the SQLite database. During application of SQLite database, SQLite Expert can be used to carry out visual design of database, as shown in Figure 7 and Figure 8.

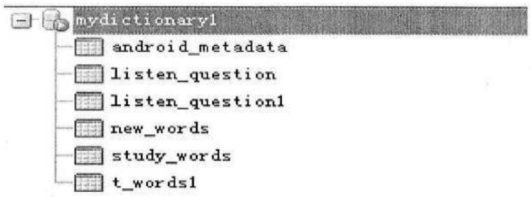

Figure 7 – The university English learning software database table structure

Index	Name	Declared Type	Type	Size	Precision	Not Null	Not Null On Conflict
1	ID	INT (30)	INT	30	0	☑	FAIL
2	question_text	TEXT (100)	TEXT	100	0	☑	FAIL
3	option_A	TEXT (100)	TEXT	100	0	☑	FAIL
4	option_B	TEXT (100)	TEXT	100	0	☑	FAIL
5	option_C	TEXT (100)	TEXT	100	0	☑	FAIL
6	option_D	TEXT (100)	TEXT	100	0	☑	FAIL
7	music_ID	VARCHAR (30)	VARCHAR	30	0	☑	FAIL
8	correct_answer	CHAR (20)	CHAR	20	0	☐	
9	List	CHAR (20)	CHAR	20	0	☐	
10	List_item	CHAR (30)	CHAR	30	0	☐	

Figure 8 – College English learning software

4.4. Application effect analysis

The research subjects are 60 non-English major freshmen of a university. there are 31 students in computer department and 30 students in surface feature department, who are randomly assigned into an experimental class and control class. In order to guarantee the objectivity of the results, the two classes were taught by the same English teacher. The experimental class has used mobile technologies to assist in college English listening and the control class has implemented the ordinary teaching method. The experiment lasted for a semester, a total of 16 weeks. The research is composed of five parts - pretest, listening learning through mobile software, posttest, questionnaire and statistical analysis.

Differences of listening scores of the two classes before and after the experiment are shown in Table 1, Table 2 and Table 3. From the test result of paired sample T before

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and after the experience in the table, it can be seen that the average posttest score of the experimental class is higher than the average pretest score by 6.23, and ,Sig. value is 0.001, i.e. P value <0.05, indicating that the difference is significant. However, the listening score of the control class decreases slightly by 1.32 due to a student's mistake causing that his score is zero, but the change has no statistical significance.

The research object	Sample size	Experimental classes on average	comparative classes averaged
Test before	30	75.23	76.04
Test after	30	82.01	75.65

Table 1 – Measure the mean differences before and after the listening ability

The research object	Sample size	Experimental classes on average	The standard deviation	Standard error of the mean
Experimental classes	30	82.01	8.457	1.236
comparative classes	30	75.23	11.362	2.213

Table 2 – Experimental classes and contrast version of the results of independent sample T test

Experimental classes on average	The standard deviation	Standard error of the mean	Difference 95% confidence interval		T	df	Sig.(On both sides)
			The lower limit	The higher limit			
7.152	10.856	2.005	3.047	11.635	3.15	25	0.01

Table 3 – Experimental classes, and that in comparative classes grades sample test

The above-mentioned data show that the listening scores of students in the experimental class after receiving the mobile listening learning method are obviously higher than that of students in the control class who didn't receive the teaching method. The result is similar with the input hypothesis of the core part of Krashen's second language acquisition theory. Only when learners come into contact with "understanding language input", they can actually learn something; i.e. the learning information provided by the learners is slightly higher than their existing learning levels, and the learners can focus on understanding the meaning or information, but not the form. The theory also reminds us that our understanding language input is a necessary condition for language acquisition.

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5. Conclusions

The research has designed and implemented phone-based college English mobile learning software, bringing a constructive idea of mobile learning of college English and promoting further development of mobile learning of college English listening. The paper, based on mobile learning theory and foreign language teaching theory, has developed English listening teaching and learning software under the Android platform, and the innovation points are as follows:

1. The teaching design and English teaching theory are assimilated into software development. At present, most mobile learning in China is initiated by mobile learning providers who firstly consider their own interests and lack the support of education concept in the mobile learning. Aimed at this problem, this paper assimilates teaching design and theory in the software development and has developed learning software which fits learners' features according to the mobile learning theory.
2. College English listening learning software is programmed.

   In view of the present insufficient mobile learning resources and existing problems of English listening teaching, the Android platform which is generally accepted by users is selected to achieve the development of English listening learning software, and the research results can be used in the practical teaching.

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Research on the Cultivation Pattern and Implementing Path of New-type occupational farmers Based on Computer Network

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Abstract: Under the background of China's social development enter into new normal, the innovation-driven pattern of agricultural development needs to combine the scientific and technological elements represented by the Internet with the farmer's elements, this paper proposes the development of a new-type occupational farmers cultivation pattern based on computer network. Through the research and analysis, we think that urban-rural binary opposition, lack of top-level design, outdated cultivation pattern are the three major obstacles to hinder the development of new-type occupational farmers. Combining new opportunities brought by computer networks to new-type occupational farmers, the paper proposes the cultivation of the new-type occupational farmers at computer network era should establish the cultivation idea of helping the farmers to realize the self-development, perfect the cultivation policy of helping as well as protecting the farmers, and develop the intensive and efficient cultivation pattern.

Keywords: Cultivation pattern, new-type occupational farmers, computer network, implementing path.

1. Introduction

Although the total number of agricultural labor force is relatively large in China, but the degree of mechanization of agricultural production is low. In addition, the problems such as hollowing of villages, farmers occupied in part job, aging of population and less educated are caused by industrialization and urbanization, all of this result in a large decrease of actual rural surplus labor force, thus the existing agricultural have been unable to meet the needs of China's development of modern agriculture. Therefore, in order to feasible protect the national food security, in the year of 2012 the central number one file proposed vigorously implement new measure of cultivating new-type occupational professional farmer. Cultivating new-type occupational farmers is also the core link of balanced urbanization and sustainable agriculture, because with the further improvement of urbanization level, more rural population will enter into urban obtain employment and life,

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only to cultivating new-type occupational farmers, continuous improving the overall quality of agricultural labor force, can alleviate agricultural production pressure which brought agricultural labor shortages for the reason of urbanization (Lutringermagnin et al, 2012; Lucas and Souza, 2016).

In the course of advancing agricultural modernization construction, farmers are the key factor to realize the transformation of scientific and technical information into actual productive forces, and the essence of cultivating new-type occupational farmers is to raise the productivity of labor force which is the production factor. In order to achieve the transformation of China's agricultural development from the old normal of factor-driven to the new normal of innovation-driven, we must combine science and technology elements represented by the Internet with farmer elements, to cultivate new-type occupational farmers who are meet the needs of computer network era (Liu, et al, 2013; Lino et al., 2016). Action plan of computer network is to promote the depth integration of informatization, industrialization and traditional industries, further to achieve improvement of quality and efficiency and transformation and upgrading in the traditional industries.

Therefore, we should vigorously promote Internet-based cultivation of the new-type occupational farmers, improve the application level of new-type occupational farmers on the Internet, cultivating a number of "Internet + new-type occupational farmers" with the quality of good at using the network, thinking, innovation and efficiency.

2. The connotation and development dilemma of new-type occupational farmers

2.1. The connotation of the new-type occupational farmers

Many domestic and foreign scholars have discussed the concept of the new-type occupational farmers. Expert Zhu Zhizhen thought that the new-type occupational farmers should first to meet the four general characteristics of farmers: firstly, to occupy or use a certain amount of cultivated land for production; secondly, most of the time to carry out agricultural production; thirdly, the main source of economic is production and management of agriculture; fourth, place of residence is in rural communities (Lourel and Mabire, 2008). In addition, he believed that the new-type occupational farmers should also meet the following three conditions: First, they should be the main body of market, and using of all possible opportunities to pursuit maximize income, general with high income; Second, they should have a high stability, engaged in the agricultural production for whole life time, and can be inherited; At final, they should have a strong sense of modern concepts and social responsibility, not only understand the technology, well-educated, good at management, but also comprehend the responsibility for ecological, social, environment and future generations, as is shown in Figure 1.

Under the background of country to accelerate agricultural science innovation, the whole society to vigorously develop "computer network + agriculture", the connotation of the new-type occupational farmers should also grasp the following two transformations.

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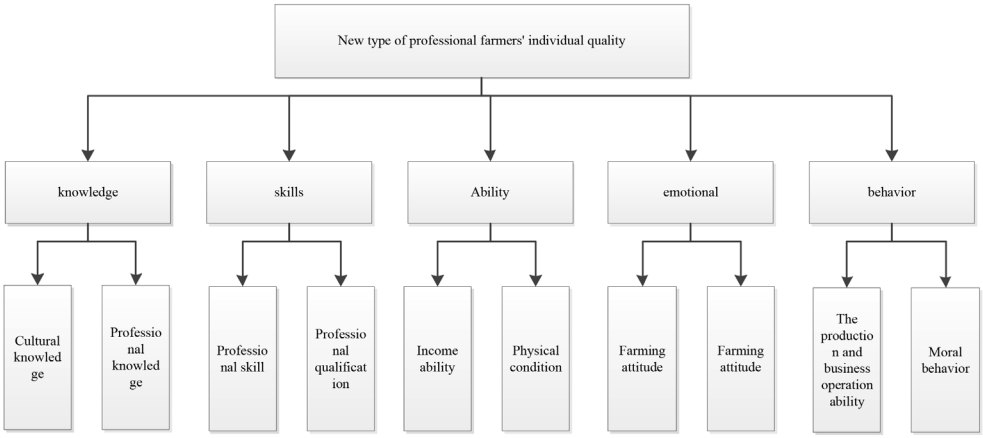

Figure 1 – The quality standard system of the new type of professional farmer

1. Transformation of the identity farmer to occupational farmer

For a long time due to restrictions of household registration system, the traditional sense of the "farmer" represents an identity relative to the "citizen" identity, refers to a rural household population (Westendorf et al., 2010). The new-type occupational farmers represents a kind of occupation, its purpose of agricultural production is no longer simply to maintain the livelihood, but to as the main body of the market, with sufficient mobility, and pursuit of considerable economic income.

When cultivating new-type occupational farmers, in order to realize the transformation from identity farmer to occupational farmer. On the other hand, the market shall play a decisive role in the labor force mobility, so the crowd with different career choices intention can get what they want; On the other hand, higher agricultural science and technology and management level is required for occupational farmer, not only can efficiently produce agricultural products, but also accurately grasp the market demand, to achieve maximum economic returns. To ensure and accelerate transformation of the identity farmer to occupational farmer is the main force point of the action plan of computer network to help new-type occupational farmers cultivation, with the help of computer networks to attract more outstanding human resources involved into agricultural production, at the same time to help existing farmers to obtain the necessary agricultural professional technology.

2. Transformation of passive change to spontaneous innovation

In the long course of history, the farmers rarely stand in the forefront of the times change, the peasant class is always being led or passive to make changes. New-type occupational farmers need to adapt to the requirements of the development of the times, can spontaneous change, not only to be able to inherit the excellent traditional agricultural culture, to adapt to China's regional characteristics, but also be able to learn new knowledge and skills, and constantly enrich themselves. The transformation

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of passive change to spontaneous innovation is the new demand of the new-type occupational farmers in the computer network era(shown in Figure 2). If innovation is the main theme of the computer network era, then the change is the new normal in the computer network era. Therefore, the new-type occupational farmers must be able to understand thoroughly the direction of market development, and spontaneous make a change.

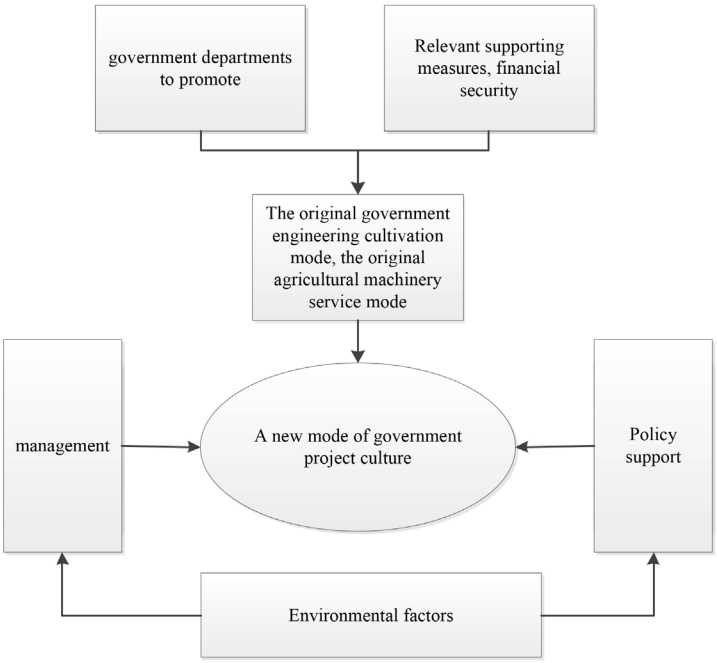

Figure 2 – new government engineering model structure diagram

2.2. The dilemma of cultivating new-type occupational farmers

"Three agriculture "issue has always been the most important task of the Party and the country, and the farmers are the key to solving "Three agriculture "issue. Therefore, the exploration of improving the quality of agricultural labor has not stopped, but with the times development and changes, farmers cultivation work also have some problems.

1. Although conducted training activities, but still with serious urban and rural confrontation

Before the introduction of the concept of a new-type of occupational farmer, the country started the project of vocational skills training for farmers as early as 1994—"Green Certificate Project", which aims to job training for farmers with the education level of junior and senior high schools, and cultivating a number of technical backbone who can play a leading role in the agricultural production. By the end of 2002, 1994 counties had implemented the "Green Certificate Project", trained more than 13 million farmers, of whom more than 6 million people obtained "green certificate".

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Although it has been long for our country training farmers for vocational skills, meanwhile the number of trained farmers is also expanding, but more farmers are still keen to jump out of the agriculture. One of the important reasons is that the opposition of urban-rural dual structure, making the conditional farmers more inclined to enter into the city where the labor income is more lucrative, medical education is more excellent, more advanced legal awareness to settle down(Hossain et al, 2009). With the existing of urban-rural dual structure, occupational farmers can't become an emerging occupation equally compete with practitioner of other industry, the cultivation of new-type occupational farmers can't achieve substantial achievements.

2. Rich in educational categories, but the lack of top-level design

The quality of agricultural labor force is the key that constraining the development of agriculture. The country has successfully implemented a series of training programs such as "Green Certificate Project", "Spark Technology Training" and "Agricultural Labor Transfer Training Sunshine Project". On the whole, China's science and technology education and training activities for farmers have achieved certain results. On the one hand, governments at all levels have attached great importance to carry out professional and technical education for farmers, the pattern of interaction between the upper and lower has been formed to promote education for occupational farmer; on the other hand, the enthusiasm of township enterprises and agricultural cooperatives to participate in training is also increasing, with incentive effect from the government , more township enterprises and agricultural cooperatives have begun to gradually participate in the education for occupational farmer (Megyesi et al., 2011).

While the various types of education and training activities for farmers are developing vigorously, the problem of lacking top-level design of occupational farmer training is also exposed. Its main performance is: the system of farmers' professional training is not perfect, leading to random training activities and poor continuity, the above mentioned farmers education and training projects were organized and implemented by the Ministry of Agriculture, Ministry of Education, Poverty Alleviation Office and other a dozen ministries , The many aspects of support from country should be a good thing, but the lack of unified leadership in action; In addition, the timely mobilization of training resources is weak, in face of rapid changes in labor demand, the existing farmer professional skills training system is not able to make quick adjustment of resources and without integration mechanism of training institutions.

3. New opportunities of new-type occupational farmers given by computer networks

3.1. Mobile Internet, to promote urban and rural integration

The dual structure of urban and rural areas is a key factor that hinders the transformation of the traditional farmers to the new-type occupational farmers. While the widely application of mobile Internet technology has brought hope and opportunity to the destroying of the urban-rural dual structure.

The extreme asymmetry of information resources is an important cause of the opposition between urban and rural areas. Agricultural production is an industry in which natural

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reproduction and economic reproduction are intertwined. Therefore, natural risks, technological risks, market risks and policy risks all have a great impact on agricultural production(Zhang, 2010). As the asymmetry of information resources, agricultural products market often had the cases like idle capital speculation, poor product sales, or even rotten in the ground, making the farmers can't timely sell products at high prices, while suffer heavy losses at lowest price (Schermerhornet al., 1986). With the accelerate popularization of the Internet in rural areas, rural areas will build a platform for sharing public information resources, form public information resources open and sharing system of physical dispersion, logical unity, in this way farmers will be able to convenient access trade information and understand the market dynamics as urban residents, so as to help them effectively reduce natural risks, reduce technical risks, forecast market risks and avoid policy risks, grasp the initiative in the market, to achieve full innovation of production and operation.

3.2. Get rid of the stale and take in the fresh, to stimulate the farmers' creativity

To refreshing Knowledge, developing specialized production. The era of computer networks to bring contemporary people is a huge amount of knowledge and information and rapid change speed, which also requires new occupational farmers to improve their ability of absorbing new knowledge and analyzing the change, then apply them to agriculture production and operation. Single isolated house agriculture model has been unable to adapt to the development of the times, it is necessary to develop more competitive and specialized cooperative production, take efforts to become township enterprise, the especial data is shown in Figure 3-5. At the same time, some new-type occupation farmers who have acquired advanced technology should establish a service-oriented enterprise oriented to large-scale agricultural production and establish an rural comprehensive service center integration of science, industry and trade, in order to overall promote the informationization process in agricultural production, and strive to enhance information service level of the production and operation, quality control and market circulation.

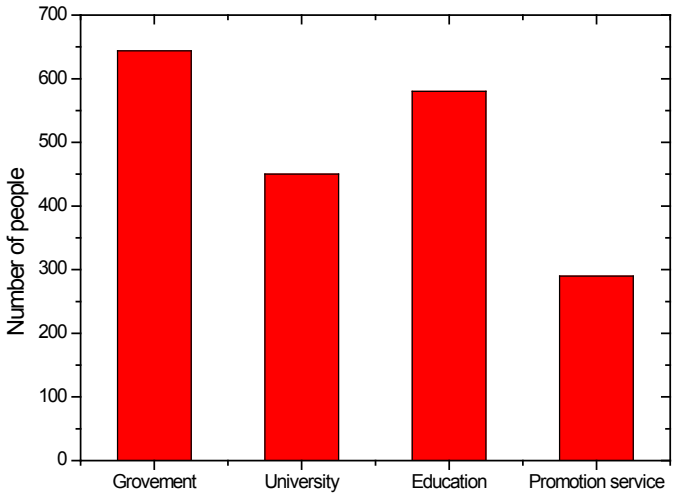

Figure 3 – Farmer perception of the mode of cultivating

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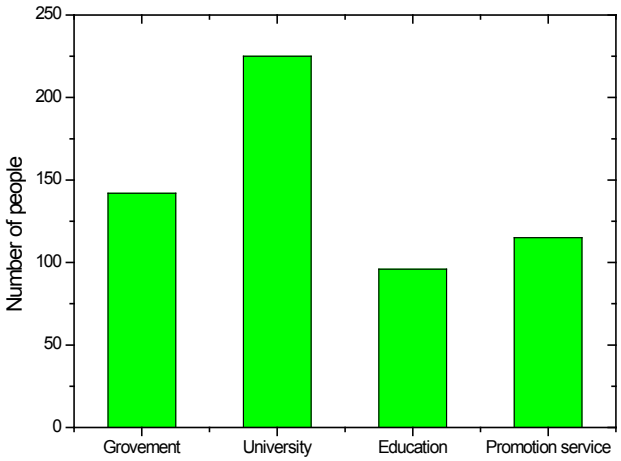

Figure 4 – The degree of farmers participation to the current patterns

In the course of advancing agricultural modernization construction, farmers are the key factor to realize the transformation of scientific and technical information into actual productive forces, and the essence of cultivating new-type occupational farmers is to raise the productivity of labor force which is the production factor. In order to achieve the transformation of China's agricultural development from the old normal of factor-driven to the new normal of innovation-driven, we must combine science and technology elements represented by the Internet with farmer elements, to cultivate new-type occupational farmers who are meet the needs of computer network era. Action plan of computer network is to promote the depth integration of informatization, industrialization and traditional industries, further to achieve improvement of quality and efficiency and transformation and upgrading in the traditional industries.

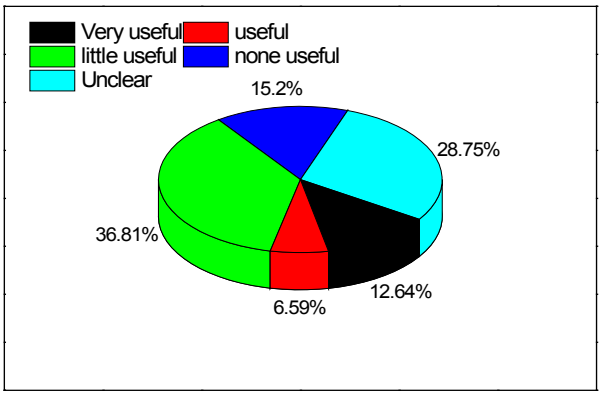

Figure 5 – The role of training play in improving agricultural production capacity

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Therefore, we should vigorously promote Internet-based cultivation of the new-type occupational farmers, improve the application level of new-type occupational farmers on the Internet, cultivating a number of "Internet + new-type occupational farmers" with the quality of good at using the network, thinking, innovation and efficiency.

3.3. Change of the times, to highlight the subjectivity of farmers

The new-type occupational farmers will be the core force of construction of a new socialist countryside, which requires not only a high level of professional skills, but also be able to act as master to participate in the exchange of all social strata. Meanwhile the emergence of the Internet provides a more convenient and reliable political participation platform for the majority of farmers, more farmers are still keen to jump out of the agriculture. One of the important reasons is that the opposition of urban-rural dual structure, making the conditional farmers more inclined to enter into the city where the labor income is more lucrative, medical education is more excellent, more advanced legal awareness to settle down (Hossain et al, 2009). With the existing of urban-rural dual structure, occupational farmers can't become an emerging occupation equally compete with practitioner of other industry, the cultivation of new-type occupational farmers can't achieve substantial achievement, and provides technical support for their self-management when participation in the new socialist countryside, as is shown in Figure 6.

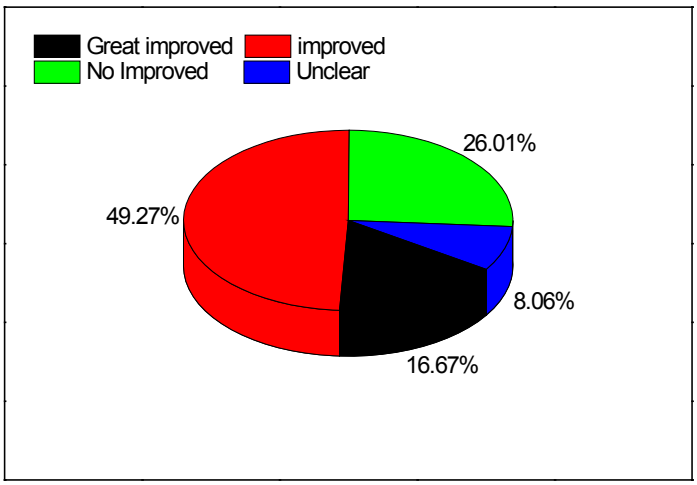

Figure 6 – The role of training play in improving income

4. Cultivating path of new-type occupational farmers in computer network era

4.1. Optimize the cultivation ideas, to achieve self-development

We should establish a new-type occupational farmers cultivation concept that promotes agriculture, science and technology, education, and so on, formulate a long-term

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cultivation plan, and make efforts to increase the investment of cultivate funds for new-type occupational farmers (Wang, 2012). From the long-term development of the new-type occupational farmers cultivation system, we should not only focus on the short-term on-the-job training for individuals who are engaged in agricultural production and management, but should strive to build education chains covering basic education in rural areas, agricultural professional education and professional training of farmers. In rural basic education stage, we should stop indoctrination of "abandon agriculture" to the next generation, but help them to correctly understand agriculture and help to eliminate the resistance to agricultural production and management (Huang and Rao, 2009); In the agricultural professional education stage, expanding the supporting to higher agricultural institutions, optimizing the professional settings, strengthening scientific research capabilities, training cutting-edge talents in the field of agricultural science and technology (Zhao and Dai, 2015); In stage of the professional training of farmers, paying attention to the practical application of Internet technology, really cultivating a group new-type occupational farmers who are rooted in rural areas, with strong technology, with ahead thinking.

4.2. Perfect the cultivation policy, to help and protect the farmers

1. To support infrastructure, improve the network system

Survey shows that the Internet penetration rate of China's rural areas is 34.1 percentage points lower than that in urban areas, therefore, the primary task to develop cultivation of computer networks new-type occupational farmers is to increase policy support to rural information network infrastructure, to enhance the cognitive level and use level of rural population to the Internet. Secondly, it is necessary to support the development of the modern logistics industry matching with the computer network, and to build the logistics and distribution system of urban and rural full coverage and global interconnection, so as to get through the "last mile" link up small farmers and big market (Zhao and Dai, 2015). Finally, it is necessary to develop large data application service technology, to achieve the deep integration of information resources and agricultural production, to improve the diversification and professional level of farmer management industry. Industrialization has already opened the distance between urban and rural areas, and the key to building a strong socialist country is in rural areas, it is necessary to make the majority of rural areas to catch up the last train of information technology, so as to clear the obstacles for development of cultivation of new-type occupational farmers in computer network era (Li, 2010).

2. To regulate the network finance, boost entrepreneurship

Internet finance and e-commerce is an effective way to solve the problem of shortage of funds when new-type occupational farmers start a business (Hu and Wen, 2010). Therefore, it is necessary to speed up the development of rural Internet finance and e-commerce centre on the agricultural production, processing and marketing of rural youth entrepreneurship, to smooth agricultural network sales channels, to establish community support for agriculture and other new agricultural business mode, to improve the rural supply and marketing service network, but also to encourage development of online rental of large agricultural machinery, agricultural testing equipment, agricultural scientific research equipment and other equipment.

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4.3. Update the cultivation mode, the pursuit of intensive and efficient

In the era of large data, the cultivation pattern of new-type occupational farmers must realize that teaching is adapted to individual aptitude, needs and time. The survey shows that among the groups of farmers of all ages, the network penetration rate of 10-40 year olds has the smallest difference with that of urban areas, and the proportion of farmer-workers is the highest in this strata, we should give full play to the advantages that they are familiar with both market of input place and the resources of output place, and support farmer-workers to return home for farming, so as to develop a number of leading-driven occupational farmers. Meanwhile, in the cultivation pattern, we should pay attention to these people's online education, develop modern agriculture with the help of computer network information, to achieve effective docking of the agricultural products of output and market of input.

5. Conclusions

This paper proposes the development of new-type occupational farmers cultivation pattern based on computer network. Through the research and analysis, we think that urban-rural binary opposition, lack of top-level design, outdated cultivation methods are the three major obstacles for the development of new-type occupational farmers. Combining with new opportunities brought by computer networks to new-type occupational farmers, proposes that in the era of Internet, the cultivation of new-type occupational farmers should establish the cultivation idea of helping the farmers to achieve their self-development, perfect the cultivation policy of helping as well as protecting the farmers, and develop the intensive and efficient cultivation pattern.

The era of computer networks to bring contemporary people is a huge amount of knowledge and information and rapid change speed, which also requires new occupational farmers to improve their ability of absorbing new knowledge and analyzing the change, then apply them to agriculture production and operation. Single isolated house agriculture model has been unable to adapt to the development of the times, it is necessary to develop more competitive and specialized cooperative production, take efforts to become township enterprise, the especial data is shown in Figure 3-5. At the same time, some new-type occupation farmers who have acquired advanced technology should establish a service-oriented enterprise oriented to large-scale agricultural production and establish an rural comprehensive service center integration of science, industry and trade, in order to overall promote the informationization process in agricultural production, and strive to enhance information service level of the production and operation, quality control and market circulation.

Acknowledgment

Study on the Innovative Path of New Type of Farmer Cultivation Mechanism in Yanshan Taihang Based on the Development of Beijing-Tianjin-Hebei (HB15GL072)

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Capital Input and Chinese Enterprises "Going Out": Empirical Evidence Based on Computer Industry

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Abstract: This paper tests the influence of the capital input on "Going Out" strategy of Chinese computer enterprises by taking the computer enterprises as samples, in the background of "One Belt, One Road". The study found that, the computer industry enterprises in the region where the better of the investment conditions in external capital market, the higher of the corresponding probability to "Going Out"; what's more, the better of the internal capital market, the more motivation to get involved in international diversification and "Going Out" strategy.

Keywords: "Going Out" strategy; International diversification; Capital input; Computer industry

1. Introduction

In the new era of China's international trade and international investment, international diversification is an important form of the upgrade of "Going Out" strategy for Chinese enterprises by the way of overseas investment, engineering contracting, technical cooperation, equipment export, etc., making related cooperation with many industries, and this will promote the computer industry to have a further development in China. By the form of international diversification, both the host country and the investment country can benefit from it, their economic will get development, industrialization will speed-up, and products will be extremely rich, also, there will have a multiple benefit. Especially in the background of "supply-side reform", for computer industry, the implementation of "Going Out" is a good way to introduce the advanced foreign technology to meet the domestic needs, and promote the domestic industry outward to get much more effective demands, which is suitable for the adjustment of "supply- side reform". Therefore, it will be a great practical significance to upgrade and optimize the quantity and quality of Chinese computer industry to international diversification, and to promote the spatial and upgrade the structure of the "Going Out" strategy.

However, for the computer industry, in the process of international diversification, neither the guidance policy from central government or local government, nor the enterprises' actually actions are an independent entity, especially in the intensity of the

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capital investment, they should get a unity performance with multi-system and multi-level. Capital market should play an important role in the process of international diversification, and provide significant support and protection to this process, by the market force. What's more, in the construction process of "One Belt, One Road", for the financial system, which use the capital market as a medium, should prop up the area of capital contribution, strategy guidance, risk precaution and capital bonus (Lin et al., 2016; Fortes et al., 2016). At the same time, international diversification is the combination of the real economy and virtual economy; it includes both international trade and the conduction of international investment.

Compared with the informed researches, the contribution-margin of this paper is in two hands. On the one hand, this paper makes a discussion about the influence of capital input on Chinese enterprises "Going Out" strategy; on the other hand, in order to enrich the research in Chinese enterprises "Going Out", this paper also take the computer industry as an example to make a relevant empirical test to provide the evidence.

2. Theoretical Model and Hypothesis Development

2.1. Internal Capital Market Investment and Chinese Enterprises "Going Out"

The operating conditions will be focused continuously after enterprises financing through the capital markets, the performance of capital markets will affect enterprises' continuous operating conditions as well. On the one hand, enterprise value includes the existing assets that created by the previous investment and the present value of the expected cash flow created by the future investment, which will lead to the inefficient investment behavior, as a result, capital market will correct the behavior of inefficient investment initiatively (Charistie and Zimmerman, 1994; Titman et al, 2004), but compared with capital market, the cost will be lower, if guide by government. So, in the process of enterprises going out, Chinese government should conduct this strategy, and government behavior will guide enterprises to make investment, which will create a healthier capital market to performance, and then the capital market will confidence to enterprises much more. All of these benefits will bring more chances for enterprises to financing and lower the cost of financing when enterprises participate in the strategy of international diversification. On the other hand, there are significant instability situations in Chinese capital market, and the phenomenon of stock price crash often occurs in recent years, which will damage the interests of investors, also destroy the normal operation of enterprises. While the reason for the stock price crash usually due to the hidden of bad news in the market (Huttion et al, 2009; Kim and Zhang, 2010). However, if the government can promote the capital market initiatively, the bad news will not exist, for the government promotes these projects, so in this case, the probability for stock price crash will be reduced, and provide a steadier chance in the capital market for enterprises performance. Theoretically, enterprises can borrow in at one country then invest in another country to get higher profits (Burgaman, 1996; Sun and Sun, 2014), but actually, the total cost will be increased for the information asymmetry cause relevant financing cost. As a result, whether enterprises can get a good chance for

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financing in capital market or not, will be a significance factor for enterprises participate in international diversification initiatively and to make a co-operation.

Therefore, getting sufficient capital support will be very important for enterprises, when they face with the opportunities for operating only national projects or operating the international strategy at the same time. So, this paper refers to the framework that capital structure problems in enterprises international diversification which analyzed by Sun and Sun (2014), and then build two kinds of models in the capital market, based on the hypothesis of enterprises take party in international diversification or not. Firstly, this paper makes a hypothesis: there are two investment projects are involved, but the enterprises can choose one project or both of them just depending on their own situation to make choose. If the enterprises only choose one project, so this project is a domestic project and the other project is a foreign project for international diversification. Assuming that each project needs a fixed investment Size-I, at this time, the enterprise has freedom capital RMB 20 thousand to make an investment, and W<I; in order to pursue a higher return, the firm will do a good job. The rate of investment success is p, otherwise the rate will be (1-p), and p≥(1-p); so, when the investment get a success, the profit of this project would be R, but R would be shared by the company (R_R)and the capital market (R_F)that give the financing opportunity to the enterprises. So, the capital market, which is the subject of financing, can obtain a competitive rate of return, and the rate of return is r, and:

$$pR_F = (I - W)(1 + r)\,\mathrm{C} \tag{1}$$

Firstly, if the enterprises only consider one of the projects, for domestic project to make investment, so, the enterprise should ensure the net present value of the invested project to be a positive number, so:

$$pR - I > 0 \tag{2}$$

At the same time, the most basic condition for the capital market willing to lend funds to the enterprise is that the guarantee income must greater than the basic rate of return of its founds, so:

$$pR > (I - W)(1 + r) \tag{3}$$

Sort out the formula we get

$$pR > (I - W)(1 + r) \tag{4}$$

Because of the enterprises only invest one project, when the fixed investment is I, the maximum recognition in the capital market that the enterprises could obtain is (I-$\overline{W}$), namely: pR/(1+r).

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At present, because there are opportunities that government promotes the enterprises to international diversification, so there are more chances for the enterprises to make investment abroad, especially in the process of "supply- side" structure reform and adjustment, many companies will face with the situation of cutting excessive industrial capacity and adjusting supply, so they can choose the foreign investment. When enterprises decide to participated in the international diversification and international cooperation, they can use the income of the domestic project as the mortgage to foreign project, and gain the recognition of the capital market. Therefore, the condition of the enterprises can participate in international diversification, not only operate the domestic project is

$$p^2 R_R \geq p(1-p)R_R + B \tag{5}$$

In the formula (5), B is for the adjustment of other income that firm has obtained when the firm fail to international diversification. Because the Chinese enterprises international diversification is in the promotion of Chinese government, even though the enterprises fails to the expected economic affections, they can get the private benefits also, for the improvement of the relationship between the enterprises and the government, and the enterprises can get some preferential policy, etc. Because of p≥(1-p), so the formula (5) could be establishment. So we can get the minimum expected profit is:

$$\frac{2p^2 B}{2p-1} = 2(1-p)\frac{pB}{2p-1} \tag{6}$$

Therefore, in the process of international diversification, both the domestic and foreign project can get the recognition from capital market, and the condition for capital from the capital market is the same as only invest one project, namely, the guaranteed income must be grate than the basic return, so:

$$2pR - 2(1-p)\frac{pB}{2p-1} \geq (2I - 2W)(1+r) \tag{7}$$

Sort out the formula (7), we get the formula (8):

$$W \geq \overline{W} \equiv I - \frac{pR + pB}{1+r} \tag{8}$$

So, when enterprises choose to make international diversification, and invest both the domestic and foreign project, the maximum recognition they have get from capital market is (I-$\overline{W}$), namely, (pR+pB)/(1+r).

Compared the amount of the capital that enterprises have obtained from capital market before and after international diversification, because of B>0, so, (pR+pB)/(1+r)>pR/(1+r), this means that enterprises can obtain more founds from capital market to have a further development by international diversification, and this is the reason why the

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enterprises to make international diversification driven by the capital market. In addition, in the process of international diversification, because of Chinese government's attention and the demand of building multi-level capital market; as well as the supply-side structure adjustment will increase of financing ways in the capital market and the decrease of the asset- liability ration of the enterprises, so, the r in the formula (4) will be reduced. Namely, the demanded profits in the capital market will become lower and lower, in other word, the cost of enterprises joint in the capital market will be lower after they take party in international diversification and the profits of international diversification that enterprises have obtained from capital market will become higher and higher. So, on the one hand, with the enterprises good performance in the capital market, which will provide a more stable financing environment for enterprises take party in international diversification (Dong and Wang, 2016), to make enterprises have more confidence;

On the other hand, this will provide more capital bonus when the enterprises carry out the strategy of "deleverage" and "lower cost", and accelerate the implementation of international diversification strategy in the area of the enterprises.

2.2. External Capital Market Input and Chinese Enterprises "Going Out"

On the view of the external capital market, it is necessary for the participation of the entity and capital sectors, both of them should play an important role in the process of enterprises' international diversification. So, this paper refers to the model of two sectors of Feder (1983), Rajan and Zngales (1998), to discuss the inference of the external capital market to the international diversification. Firstly, this paper divides the foreign economic activities of the enterprises into two sectors' activities: the real sector (R) and the capital market sector (F), and each of the sector's activities are consistent with the basic assumption of the general production function. Therefore, the gross output of the firm (Y) is:

$$Y = F + R \tag{9}$$

Assuming both of the two sectors use the same basic factors of production, namely, capital (K) and labor (L), but considering the external capital market will give the external spillover effects to the entity operation, so, the output of the external capital market will become another production factors for the real sector. Therefore, the production functions of the two sectors are:

$$F = F\left(L_F, K_F\right) \tag{10}$$

$$R = F\left(L_R, K_R, F\right) \tag{11}$$

As the amount of the total resources is limited in the enter enterprises, so, in the condition of the certain amount of the total capital and total labor, there are:

$$K = K_F + K_R \tag{12}$$

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$$L = L_F + L_R \tag{13}$$

At the same time, there are differences in the marginal rate of return of the two sectors, so, this paper assumes these differences are fixed, they are satisfied with the formula:

$$\frac{\partial F / \partial L_F}{\partial R / \partial L_R} = \frac{\partial F / \partial K_F}{\partial R / \partial K_R} = 1 + \delta \tag{14}$$

The formula (14) shows the differences of the marginal rate of return of the two sectors. Usually, others think that there is phenomenon of financial repression, so, the yield of the capital market is less than the real sector, and the value is between -1 and 0. However, in the promotion and the process of the international diversification, Chinese government shows a positive attitude to give financing repression, financing support and the development of capital market. That is to say, in the process of enterprises' international diversification, the capital market will not inhibition the development, on the contrary, the enterprises will get more yield by the way of the development of the domestic capital market, the international investment, overseas listing, etc. In other word, the government will improve the development of the capital market, and provide a better external capital market conditions for the international diversified enterprises. Therefore, this paper assumes that, if the enterprises not get involved in the international diversification, because of the financing repression, so, $\delta \in (-1,0)$; if the enterprise get involved in the international diversification, enterprises will get preferential policy from the government, so, $\delta \in (-1,0)$.

In addition, in the real sector, about the output elasticity of the capital (α) and the output elasticity of the labor (β) are:

$$\alpha = \frac{\partial R}{\partial K_R} \cdot \frac{K_R}{R}, \ \beta = \frac{\partial R}{\partial L_R} \cdot \frac{L_R}{R} \tag{15}$$

So, total differential on the equal of the formula (9), we get:

$$dY = dF + dR \tag{16}$$

And put the formula (10) to formula (15) into the formula (8), we can get:

$$\frac{dY}{Y} = \alpha\left(\frac{dK}{Y}\right) + \beta\left(\frac{dL}{L}\right) + \left[\frac{\delta}{1+\delta} + R_F\right] \cdot \left(\frac{dF}{F}\right) \cdot \left(\frac{F}{Y}\right) \tag{17}$$

In the formula (17), the contribution of the capital market sector to the economic outcome is (F/Y), the coefficient of the capital market contribution is $(\delta/(1+\delta)\ R_F)$. Because of the externality of the capital market to the real sector is R_F, and this externality is considered positive, so $R_F>0$. The degree of the contribution that the capital market to the whole of the enterprises will be effected by $(\delta/(1+\delta))$. Because of the financing repression, so, $\delta<0$, and there will be cost-effective in the capital market, which will have a negative influence on the outcome of the whole enterprise. (In actually, enterprises will be influenced by the

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instability of the capital market and the over-regulation of the capital market, which will cause the cost is higher than the earning for the enterprises). However, in the process of the international diversification, there is external preferential policy, the construction of the multi-level capital market, the convenience of the overseas financing, so, $\delta>0$, as a result, the development of the capital market will promote the enterprises to get more profits. That is to say, in the process of the international diversification, capital market will bring a better profit to enterprises, and the enterprises will be more willing to get involved in the international diversification. Especially in the background the supply-side structure reform, with the relaxation of the supply and demand of the real economy, the development of the concentration all of the industries, there will be more chances for the restructuring and investment in the capital market. All of these will make the enterprises to get more bonus of the international diversification through capital market, and enhance the confidence of the enterprises to get involved in the international diversification.

Therefore, this paper puts forward the research hypothesis:

H: the better the investment situation in the capital market, the more possibility of the enterprises to participate in the international diversification.

3. Research Design

3.1. Variable Definition and Empirical Model

3.1.1. Explained Variable: International Diversification (ID)

Usually, the measurement of diversification is using the Herfindahl index and the entropy index. However, many Chinese enterprises do not make a strict distinction for the destination of the foreign sales when they disclose the international revenues, so it is hard to make a measurement for the ID by this way. As a result, this paper refers to the method that Wei and Chen (2011) and Sun and Sun (2014) have used, and use dummy variable to make definition, that is to say, if the foreign income is contained in the disclosed income, the ID=1, or, ID=0.

3.1.2. Explanatory Variable: Capital Market Input (CM)

1. CM1: In this paper, the measurement of the external capital market is the capitalization rate, namely, CM1= total capital market value at the end of the year/ GDP at the end of the year;
2. CM2: Measured by the ratio of book value about every enterprise.

3.1.3. Control Variable

This paper adds capital size, return on assets (ROA), debt to assets ratio (Debt), ownership concentration (H10), listing age (Age) and regional marketization index (Index) are taken as control variables.

Capital Size (Size): Measured by the total assets about the sample enterprises at the end of the year, and then take natural logarithm;

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Return on Assets (ROT): Measured by the ratio of net profit to total assets about the sample enterprises at the end of the year;

Debt to Assets Ratio (Debt): Measured by the ratio of total liabilities to total assets about the sample enterprises;

Ownership concentration (H10): Measured by the total square of proportion of shareholdings about the ten biggest shareholders;

Listing Age (Age): Measured by the balance of the sample year and the year of the listed

3.1.4. Empirical Model

According to the selected variables, this paper set the empirical model correspondingly:

$$\Pr\left(ID=1\right)=\log it\begin{pmatrix}\alpha_1 CM+\alpha_2\ln\left(Size\right)+\alpha_3 ROA+\alpha_4 Debt+\alpha_5 H10\\+\alpha_6 Age+C+\varepsilon\end{pmatrix} \tag{18}$$

3.2. Date Declaration

This paper chooses enterprises of computer industry in Chinese A-share market as the sample to make an empirical test, the computer, communication, electronic equipment manufacturing industry, information transmission; software and information technology service, etc. are included. The interval- time of the sample is 2008-2014, and according to the following principles to filter the sample: ① the special treatment of the enterprises sample in the Chinese capital market is eliminated;② the terminated enterprises are removed from the sample; ③the data-missing or singular sample is removed. So, this paper gets 325 samples in 2008-2014, these enterprises are in computer industry, which taking international diversification.

At the same time, in order to make a comparison of behaviors between different "Going Out" enterprises, this paper makes the match one-to-one with the companies that do not disclose overseas incomes in their total incomes, and the specific matching principle is as following. ①enterprises that belong to the same industry as the international diversification enterprises; ②enterprises' scale are similarity with the international diversification enterprises, but the gap of assets not exceed 50% of the original company; ③enterprises not have special treatment and did not stop business. This paper get 130 pairs of samples after eliminating the enterprises which cannot be matched and double matched. Finally, we get 455 listed enterprises samples in 2008-2014.

4. Empirical Test and Result discussion

	Total Samples			International Diversification Samples		
	N	Mean	Median	*N*	Mean	Median
ID	455	0.633	1.000	325	—	—
CM1	455	0.869	0.293	325	0.906	0.293
CM2	455	1.622	1.267	325	1.538	1.182

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ln(Size)	455	22.248	22.048	325	22.368	22.158
ROA	455	0.037	0.032	325	0.031	0.028
Debt	455	0.489	0.500	325	0.517	0.526
H10	455	0.180	0.156	325	0.176	0.151
Age	455	10.014	11.000	325	11.706	12.000
	Matching Samples			T		
	N	**Mean**	**Median**			
ID	130	—	—			
CM1	130	0.806	0.293	1.921**		
CM2	130	1.768	1.444	-6.154***		
ln(Size)	130	22.041	21.884	9.202***		
ROA	130	0.047	0.041	-7.034***		
Debt	130	0.442	0.444	13.589***		
H10	130	0.188	0.165	-3.454***		
Age	130	7.098	6.000	31.673***		

***, ** and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 1 – Descriptive Statistics

Table 1 shows descriptive statistical of the variables. The median of the explained variable ID is 0.633, more than 60% of the sample enterprises are international diversified enterprises, and the others are not. In the sample of explanatory variables, the mean of the variable CM1 is 0.869, which shows that the total value at the end of the year about the listed enterprises is about 85% of the GDP. The mean of international diversification samples is 0.906, and the mean of the matching samples is 0.806, the mean of the sample differences can pass the significance testing of the confidence level. In the control variables, the mean of the variable ln (Size) is 22.248, which shows that the capital of the sample enterprises is 4.6 billion yuan. The mean of the variable ROA is 0.037, which shows that the net profits of the enterprises are about 4% of the total assets. The mean of the variable Debt is 0.489, which shows the debt size is about 50% of the total assets. The variable H10's mean is 0.180, which shows the sample enterprises' ownership concentration is not high. The median of the variable is 11, which shows the sample enterprises' listed age is about 11. At the same time, all of the control variables in the samples of international diversification and matching can pass the significance testing of the confidence level.

Table 2 shows the correlation test results. The correlation coefficient in the explanatory variables with control variables, and the correlation coefficient between the control variables are not high, which shows there are not significant linear relationships between the variables, namely, not any of the explanatory variables are the linear function of other explanatory or control variables, so, there are not obvious multicollinearity between these variables.

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	ID	***CM1***	***CM2***	***ln(Size)***
ID	1	0.014*	-0.109***	0.122***
CM1	0.026**	1	0.204***	0.060***
CM2	-0.085***	0.057***	1	-0.527***
ln(Size)	0.126***	0.188***	-0.432***	1
ROA	-0.097***	0.017	0.181***	0.054***
Debt	0.184***	0.001	-0.450***	0.369***
H10	-0.048***	0.152***	-0.034**	0.340***
Age	0.400***	-0.049***	-0.100***	0.075***
	ROA	Debt	H10	***Age***
ID	-0.135***	0.176***	-0.052***	0.390***
CM1	0.100***	-0.068***	0.064***	0.019*
CM2	0.428***	-0.583***	-0.052***	-0.135***
ln(Size)	0.036***	0.389***	0.262***	0.116***
ROA	1	-0.444***	0.135***	-0.205***
Debt	-0.320***	1	0.016	0.236***
H10	0.099***	0.010	1	-0.220***
Age	-0.127***	0.259***	-0.214***	1

The left bottom is the normal correlation value, the top right corner is the Spearman correlation coefficient value, ***, ** and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 2 – Correlation Test Results

	(1)	(2)
CM1	0.038** (0.018)	
CM2		0.053* (0.030)
ln(Size)	0.156***	0.188***
ROA	-1.685***	-2.018***
Debt	0.385**	0.451**
H10	0.196	0.202
Age	0.161***	0.160***
Index	-0.011	-0.003
C	-4.545***	-5.394***
Mc-Fadden R2	0.141	0.140
LR statistic	971.307***	969.901***

The standard error is in the brackets, ***, **, and *, indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 3 – Empirical Results

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Table 3 shows the empirical test results. There are not obviously differences between the actual distribution of the explained variables and the simulating distributing of the explanatory variables and the control variables, that is to say, it is credible for the regression results. At the same time, in the regression result (1), there is a positive correlation between the variables CM1 and the explained variables, and they can pass the significance testing of the confidence level, which shows the better of the capital market investment, the more possibility of the enterprises get involved in international diversification. In the regression (2), there is a positive relationship between the variable CM1 and the explained variables also, and they can pass the significance testing of the confidence level, which shows the better of the capital market investment, the more possibility of the enterprises involved in the international diversification.

From the test results of control variables, obviously, there is a positive correlation relationship between the variables ln (Size) and explained variables, which shows the bigger asset size of the enterprises, the more possibility of involving in the international diversification. There is an obviously negative correlation between the variable ROT and the explained variable, which shows the lower of the return on asset, the more motivation to get involved in international diversification. There is an obviously, a positive correlation between the variable Debt and the explained variable, this shows the more of debt, the more possibility of the enterprises will get involved in the international diversification, because the international diversification strategy will lower the ratio of the debt. However, the correlation relationship between the variable H10 and the explained variable does not pass the significance testing of the confidence level, which shows the ownership structure will not have a substantial impact on the enterprises' strategy of the international diversification. There is an obvious positive correlation relationship between the variable age and the explained variable, this show the longer of the listed, the more possibility of get involved in international industrial capacity cooperation.

This paper makes a corresponding robustness test, in order to verify the credibility of the conclusions. Firstly, this paper chooses the ratio between the total turnover of the year and the GDP, to use the ratio of the market value of the B-share market to measure the capital market and then have an empirical test correspondingly. Beside this, considering the corresponding replacement of some control variables, such as, H5 to replace H10, ROE to replace ROA, etc., after that to make the corresponding empirical test. The results of the robustness are coincidence with the former empirical results, and there are not substantial differences, therefore, the empirical results are credible.

5. Conclusion

In recent years, with the proposal of "One belt, One Road", China's new round of opening up at a higher level is gradually undertaking, and more computer industry enterprises choose to "go out" to enhance international competitiveness. However, international diversification is not just the external output of the relevant industries, it is in need of the financial system support as well, especially for the obstacle in the process of financing in the capital market and the bonus system must be resolved immediately. Therefore, this paper is in the perspective of the international diversified enterprises, uses the enterprises of computer industry as an example, studies the impact of capital market's input on

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international diversification. The study found that the more the capital market input, the stronger motivation of the enterprises get involved in international diversification.

In the new era, international diversification is not only a new pattern of international trade. In the background of export-oriented economy, "One Belt, One Road" and the adjustment of "supply-side" structure, Chinese enterprises get involved in international diversification is an important way to solve the problem of excess manufacturing capacity, a good way to stimulate economic development, and the driving force of China's economic growth in the future. From the empirical evidence, the capital market can provide impetus to promote the international diversification, the power of the capital market can provide the corresponding financing channels for enterprises, and give more financial support, which is an important way to the international diversification, even the implementation of the "One Belt, One Road". Therefore, how to make the capital market play a better role, such as, construct a multi-level capital market and hold the stead of the capital market, ect. These phenomena are worthwhile of paying much attention in the process of international diversification.

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Classroom Teaching Performance Evaluation Model of Ideological and Political Education in Colleges and Universities based on TOPSIS and Triangle Fuzzy Number

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Abstract: Being the core component of ideological and political education and an indispensable part of higher education, classroom teaching of ideological and political education in colleges and universities has a great significance to the cultivation of high quality talents. This paper begins with an analysis of the existing issues of classroom teaching of ideological and political education in colleges and universities and corresponding performance evaluation, and a preliminary research on the basic characteristics of classroom teaching of ideological and political education with the development of the times. Then, this paper analyzes the key contents of classroom teaching performance evaluation system of ideological and political education, such as evaluation mode, evaluation means, evaluation index selection, etc., and establishes the corresponding classroom teaching evaluation performance system. In the end, this paper puts forward a classroom teaching performance evaluation model of ideological and political education in colleges and universities based on TOPSIS and fuzzy evaluation model, and points out an effective way to evaluate classroom teaching performance of ideological and political education by integrating the classroom teaching evaluation performance system with the evaluation model.

Keywords: colleges and universities, classroom teaching, ideological and political education, fuzzy evaluation model, TOPSIS, triangular fuzzy number

1. Introduction

Classroom teaching plays an important role in improving the quality and ability of higher education, and in cultivating of high quality talents. In view of its critical importance to higher education, many researchers and education administrators have made valuable suggestions to classroom teaching (Liu and Tian, 2010; Liu et al., 2014). Classroom teaching is particularly important to ideological and political education due to strong theoretical, social and political implications. So, classroom teaching of ideological and political education has gradually become a hot issue in higher education research (Zeng and Chen, 2011; Song, 2012; Xiao and Fan, 2016). Classroom teaching performance of ideological and political education is an effective way to evaluate the quality, level and

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ability of teaching and to provide important support and direction guidance for ideological and political education reform (Lin and Lin, 2014; Wang et al., 2012; Li, 2009; Sun and Wang, 2015). With social progress and development, however, the existing classroom teaching performance evaluation methods for ideological and political education are facing certain limitations. For this reason, this paper establishes a classroom teaching evaluation performance system of ideological and political education by analyzing the existing issues of classroom teaching of ideological and political education, and puts forward a classroom teaching performance evaluation model of ideological and political education in colleges and universities based on TOPSIS (Shahab et al., 2016); Shyi et al., 2016) and fuzzy evaluation model (Chen and Li, 2011; Yu, 2013; Giachetti and Young, 1997, Lino et al., 2016) from the perspective of integrity and completeness, in consideration of the fuzziness of evaluation information (Silva et al., 2014; Cebi and Kahraman, 2010; Quinonez et al., 2016).

2. Classroom Teaching of Ideological and Political Education in Colleges and Universities and the Existing Problems in Performance Evaluation

The implementation of classroom teaching of ideological and political education is affected by many factors. As China vigorously pushes forward quality education, there are still a string of problems in classroom teaching of ideological and political education, namely (1) outdated teaching contents: the teaching contents are clearly out of line with social development as many textbooks have been used for years without any replacement or improvement; (2) backward teaching methods: with blackboard teaching as the traditional teaching mode, scientific means like computer, internet and videos should be utilized more extensively in classroom teaching; (3) unreasonable

Content	Meaning
Backward Thinking	The backward thinking cannot keep pace with the development goals of the quality education and the development needs of the overall planning of higher education.
Incomplete Contents	Incomplete contents make it impossible to measure the performance of classroom teaching from the perspective of integrity and completeness.
Inconsistent Criteria	Due to the absence of unified evaluation criteria and system, educators have different understanding and attach different degrees of importance to classroom teaching of ideological and political education.
Lack of Diversity	Most of evaluation subjects are education administrators, while other carriers, e.g. teachers, students and the society, are overlooked.

Table 1 – Limitations on Classroom Teaching Performance Evaluation of Ideological and Political Education

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curriculum planning: there is the lack of systematic and scientific curriculum planning and setting; (4) utilitarian-based teaching: more importance is attached to immediate educational interests and effects than long-term educational development; (5) divorce between theory and practice: practice and theory are not well integrated and the poor teaching adaptability is rather poor; (6) lack of attention: emphasizing on professional education, the leaders and administrators overlook ideological and political education; and (7) poor teaching quality: there is still much to be desired in terms of faculty, team building and teaching investment.

As the main way and means of ideological and political education, the shortcomings and limitations of classroom teaching result in many problems in the performance evaluation. See Table 1 for more details.

3. Analysis of Classroom Teaching Evaluation Characteristics of Ideological and Political Education in Modern Times

With the development of the times, the author believes that classroom teaching evaluation of ideological and political education in colleges and universities should have the following characteristics:

Content	Meaning
Contemporariness	The classroom teaching evaluation of ideological and political education should have obvious characteristics of the times because ideological and political education should have different emphases in different times.
Expansibility	The classroom teaching evaluation of ideological and political education should be consistent with the law of social development, taking into account relevant factors of social development.
Orientation	The evaluation of ideological and political education should reflect the intentions of national policies.
Scientificity	Classroom teaching performance evaluation of ideological and political education should consider the factor of science and technology development because the rapid development of science and technology changes the classroom teaching mode of ideological and political education.
Serviceability	Social serviceability is an important index in classroom teaching performance evaluation of ideological and political education because the purpose of ideological and political education is to serve the society.
Practicalness	The integration of the theory of ideological and political education theory and the social practice can better promote the implementation of ideological and political education.
Innovativeness	Reform and innovation ability should be fully taken into consideration because teaching innovation is a powerful impetus to the development of ideological and political education

Table 2 – Classroom Teaching Evaluation Characteristics of Ideological and Political Education in Modern Times

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4. Classroom Teaching Performance Evaluation Index System of Ideological and Political Education in Colleges and Universities

4.1. Analysis of Evaluation Mode

With education administrators as the main subjects, the traditional evaluation mode cannot reflect the situation of classroom teaching objectively. Therefore, the evaluation should integrate teacher self-evaluation, student evaluation, school evaluation, social evaluation, parent evaluation and administrator evaluation, in consideration of the situation, process and effect of classroom teaching of ideological and political education. To carry out the performance evaluation and analysis from multiple angels, a scientific and objective classroom teaching performance evaluation index system of ideological and political education should be established to reflect the true level of classroom teaching and to provide effective support to classroom teaching reform and innovation of ideological and political education.

4.2. Analysis of Evaluation Method

The evaluation method should integrate various methods, means and approaches, such as data collection and statistics, questionnaires targeted at the society, schools and students, expert interviews, systematic analysis, social and institutional feedback. The evaluation results are more objective and reliable if there are various ways to obtain evaluation information.

4.3. Analysis of Selection Principle of Evaluation Indices

See Table 3 for the selection principle of evaluation indices.

Type	Meaning
Scientificity and Objectiveness	In accordance with objective facts and in a scientific manner, select indices to reflect the nature of the evaluation objects.
Guidance and Expansibility	In consideration of the new demands of the time, select indices which meet national policies.
Operability	Select indies to ensure effective evaluation and measurement of classroom teaching of ideological and political education.
Effectiveness	Select indices to effectively promote the level and ability of classroom teaching of ideological and political education.
Integration between Qualification and Quantification	Give comprehensive consideration of the qualitative and quantitative information in classroom teaching performance evaluation of ideological and political education.

Table 3 – Selection Principle of Classroom Teaching Evaluation Indices of Ideological and Political Education

4.4. Construction of Evaluation Index System

The author comes up with a new type of performance evaluation index system for classroom teaching of ideological and political education in colleges and universities. See Table 4.

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Hierarchy	Primary Indices	Secondary Indices
Classroom Teaching Performance Evaluation Index System of Ideological and Political Education	Teaching design and supports	Discipline settings
		Curriculum settings
		Teaching link planning
		Hardware and software facilities and funding
		Working, cultural and sports environment
		Party and League building
		Service system construction
	Teaching contents	Clear purpose
		Prominent key points
		Controllable progress
		Scientific and systematic
		Open contents
		Innovative contents
		Instructive contents
	Teaching methods, means and approaches	Competence-based teaching ability
		Integration of theory and practice
		Teaching organization
		Application of teaching tools
		Diversity
		Scientific and advanced nature
		Integration
		Interactivity
	Classroom teaching effect	Classroom atmosphere
		Classroom discipline
		Impartment of knowledge, skills and theory
		Homework assignment
		Completion of teaching goals
		Students' attitudes towards learning
		Student' interest in learning
		Students' participation
		Standard and neat languages
	Teaching ability	Teaching attitude
		Preparedness of teaching plans
		Familiarity with textbooks
		Professional knowledge
		Charisma
		Teaching and expression skills
		Reasonable proportion of teachers and students
		Reasonable academic structure
	Teaching results	Teaching and research projects
		Base and textbook construction
		Works, papers and patents
		Merit rate and pass rate of students
		Social satisfaction
		Number of awards
		Cultivation of innovation and problem-solving ability
		Cultivation of thinking and exploration ability
	Teaching management mechanism and construction of the mechanism	System construction
		System implementation
		Institutional settings
		Management and service abilities
		Concept construction
		Teaching reform ability

Table 4 – Classroom Teaching Performance Evaluation Index System of Ideological and Political Education

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5. Classroom Teaching Performance Evaluation Model of Ideological and Political Education Based on TOPSIS and Triangle Fuzzy Number

5.1. Basic Model of Triangular Fuzzy Number

Suppose A is the fuzzy number on the real number field R, $x \in R$, if the fuzzy membership function $u_A(x)$ of the fuzzy number A satisfies the following formula:

$$u_A(x) = \begin{cases} (x - a^L)/(a^M - a^L) & a^L \le x \le a^M \\ 0 & x \ge a^U \vee x \le a^L \\ (a^U - x)/(a^U - a^M) & a^M \le x \le a^U \end{cases} \tag{1}$$

Then

$$A = (a^L, a^M, a^U),\ a^L \le a^M \le a^U \tag{2}$$

is called the triangular fuzzy number on the real number field R. $[a^L, a^U]$ represents the fuzzy range of the triangular fuzzy number. The bigger the range is, the stronger the fuzzy degree is.

See Figure 1 for the distribution of fuzzy membership function of triangular fuzzy number A.

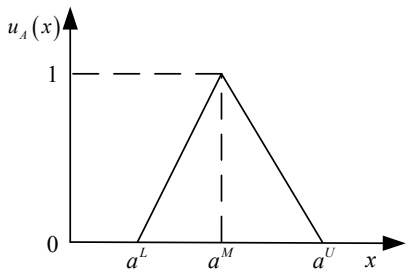

Figure 1 - Distribution of Fuzzy Membership Function of Triangular Fuzzy Number A

If there are $A = (a^L, a^M, a^U)$, $a^L \le a^M \le a^U$, and real number $k \in R$, the multiplication of triangular fuzzy number is expressed as:

$$k * A = k * (a^L, a^M, a^U) = (k * a^L, k * a^M, k * a^U) \tag{3}$$

If there are $A = (a^L, a^M, a^U)$, $a^L \le a^M \le a^U$, and $B = (b^L, b^M, b^U)$, $b^L \le b^M \le b^U$, the multiplication of triangular fuzzy number is expressed as:

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$$A*B=\left(a^L,a^M,a^U\right)*\left(b^L,b^M,b^U\right)=\left(a^L*b^L,a^M*b^M,a^U*b^U\right) \tag{4}$$

The division of triangular fuzzy number is expressed as:

$$A/B=\left(a^L,a^M,a^U\right)/\left(b^L,b^M,b^U\right)=\left(a^L/b^U,a^M/b^M,a^U/b^L\right) \tag{5}$$

If there are $A=\left(a^L,a^M,a^U\right)$, $a^L\le a^M\le a^U$, and $B=\left(b^L,b^M,b^U\right)$, $b^L\le b^M\le b^U$, the similarity of triangular fuzzy number $S(A,B)$ is:

$$S(A,B)=\left(\frac{a^L*b^L+a^M*b^M+a^U*b^U}{max\left(\left(a^L\right)^2+\left(a^M\right)^2+\left(a^U\right)^2,\left(b^L\right)^2+\left(b^M\right)^2+\left(b^U\right)^2\right)}\vee\frac{min\left(\left(a^L\right)^2+\left(a^M\right)^2+\left(a^U\right)^2,\left(b^L\right)^2+\left(b^M\right)^2+\left(b^U\right)^2\right)}{a^L*b^L+a^M*b^M+a^U*b^U}\right) \tag{6}$$

5.2. Construction of Triangular Fuzzy Number Matrix

Suppose P experts are invited to evaluate the performance of m evaluation objects with n indices, the triangular fuzzy number value of the k-th expert on the j-th index of the i–th object is $A_{ij}(k)=\left(a_{ij}^L(k),a_{ij}^M(k),a_{ij}^U(k)\right)$. Specifically, $a_{ij}^L(k)$, $a_{ij}^M(k)$ and $a_{ij}^U(k)$ respectively represents the lower limit, the most possible value and the upper limit of the fuzzy value of the k-th expert on the j-th index of the i–th object.

A_{ij}, the triangular fuzzy number value of the j-th index of the i–th object is expressed as:

$$A_{ij}=\left(a_{ij}^L,a_{ij}^M,a_{ij}^U\right)=\frac{1}{P}\left(\sum_{k=1}^{P}a_{ij}^L(k),\sum_{k=1}^{P}a_{ij}^M(k),\sum_{k=1}^{P}a_{ij}^U(k)\right) \tag{7}$$

Then, the triangular fuzzy number matrix $\mathbf{A}$ of classroom teaching performance evaluation of ideological and political education is expressed as:

$$\mathbf{A}=\begin{bmatrix} A_{11} & \cdots & A_{1j} & \cdots & A_{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ A_{i1} & \cdots & A_{ij} & \cdots & A_{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ A_{m1} & \cdots & A_{mj} & \cdots & A_{mn} \end{bmatrix}_{mxn} \tag{8}$$

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5.3. Normalization

To set up a unified standard for various indices, it is necessary to normalize various types of indices in the process of classroom teaching performance evaluation of ideological and political education.

If the j-th index is a benefit-type index, the value $\bar{r}_{ij}$ of the j-th index of the i-th evaluation object after normalization is:

$$\bar{r}_{ij} = \left(r_{ij}^{L}, r_{ij}^{M}, r_{ij}^{U}\right) = \left(a_{ij}^{L}, a_{ij}^{M}, a_{ij}^{U}\right) / \max_{1 \le i \le m}(A_{ij}) \tag{9}$$

If the j-th index is a cost-type index, the value $\bar{r}_{ij}$ of the j-th index of the i-th evaluation object after normalization is:

$$\bar{r}_{ij} = \left(r_{ij}^{L}, r_{ij}^{M}, r_{ij}^{U}\right) = \min_{1 \le i \le m}(A_{ij}) / \left(a_{ij}^{U}, a_{ij}^{M}, a_{ij}^{L}\right) \tag{10}$$

The normalized triangular fuzzy number matrix R of the classroom teaching performance evaluation of ideological and political education is expressed as:

$$R = \begin{bmatrix} \bar{r}_{11} & \cdots & \bar{r}_{1j} & \cdots & \bar{r}_{1n} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \bar{r}_{i1} & \cdots & \bar{r}_{ij} & \cdots & \bar{r}_{in} \\ \vdots & \cdots & \vdots & \cdots & \vdots \\ \bar{r}_{m1} & \cdots & \bar{r}_{mj} & \cdots & \bar{r}_{mn} \end{bmatrix}_{mxn} \tag{11}$$

5.4. Construction of Ideal Solutions

Based on the normalized triangular fuzzy number matrix R, the positive ideal and negative ideal solutions are constructed respectively.

The positive ideal solution g_j^{+} of the j –th index is:

$$g_j^{+} = \left(g_j^{+L}, g_j^{+M}, g_j^{+U}\right) = \left(\max_{1 \le i \le m}\left(r_{ij}^{L}\right), \max_{1 \le i \le m}\left(r_{ij}^{M}\right), \max_{1 \le i \le m}\left(r_{ij}^{U}\right)\right) \tag{12}$$

The negative ideal solution g_j^{-} of the j –th index is:

$$g_j^{-} = \left(g_j^{-L}, g_j^{-M}, g_j^{-U}\right) = \left(\min_{1 \le i \le m}\left(r_{ij}^{L}\right), \min_{1 \le i \le m}\left(r_{ij}^{M}\right), \min_{1 \le i \le m}\left(r_{ij}^{U}\right)\right) \tag{13}$$

5.5. TOPSIS Model of Triangular Fuzzy Number Based on Similarity

The similarity between the performance evaluation object and the ideal solution is calculated according to the triangular fuzzy value of the normalized object on each index.

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The triangular fuzzy similarity $S_{ij}^{+}\left(\bar{r}_{ij},g_j^{+}\right)$ between the i–th object on the j–th index and the positive ideal solution g_j^{+} is:

$$S_{ij}^{+}\left(\bar{r}_{ij},g_j^{+}\right)=\left(\frac{r_{ij}^{L}*g_j^{+L}+r_{ij}^{M}*g_j^{+M}+r_{ij}^{U}*g_j^{+U}}{max\left(\left(r_{ij}^{L}\right)^2+\left(r_{ij}^{M}\right)^2+\left(r_{ij}^{U}\right)^2,\left(g_j^{+L}\right)^2+\left(g_j^{+M}\right)^2+\left(g_j^{+U}\right)^2\right)}\vee\frac{min\left(\left(r_{ij}^{L}\right)^2+\left(r_{ij}^{M}\right)^2+\left(r_{ij}^{U}\right)^2,\left(g_j^{+L}\right)^2+\left(g_j^{+M}\right)^2+\left(g_j^{+U}\right)^2\right)}{r_{ij}^{L}*g_j^{+L}+r_{ij}^{M}*g_j^{+M}+r_{ij}^{U}*g_j^{+U}}\right) \tag{14}$$

The triangular fuzzy similarity $S_{ij}^{-}\left(\bar{r}_{ij},g_j^{-}\right)$ between the i–th object on the j–th index and the negative ideal solution g_j^{-} is:

$$S_{ij}^{-}\left(\bar{r}_{ij},g_j^{-}\right)=\left(\frac{r_{ij}^{L}*g_j^{-L}+r_{ij}^{M}*g_j^{-M}+r_{ij}^{U}*g_j^{-U}}{max\left(\left(r_{ij}^{L}\right)^2+\left(r_{ij}^{M}\right)^2+\left(r_{ij}^{U}\right)^2,\left(g_j^{-L}\right)^2+\left(g_j^{-M}\right)^2+\left(g_j^{-U}\right)^2\right)}\vee\frac{min\left(\left(r_{ij}^{L}\right)^2+\left(r_{ij}^{M}\right)^2+\left(r_{ij}^{U}\right)^2,\left(g_j^{-L}\right)^2+\left(g_j^{-M}\right)^2+\left(g_j^{-U}\right)^2\right)}{r_{ij}^{L}*g_j^{-L}+r_{ij}^{M}*g_j^{-M}+r_{ij}^{U}*g_j^{-U}}\right) \tag{15}$$

In consideration of the weight w_j of the j–th index, the weighted similarity S_i^{+} between the i–th object and the positive ideal solution g_j^{+} is:

$$S_i^{+}=\sum_{j=1}^{n}\left(w_j*S_{ij}^{+}\left(\bar{r}_{ij},g_j^{+}\right)\right) \tag{16}$$

The weighted similarity S_i^{-} between the i–th object and the negative ideal solution g_j^{-} is:

$$S_i^{-}=\sum_{j=1}^{n}\left(w_j*S_{ij}^{-}\left(\bar{r}_{ij},g_j^{-}\right)\right) \tag{17}$$

And the weighted similarity S_i between the i–th object and the ideal solution is:

$$S_i=\frac{S_i^{-}}{S_i^{+}+S_i^{-}} \tag{18}$$

According to the value of comprehensive weighted similarity S_i, identify the best performance evaluation object.

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6. Conclusion

This paper firstly analyzes the problems existing in the classroom teaching of ideological and political education in colleges and universities and in the classroom teaching performance evaluation process, and discusses some basic characteristics of the current classroom teaching performance evaluation of ideological and political education. On this basis, this paper analyzes the key links of classroom teaching performance evaluation of ideological and political education and establishes corresponding evaluation index system. Finally, this paper establishes a classroom teaching performance evaluation model of ideological and political education based on TOPSIS and fuzzy evaluation model which can quantitatively analyze the classroom teaching performance evaluation of ideological and political education.

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An AHP-based fuzzy evaluation model of the effectiveness of ideological and political education in colleges and universities

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Abstract: The position of ideological and political education (IPE for short) as a key part of higher education means that a scientific evaluation on its effectiveness is of great significance. First, a discussion was conducted in this paper on the multi-target, multi-faceted, multi-angle, and multi-channel evaluation methods of college IPE. With this framework, we determined the principles of evaluation index selection, on whose basis a corresponding evaluation system was established from the perspectives of IPE quality, IPE reform, investment of software and hardware basis, and IPE output as well. Finally, by referring to fuzzy theories, we built up an AHP-based fuzzy evaluation model of IPE effectiveness in colleges and universities, which served as an efficacious support for the implementation of IPE in campus.

Keywords: Colleges and universities; Ideological and political education; Effectiveness; AHP; Fuzzy evaluation model

1. Introduction

IPE effectiveness denotes the actual effect that IPE achieves under the actual situations of the society, the school and in-school students by being conducted according to required education purposes and education development plannings (Xu, 2010; Zhang and Liu, 2011). During the process of IPE effectiveness evaluation, it is necessary to integrate a variety of means and methods to assess the actual effect, so as to enhance the ability and level of IPE in campus (Du and Chen, 2015; Zhang, 2011; Wang, 2013). This important link of overall quality education has received more and more attention. Accordingly, a series of research findings has been attained in terms of IPE mode, content, concept, objective, methods, means, mechanism and evaluation, which well backs up college IPE improvement (Wang, 2012; Xu, 2014; Xu and Gao, 2014; Li, 2014; Maritza et al., 2016). Especially with social development and progress, the demand for better fostering talents of high caliber has increasingly highlighted the importance of IPE effectiveness evaluation. They provide the authorities in school with a rapid and effective way to improve IPE quality. Simultaneously, they serve as a significant motive power for the cultivation of advanced talents in terms of comprehensive quality, which meets the needs of social development and promotes social progress (Li, 2012; Li and Ou, 2015;

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Xu, 2010). The evaluation process is contingent upon multiple influential factors, and is accompanied by different standards and requirements for IPE effectiveness in the developing era of today. Given this, in order to render IPE effectiveness analysis more scientific and rational, we updated the IPE effectiveness evaluation index system with several modifications, and used the fuzzy theory (Silva et al., 2014; Lim and Chan, 2015; Lino et al., 2016) to establish an IPE effectiveness fuzzy evaluation model.

2. An analysis of IPE effectiveness for college students

Type	Content
Multi-objective evaluation mode	Recognition of evaluation targets may vary with evaluators. IPE effectiveness evaluation should take a comprehensive account of the evaluation standards of different possible carriers such as the society, the school, units, families and individuals.
Multi-level evaluation mode	Due to recognition limitations and discrepancies between evaluation standards, single-level evaluation always fails to convey the objectiveness of evaluation results. Accordingly, it is necessary to evaluation IPE effectiveness by combined means of self-evaluation, mutual evaluation, expert evaluation and so on.
Multi-faceted evaluation mode	The result of single-type IPE effectiveness evaluation may have limitations and deviate greatly from actual results. Therefore, multi-faceted analysis is a necessity. This evaluation model not only takes IPE implementation output into consideration, but emphasizes more on the implementation itself, the pre-phase planning and preparation as well as different expression forms of IPE themes and contents
Multi-channel evaluation mode	The process of IPE effectiveness evaluation features a combination of quantitative factors, qualitative factors, fuzzy information, and accurate information. They need to be addressed through different effective means and approaches like questionnaire survey, data statistics, expert assessment, panel discussion, interview, and field investigation and practice.

Table 1 – The mode of IPE effectiveness evaluation for college students

Considering the complexity and multi-factor feature manifested during the process of IPE effectiveness evaluation, we hold that against the present background of social development, the methods of IPE effectiveness evaluation should be adopted with a variety of objectives, levels, perspectives and/or channels. Table 1 lists their specified forms.

3. The IPE effectiveness evaluation index system

3.1. Principles of index selection

Through analysis and summarization, we suggested to adopt the following basic principles of index selection as a guarantee for further reliability, creditability and precision of final output. Corresponding details are shown in Table 2.

3.2. Establishment of the hierarchically structured index system

Under the guidance of the above principles, we build up the hierarchically structured evaluation index system from the perspectives of IPE quality, IPE reform, investment of software and hardware basis, IPE output, and IPE ability as well.

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Principle	Content
Scientificity	Evaluation index selection should conform to the scientific outlook on development. The evaluation conducted on IPE effectiveness for college students with indices selected should be scientific and proper in a way that reflects the essence of IPE effectiveness evaluation.
Social guidance	Evaluation index selection should follow the pace of social development and the overall planning of policies and guidelines. Indices should be able to guide public opinions in the society, and contribute to social stabilization and the promotion of coordinated development.
Comprehensiveness	Evaluation indices should be selected on the premise of multiple facets, multiple levels and multiple dimensions. Different factors influencing the process of evaluation should be considered comprehensively, with primary and secondary sequences be clarified. This is aimed at ensuring the wholeness and integrity of the evaluation process.
To reflect the characteristics of times	Evaluation index selection should be a combination of dynamic and static process that complies with the law of development of the era.
measurability	Both quantitative and qualitative evaluation indicators must be transformed into an evaluation index which can be compared and analyzed accurately so as to ensure the accuracy of evaluation results.
Objectivity	In light of guarding against result deviation, evaluation index selection should be more based on objective facts than subject to subjective imagination, fabrication and garbling.
Expansibility	Evaluation indices selected cannot be immutable. Instead, they are open to adjustments and improvements along with social progress.

Table 2 – selection criteria for evaluation indices

1. Embodiment of IPE quality

IPE quality embodiment is a comprehensive reflection of the overall IPE quality, and the corresponding contents are shown in Table 3.

Tier-one index	Tier-two index
IPE quality embodiment	Ideological and political awareness
	Rule of law
	Sense of discipline
	Morality
	Mental health
	quality of social sciences and humanities

Table 3 – IPE quality embodiment

2. IPE reform embodiment

IPE reform embodiment provides strong impetus for IPE ability improvement, and the corresponding contents are listed in Table 4.

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Tier-one index	Tier-two index
IPE core embodiment	Reform of educational concept
	Reform of educational contents
	Reform of educational methods
	Reform of educational means and approaches
	Reform of educational mechanism and systems
	Reform of educational environment

Table 4 – IPE core embodiment

3. Investment of software and hardware basis

Investment of software and hardware basis is a significant measurement standard of pre-phase IPE planning and preparation. The quality and investment of software and hardware basis dominate IPE substructures. Table 5 is the related details.

Tier-one index	Tier-two index
Investment of software and hardware basis	Construction of education staff
	Mechanisms, rules and regulations of management and assessment
	Institution setting and leadership mechanism
	Construction of IPE talent-fostering plan
	campus culture
	Investment in infrastructures
	IPE content teaching
	development of social practice
	Improving educational environment
	Student work management
	Service and security embodiment

Table 5 – Investment of software and hardware basis

4. IPE result embodiment

IPE result embodiment denotes a form of output embodiment during the implementation of IPE, focusing on the investigation of teaching and learning results. Table 6 is the details.

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Tier-one index	Tier-two index
IPE result embodiment	Pass rate
	Excellence rate
	The number of core IPE papers
	The number of IPE-related teaching and scientific research projects
	The number of IPE teaching materials of fine quality
	The number of practice bases
	The number of awarded IPE
	The size of students' IPE knowledge pool

Table 6 – IPE result embodiment

Tier-one index	Tier-two index
IPE ability embodiment	Social recognition degree
	The acceptance degree of employers
	Approbation degree of authorities in charge
	Student recognition degree
	The capability of social service

Table 7 – IPE ability embodiment

5. IPE ability embodiment

IPE ability embodiment refers to the degree to which different carriers recognize IPE ability. Relative details are listed in Table 7.

4. AHP-based IPE effectiveness fuzzy evaluation model

The triangular fuzzy number (Ban and Coroianu, 2012; Deng, 2010; Wu and Ni, 2011) was employed in this paper to establish the IPE effectiveness evaluation model. In a real number set R, if there exists $0 \le u^l \le u^m \le u^r \in R$, then $\tilde{u}$ ($\tilde{u} = \left[u^l, u^m, u^r\right]$ (1)) is a triangular fuzzy number of this set, where u^l, u^m, u^r denote the respective lower bound, median and the upper bound of $\tilde{u}$.

The corresponding fuzzy membership function $f_u(x)$ is expressed as

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$$f_u(x)=\begin{cases}\dfrac{x-u^l}{u^m-u^l} & u^l \le x \le u^m \\ 0 & x \notin \left[u^l, u^r\right] \\ \dfrac{u^r-x}{u^r-u^m} & u^m \le x \le u^r\end{cases} \tag{1}$$

Whose structure map is shown in Figure 1.

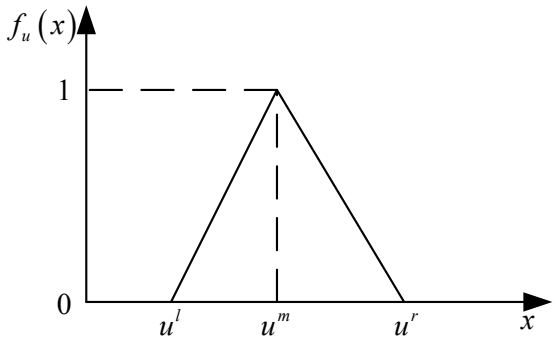

Figure 1 – the fuzzy membership function of $\tilde{u}$

In particular, when $u^l<u^m=u^r$, $f_u(x)$ is the upper bound fuzzy membership function, i.e.

$$f_u(x)=\begin{cases}0 & x \le u^l \\ \dfrac{x-u^l}{u^m-u^l} & u^l \le x \le u^m \\ 1 & x \ge u^r = u^m\end{cases} \tag{3}$$

Whose structure drawing is shown in Figure 2.

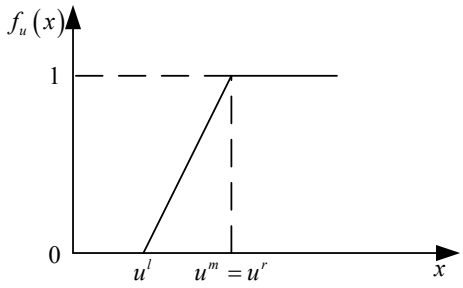

Figure 2 – the upper bound fuzzy membership function of $\tilde{u}$

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When $u^l=u^m<u^r$, $f_u(x)$ is the lower bound fuzzy membership function, i.e.

$$f_u(x)=\begin{cases}1 & x\le u^l=u^m\\ \dfrac{u^r-x}{u^r-u^m} & u^m\le x\le u^r\\ 0 & x\ge u^r\end{cases} \tag{4}$$

Whose structure drawing is shown in Figure 3.

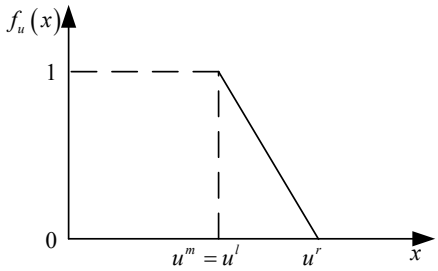

Figure 3 – the lower bound fuzzy membership function of $\tilde{u}$

4.1. Initial data processing

Assuming that there are m IPE evaluation carriers and m evaluation indices, and that the j-related triangular fuzzy number magnitude of the ith objective is $\widetilde{u_{ij}}=\left[u_{ij}^l,u_{ij}^m,u_{ij}^r\right]$.

Different types of indicators tend to have different dimensions. Given this, in order to ensure the effectiveness, reliability and accuracy of IPE effectiveness evaluation, it is necessary to process indices with uniform scaling.

If the jth index is a positive indicator, then the uniformly scaled magnitude $\widetilde{v_{ij}}$ is

$$\widetilde{v_{ij}}=\left[v_{ij}^l,v_{ij}^m,v_{ij}^r\right]=\left[\frac{u_{ij}^l}{u_{ij}^{l\Delta}},\frac{u_{ij}^m}{u_{ij}^{m\Delta}},\frac{u_{ij}^r}{u_{ij}^{r\Delta}}\right] \tag{5}$$

In which

$$\begin{cases}u_{ij}^{l\Delta}=\max\limits_{1\le i\le m}\left(u_{ij}^l\right)\\ u_{ij}^{m\Delta}=\max\limits_{1\le i\le m}\left(u_{ij}^m\right)\\ u_{ij}^{r\Delta}=\max\limits_{1\le i\le m}\left(u_{ij}^r\right)\end{cases} \tag{6}$$

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If the jth index is a negative indicator, then the uniformly scaled magnitude $\widetilde{v_{ij}}$ is

$$\widetilde{v_{ij}} = \left[v_{ij}^{l}, v_{ij}^{m}, v_{ij}^{r} \right] = \left[\frac{u_{ij}^{l\nabla}}{u_{ij}^{l}}, \frac{u_{ij}^{m\nabla}}{u_{ij}^{m}}, \frac{u_{ij}^{r\nabla}}{u_{ij}^{r}} \right] \tag{7}$$

Where

$$\begin{cases} u_{ij}^{l\nabla} = \min\limits_{1 \le i \le m} \left(u_{ij}^{l} \right) \\ u_{ij}^{m\nabla} = \min\limits_{1 \le i \le m} \left(u_{ij}^{m} \right) \\ u_{ij}^{r\nabla} = \min\limits_{1 \le i \le m} \left(u_{ij}^{r} \right) \end{cases} \tag{8}$$

4.2. Triangular fuzzy distances

In order to optimize multiple IPE effectiveness evaluation targets, it is necessary to construct a reasonable selection criterion. In this paper, the maximum value of each evaluation target with respect to the index is selected as the reference, i.e.

$$\widetilde{v_{j}^{\max}} = \left[\max_{1 \le i \le m} \left(v_{ij}^{l} \right), \max_{1 \le i \le m} \left(v_{ij}^{m} \right), \max_{1 \le i \le m} \left(v_{ij}^{r} \right) \right] \tag{9}$$

We construct a base scheme $\widetilde{V}$ that covers all indices, i.e.

$$\widetilde{V} = \left\{ \widetilde{v_{1}^{\max}}, \cdots, \widetilde{v_{j}^{\max}}, \cdots, \widetilde{v_{n}^{\max}} \right\} \tag{10}$$

The j-related triangular fuzzy distance $\widetilde{D_{ij}}$ between the ith target and the scheme $\widetilde{V}$ is

$$\begin{aligned} \widetilde{D_{ij}} &= D\left(\widetilde{v_{ij}}, \widetilde{v_{j}^{\max}} \right) = \left\| \widetilde{v_{ij}} - \widetilde{v_{j}^{\max}} \right\| \\ &= \sqrt{\frac{(\max\limits_{1 \le i \le m}\left(v_{ij}^{l} \right) - v_{ij}^{l})^2 + (\max\limits_{1 \le i \le m}\left(v_{ij}^{m} \right) - v_{ij}^{m})^2 + (\max\limits_{1 \le i \le m}\left(v_{ij}^{r} \right) - v_{ij}^{r})^2}{3}} \end{aligned} \tag{11}$$

4.3. AHP-based weight obtainment

In this paper, we use the analytic hierarchy process to calculate index weight. The steps are:

1. Select evaluation indices according to evaluation targets and establish the index set.
2. Grade indices in the form of expert assessment, and accordingly obtain the initial evaluation matrix A.

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$$\mathbf{A} = \left[a_{ij} \right]_{nxn} \tag{12}$$

Where a_{ij} is the j-related weight of index I, and there satisfies $a_{ij}=1/a_{ji}$.

3. Normalize rows in evaluation matrix A, i.e.

$$\overline{a}_{ij} = a_{ij} / \sum_{i=1}^{n} a_{ij} \tag{13}$$

4. Conduct sum processing on each line of the normalized evaluation matrix A, i.e.

$$\overline{w}_j = \sum_{i=1}^{n} \overline{a}_{ij} \tag{14}$$

5. Normalize the acquired sum results to obtain the index weight, i.e.

$$w_j = \overline{w}_j / \sum_{j=1}^{n} \overline{w}_j = \sum_{i=1}^{n} \overline{a}_{ij} / \sum_{j=1}^{n} \overline{w}_j \tag{15}$$

6. Obtain the largest eigenvalue of the evaluation matrix A, i.e.

$$\lambda_{\max} = \sum_{j=1}^{n} \frac{(AW)_i}{nW_i} \tag{16}$$

7. conduct consistency test on the evaluation matrix A, i.e.

$$\begin{cases} CI = \dfrac{\lambda_{\max} - n}{n-1} \\ CR = CI / RI \end{cases} \tag{17}$$

Where *RI* magnitude is obtainable by checking look-up tables. If $CR \le 0.1$, the evaluation matrix A is well consistent, which means that the weight assignment result is acceptable; or else a re-distribution is required.

4.4. Model and algorithm implementation

The *j*-related closeness degree $\widetilde{\tau_{ij}}$ between the ith evaluation target and the scheme $\widetilde{V}$ is

$$\widetilde{\tau_{ij}} = 1 - \widetilde{D_{ij}} \tag{18}$$

In consideration of index weight, the weighed closeness degree $\widetilde{\tau_i}$ between the ith evaluation target and the scheme $\widetilde{V}$ is

$$\widetilde{\tau_i} = \sum_{j=1}^{n} \left(w_j * \widetilde{\tau_{ij}} \right) = \sum_{j=1}^{n} \left(w_j * \left(1 - \widetilde{D_{ij}} \right) \right) \tag{19}$$

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According to the principle of system optimization, the larger the weighed closeness degree $\widetilde{\tau_i}$ is, the better the corresponding evaluation target is. Therefore, the evaluation object with the maximum weighted closeness degree $\widetilde{\tau_i}$ is the optimal one, i.e. the IPE effectiveness is the best.

5. Conclusions

This paper analyzes the effectiveness of the ideological and political education of college students, and discusses the basic principles of index selection during the process of IPE effectiveness evaluation. Meanwhile, under the guidance of the basic principles of index selection, we choose IPE effectiveness evaluation indices and accordingly establish the hierarchically structured evaluation index system. Finally, on the basis of triangular fuzzy numbers, an AHP-based IPE effectiveness evaluation model is built up, serving as an effective support for IPE effectiveness evaluation for college students.

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Research on the Application of Multimedia Technology in Physical Education

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Abstract: Optimization of physical education development cannot be completed overnight, it is required that a variety of techniques and methods should be applied to physical education. Multimedia technology, as an achievement of science and technology research, has played a very important role in the teaching and training of physical education. In this paper, the application of multimedia technology in physical education teaching and training has been analysed and studied.

Keywords: Multimedia technology, Physical education, Control simulation application

1. Introduction

With the popularity of the Internet and the integrated development of computer information technology, campus teaching network belonging to the university itself is becoming more and more developed, more and more students begin to use the Internet to carry out their own learning and related work (Cui, 2014; Salvador & Rocha, 2014). So Network teaching in the daily teaching in colleges and universities is giving full play to its prominent advantage role, with which the applied subject scope is also more and more extensive.

Not only can multimedia network teaching simply make students actively learn to master knowledge and self-explore, but also more cultivate students' creative ability and innovative thinking.

Therefore, the significance of the promotion of multimedia network platform in physical education teaching of colleges and universities is summarized as the following points:

First, the popularization of multimedia network teaching platform in physical education teaching of colleges and universities makes sports teaching resources shared, advantages among different universities can complement each other (Papastergiou, 2009; Quinonez et al., 2016).

Second, the popularization of multimedia network teaching platform in physical education teaching of colleges and universities has broken the traditional concept of students in colleges and universities for physical education, which makes understanding

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and learning on physical education of the students in colleges and universities reach a new height.

Third, the popularization of multimedia network teaching platform in physical education teaching of colleges and universities has broken through the traditional geographical limitations, which is not limited to the school, we can also take PE learning home (Wang, 2014), to the community and even to any place where there is a network.

Fourth, the popularization of multimedia network teaching platform in physical education teaching of colleges and universities can effectively integrate the most advanced multimedia technology (such as: sound, image, text, pictures, graphics, animation), and can realize the simulation of the real environment (Liu, 2012). The real-time communication and feedback between teachers and students can be carried out through the interaction of multimedia network teaching platform, and the problems can be found, put forward and solved in time.

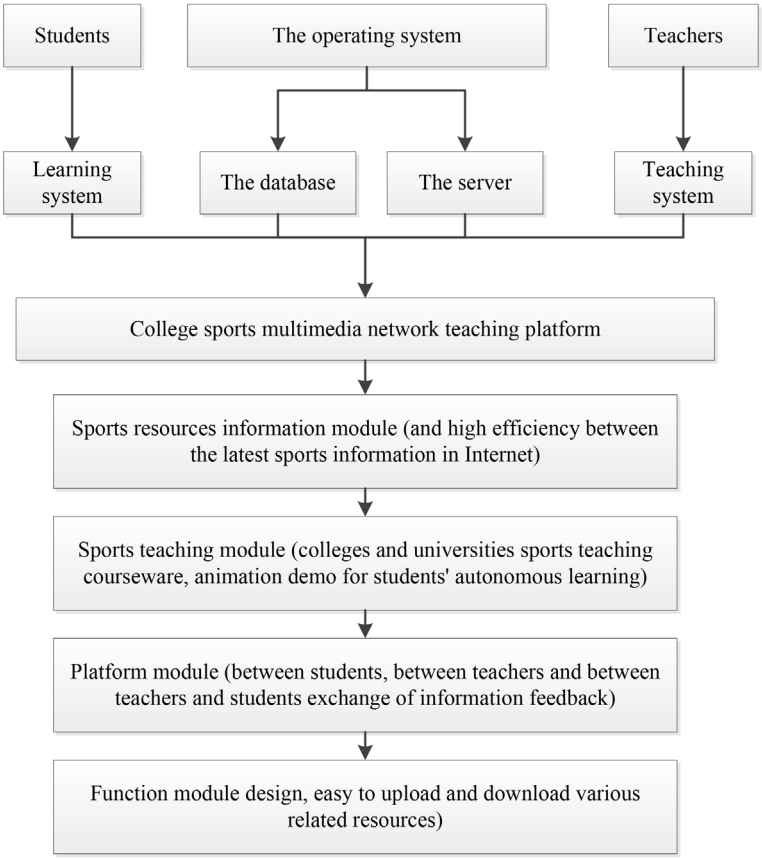

Figure 1 – College sports support environment of multimedia network teaching platform structure

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Fifth, the popularization of multimedia network teaching platform in physical education teaching of colleges and universities is not a substitute for the traditional physical education teaching, but is a powerful supplement and assistance to the traditional physical education teaching. Teachers are the main body in most of the traditional physical education teaching which are carried out generally in the form of classroom and training. So students' autonomous learning and individual learning have been restricted by the field and facilities and teaching materials as well as teaching methods. However, the multimedia network teaching platform provides a powerful information database for students in colleges and universities, in which there is the latest global sports information, the most detailed technical action essentials and the most intuitive motion videos, through the use of interactivity, professional coach and expert's "close fitting" guidance can be achieved. At the same time, the multimedia network teaching platform has broken through the restriction of time and space, students can learn physical education even in out-of-class time, it complements with the traditional teaching method of teaching by words and influence by deeds, and is the development trend of modern PE teaching.

2. Advantages of applying multimedia technology in Physical Education

With the rapid development of information technology, multimedia technology is playing an important role in many fields. The application of multimedia technology in the field of education has greatly improved the quality of teaching. The application of multimedia technology in Physical Education Teaching has a breakthrough in progress, which effectively has solved the problem in teaching that has unsolved for many years, and has developed new teaching methods. The main advantages of applying multimedia technology in physical education teaching are mainly embodied in three aspects (Li, 2014).

2.1. Improvement of students' interest

PE teaching is divided into two parts, namely theory teaching and outdoor sports training. The completion of traditional theory teaching is only by virtue of a teacher's mouth, a piece of chalk, a blackboard, combined with the students' listening to the lecture and making notes. The whole teaching process is boring, uninteresting and has nothing new. In traditional outdoor sports training, teachers' modelling, teachers' explanation and students' practice are taken as the main, normativity and systematic of the whole teaching process are bad and the overall level of physical education teaching is low, not achieving the purpose of the physical education. The multimedia technology is applied to physical education teaching, through the expansion of audio-visual information, high-tech expression, students' visual sense and hearing can be stimulated, effectively attracting students' attention, which makes the students focus on images, three-dimensional animation and video created by multimedia technology and other rich content of the teaching of physical education. And it makes PE teaching visualizing and three-dimensional, as a result, effectively increasing students' interest and motivating students to learn physical education from passivity to initiative (Zhang, 2014). The application of multimedia technology

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can stimulate students' interest in learning, improve students' theoretical knowledge on physical education as well as physical education, and can encourage students to have a healthy body and mind.

2.2. Improvement of the learning effects

The application of multimedia technology in physical education has played an important role, which is particularly evident in improving the learning effects. In the course of physical education teaching, the video, pictures, audio and other courseware's related to physical education made by multimedia technology are applied to physical education teaching, the vivid and visual courseware's are used to attract the attention of students (Zhang, 2014); through the courseware, a variety of sports will be three-dimensionally shown to the students, instead of teachers' speaking, which can make students much easier to master the way and essentials of sports. The multimedia technology is used to carry out physical education, so the learning of physical education knowledge and training have been greatly improved, and learning effects are remarkable (Ying, 2016).

2.3. Effective combination of multimedia and physical education teaching

In physical education have always maintained the traditional teaching methods, and "cramming" teaching method is treated as the main, its scientific, innovation and pioneering are not strong. With the continuous development of economy in our country, education is taken as an important means of China's long-term development, so constantly improving the quality of teaching is one of the goals of every school. As one of the advanced scientific and technological achievements, multimedia technology is playing an important role in improving the quality of teaching, the application in the teaching of physical education can avoid many kinds of adverse factors in the teaching process, such as teachers' traditional teaching idea, the limited resources of the school, single teaching mode, etc. The specific application of multimedia technology in physical education teaching is based on the traditional

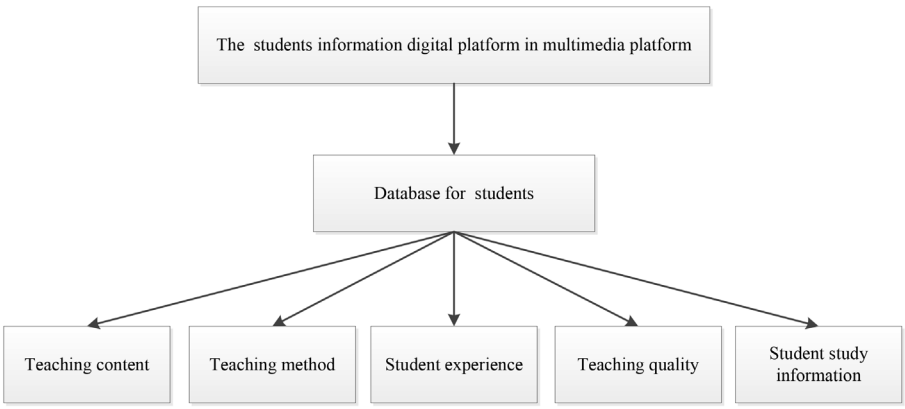

Figure 2 – The students information digital platform in multimedia platform

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teaching mode, reasonable application of science and technology can make up for the shortcomings and disadvantages in traditional teaching, improving the effectiveness of physical education somewhat.

3. Application of multimedia technology in the teaching of physical education

Application of multimedia technology in physical education teaching is mainly shown as follows:

3.1. Animation applications

Applying multimedia technology to make animation is one of the major characteristics of this technology. The characteristics of multimedia technology shall be applied in physical education teaching, the production of teaching courseware can be completed through animation, which can encourage students, at the time of learning the theoretical knowledge of physical education, in the form of vivid animation, to acquire the teaching content shown by means of the movement, rotation, frame, slow, play, flicker, colour changes of graphics and animation combined with the simultaneous interpretation in its specific applications, enhancing the teaching effect. The expression of the teaching content through the form of animation can not only attract the students' attention, but also PE knowledge can be deeply imprinted in the minds of students, as a result, improving the students' PE knowledge level.

3.2. Applications of video, audio, images and other materials

It is a very common situation that video, audio, images and other materials are applied in multimedia technology. In the course of physical education teaching, these common materials in multimedia technology are applied to optimize the teaching content, greatly improving the teaching level of physical education. In the teaching of physical education, the specific application of audio, video, pictures and other materials of multimedia technology is that the teacher, according to the needs of physical education will make the movie and video related to the PE knowledge or online related information into teaching courseware's with teaching meaning through multimedia materials and use them in the classroom. When telling PE knowledge in the class, the teacher can further describe it through the application of the courseware consisting of video, audio, images, etc., improving the teaching effectiveness.

3.3. Control simulation application

By using multimedia technology to achieve control simulation sports events, sports events to learn in sports classes are correctly acted out through the control simulation, which can contributes to students' grasping the standard operation of sports. In physical education teaching, teaching students to grasp the standard sports posture will lay a foundation for the follow-up sports training. Application of multimedia technology to achieve control simulation demonstration has fully expressed the relevant elements of the technical action and sports performance.

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4. Application of multimedia technology in physical education training

4.1. Application of multimedia technology to optimize the demonstration link of sports events

Demonstration is a kind of method often used in physical education teaching, it is that the teacher exercises the sports action to the student, which makes the students have an intuitive impression on the sports action, so that students can imitate and learn. In sports training, the Demonstration has a variety of types, such as mirror demonstration, demonstration of comparing right with wrong, local action demonstration, etc.. Various types of demonstration have unique characteristics, and the difficulty is different, teachers' choice of demonstration method may not achieve the desired objectives, students are not able to fully grasp the correct standard action steps and action essentials (Zhenrui, 2016). In demonstration link of sports, the multimedia technology should be applied to improve the standard of demonstration. Because the application of three-dimensional images and synchronous interpretation materials in the media technology can reasonably show a variety of sports actions. When carrying out the demonstration link of sports in the implementation of sports training, the action of all kinds of sports events

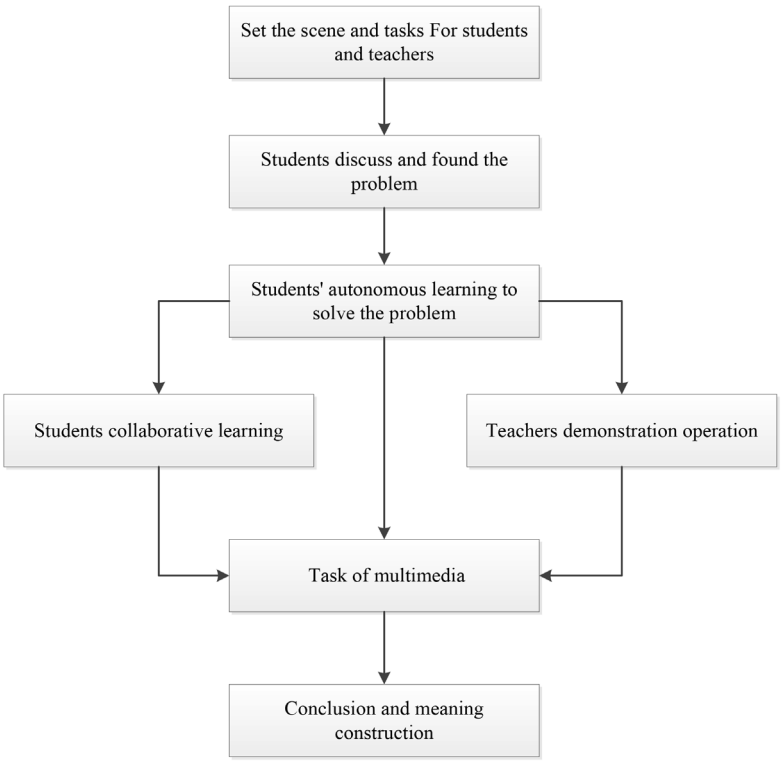

Figure 3 – Teaching modes for multimedia

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can be decomposed, displayed and simultaneously interpreted by three-dimensional image, which can make the students master the action steps and the essentials of the sports events and play a positive role in promoting students' PE training.

4.2. Simulated confrontational exercises

In the process of physical exercise, the method shall be stressed; The confrontational exercise is applied in many sports, which has a great effect on the proficiency level of the improvement of sports. At present, the method of confrontational exercise is to choose an opponent with a certain technical characteristics to practice with, this way of confrontation exercises has a certain limitation, which is difficult to achieve in the absence of opponents. When the multimedia technology is applied to realize simulated implementation of confrontational exercises, its main application mode is to use multimedia technology to simulate the opponent with a certain technology level and the technology type, which can make your opponent have a certain "character" or "technical characteristics". Training personnel can continuously train their ability and level by the tactics that can be demonstrated in the multimedia technology to continuously improve their movement level.

4.3. Test and calculation of applying multimedia to optimize physique

The monitoring and evaluation of physique is the monitoring of the standard degree of sports events of middle school students in physical education. It is one of the essential events to carry out monitoring and evaluation of physique in physical education, by which the level of the physical and mental health of the students can be mastered to assist in the development of follow-up sports. Main contents of monitoring and evaluation of physique include the test of various sports, examination of physical ability of middle school students in medical room, calculation of test results, comprehensive evaluation, etc.. In the process of monitoring and evaluation of physique, it is susceptible to a variety of adverse factors, so the accuracy of monitoring and assessment of physique is difficult to guarantee. Application of multimedia technology can solve various influencing factors of the physique evaluation. Multimedia technology has built a physique model, has analysed possible influencing factors in the process of monitoring and evaluation of physique and has determined the relationship between the physique type and other physique factors. In the course of monitoring and evaluation of the actual students' physique, the application of various influencing factors analysed by the multimedia technology shall be focused on, it shall be ensured as far as possible that the monitoring and evaluation of physique is accurate and reasonable.

4.4. Creation of new technologies and new tactics

Multimedia technology has many functions, such as combination, splicing, transformation and so on, the reasonable application of a variety of materials has made the multimedia technology become a good creation tool. This tool plays an important role in the training of sports events, mainly through which the technical and tactical innovation of sports has been completed. Using multimedia technology to innovate the technology and tactics of sports is mainly to simulate tactics and technology of sports events, after bold combination, splicing, transformation, etc., a variety of different types

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of technology and tactical has been created. In the test of newly-created technologies and tactics, the final results are reasonable and effective. So the application of strong technologies and tactics can contribute to the improvement of the students' sports level.

5. Conclusion

By using multimedia technology to achieve control simulation sports events, sports events to learn in sports classes are correctly acted out through the control simulation, which can contributes to students' grasping the standard operation of sports. In physical education teaching, teaching students to grasp the standard sports posture will lay a foundation for the follow-up sports training. Application of multimedia technology to achieve control simulation demonstration has fully expressed the relevant elements of the technical action and sports performance.

Multimedia technology is the crystallization of the comprehensive development of modern science and technology. Application of multimedia technology has played an important role in strengthening physical education teaching and training, the application of multimedia technology in physical education teaching can improve the level of students' physical education theoretical knowledge, stimulate students' creative ability and dig the potential of students. The application of multimedia technology in physical education training can optimize the demonstration link of sports events, realize simulated confrontational exercises and optimize the test and calculation of physique as well as the creation of new technologies and new tactics. Only if the use of multimedia technology is constantly optimized to carry out physical education teaching and training can the students be better motivated to actively put their hearts into the study of physical education, finally promoting the realization of teaching goal of physical education.

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An Improved Performance Evaluation Index System and Fuzzy Evaluation Model of College Students' Ideological and Political Education

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Abstract: As the key to ensure the quality of higher education, the ideological and political education of college students is of great significance to improving the comprehensive quality and competitiveness of top talents so that they can better service the society and promote social development. Through analysis of the problems in the performance evaluation of college students' ideological and political education, this paper unveils an improved performance evaluation index system and fuzzy evaluation model. Firstly, the author discusses the perspective of constructing the evaluation index system, and outlines the perspective of constructing the performance evaluation index system of ideological and political education; secondly, the author selects evaluation indices by analyzing the principle of index selection, and constructs a hierarchal performance evaluation index system of college students' ideological and political education on the basis of the selected indices; thirdly, based on the theory of fuzzy mathematics, the author establishes a fuzzy evaluation model of college students' ideological and political education which gives full consideration to the evaluation indices, realizing the quantitative analysis of the performance of college students' ideological and political education; finally, the author summarizes the features and looks at the prospects of the evaluation index system and the evaluation model.

Keywords: Colleges, Ideological and political education, Performance analysis, Evaluation index system, Fuzzy evaluation model

1. Introduction

With the rapid social development, the ideological and political performance of top talents is playing an increasingly important role in promoting high-level scientific and technological innovation and social advancement. Therefore, more and more importance is being attached to the ideological and political education of college students. Scholars have carried out research and analysis from multiple angles, presenting many valuable findings (Zhang, 2011; She, 2014; Wu and Zhang, 2014; Li, 2012). As the key to ideological and political education, the ideological and political education performance evaluation of college students charts the course for the models, means and methods of implementing college students' ideological and political education in the future, and improves the level of ideological and political education of college students so that these top talents can

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adapt to social development and serve the society in a better way (Zhang and Liu, 2012; Long, 2013). So far, there has been some research on the performance evaluation of college students' ideological and political education. Achieving fruitful results in the aspects of evaluation systems, strategies and models, the previous research has played a positive role in promoting the ideological and political education of college students (Guo and Li, 2008; Li, 2008; Yang and Wang, 2010; Li and Ou, 2015). However, due to the complexity of performance evaluation, especially the limitations of existing evaluation systems and models emerging with the rapid social development, this paper probes into the a brand new performance evaluation system of college students' ideological and political education, and constructs a corresponding performance evaluation model on the basis of fuzzy mathematics (Chatterjee et al., 2014; Shidpour et al., 2016; Ban and Coroianu, 2015; Maritza et al., 2016; Lino et al., 2016).

2. A New Perspective of Performance Evaluation of College Students' Ideological and Political Education

Previous performance evaluation systems of college students' ideological and political education are often constructed to analyze issues from a single perspective or at a single level. These systems may have some positive effects on the level of ideological and political education. However, their perspectives are too narrow to have a holistic and integrated view of the problems and find a solution to the problems. Lacking completeness and consistency, these evaluation systems can only be applied within limited areas. Ideological and political performance evaluation index system should be constructed in consideration of the theoretical soundness, practical feasibility, and the interaction between the two indices. Besides, it should be noted that these indices are affected by factors like politics, ideology, knowledge reserve, capacity and quality, moral character, mental health, and behavior, and these factors are closely bounded up with a variety of carriers, such as colleges, the society, teachers, students, software, hardware, etc. To make the results of performance evaluation more scientific, objective and accurate, the performance evaluation systems of college students' ideological and political education should be established from a holistic and integrated perspective. To this end, this paper, through comprehensive analysis and reference to the existing research results, provides a new perspective of constructing a performance evaluation system of college students' ideological and political education. See Figure 1.

3. Performance Evaluation Index System of College Students' Ideological and Political Education

3.1. Principles of Index Selection

The performance evaluation indices of college students' ideological and political education should be selected in the following principles:

1. The principle of scientificity: To ensure the scientific nature of the evaluation, the evaluation indices should be selected properly, rationally in accordance with scientific laws.

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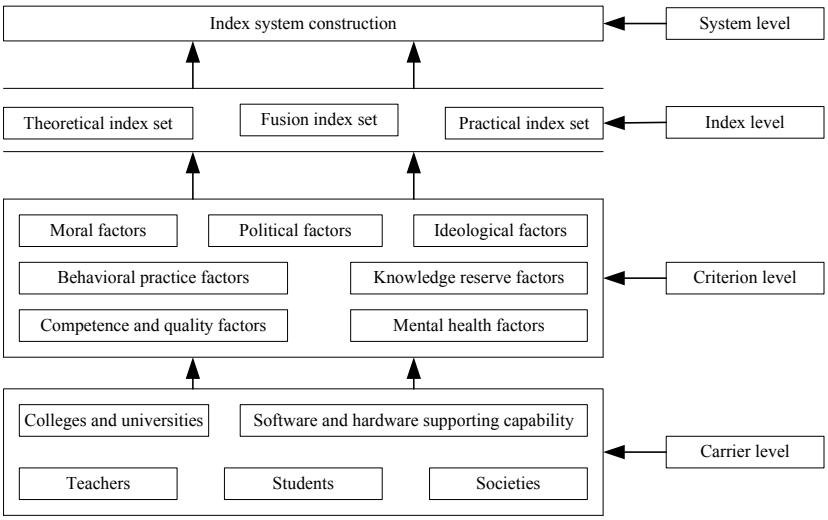

Figure 1 – A New Perspective of Constructing a Performance Evaluation System of Ideological and Political Education

2. The principle of objectivity: To ensure the objectivity and authenticity of the evaluation results, the evaluation indices should be selected in view of the reality and in exclusion of subjective factors.
3. The principle of hierarchy: Since single-level evaluation indices often fail to clearly describe the evaluation contents of complex problems, thus affecting the effectiveness of the evaluation results, the evaluation indices should be rendered into a hierarchical structure to improve the credibility of the evaluation results.
4. The principle of relevance: To effectively improve the accuracy of the evaluation results, the evaluation indices should be selected in consideration of the relevance and integration between difference sets of evaluation indices, achieving a clear, modular representation of the relationship.
5. The principle of integrity and completeness: To make the evaluation results more authentic, the evaluation indices should be selected from the overall perspective. The indices should be consistent, and capable of reflecting the different levels and sides of the overall situation.
6. The principle of operability: To improve the reliability of the evaluation results, the evaluation indices should be selected with the aim to quantify the evaluation results.

3.2. Selection of Evaluation Indices

The performance evaluation indices of ideological and political education are selected from three perspectives, namely the theoretical soundness of ideological and political education, the practical feasibility of ideological and political education, and the integration capacity of ideological and political education.

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The theoretical soundness of ideological and political education mainly focuses on theory teaching, including curriculum setting, demonstration by teaching process, and the teaching effect.

The practical feasibility of ideological and political education mainly focuses on practical teaching, including the planning and implementation of practical activities, and the effect of the practice mode.

The integration capacity of ideological and political education mainly focuses on the interaction between the theoretical soundness and practical feasibility, including the integration of institutional and systematic sophistication, platform construction and execution, the integration of plan implementations, the integration of carriers, and demonstration by integration results.

3.3. Construction of Evaluation Index System

The author further refines the above performance evaluation indices and establishes an improved, hierarchal performance evaluation index system of college students' ideological and political education. See Table 1 for specific contents and hierarchies.

4. Fuzzy Evaluation Model of College Students' Ideological and Political Education

Because of the fuzziness of the performance evaluation indices of college students' ideological and political education, this paper uses the triangular fuzzy numbers (Molinari, 2016; Chandra and Aggarwal, 2015; Liao and Chen, 2015) to build a model for the performance evaluation of college students' ideological and political education.

4.1. The Concept of Triangular Fuzzy Numbers

If $b=\left(b^1,b^2,b^3\right)$, and $0\le b^1\le b^2\le b^3$, $b=\left(b^1,b^2,b^3\right)$ is called a triangular fuzzy number, abbreviated as $\tilde{b}\left(b^1,b^2,b^3\right)$. Its corresponding fuzzy membership function $\theta_b\left(x\right)$ is expressed as:

$$\theta_b\left(x\right)=\begin{cases}0 & x\le b^1\\ \dfrac{x-b^1}{b^2-b^1} & b^1\le x\le b^2\\ \dfrac{b^3-x}{b^3-b^2} & b^2\le x\le b^3\\ 0 & x\ge b^3\end{cases} \tag{1}$$

If there are two triangular fuzzy numbers $\tilde{b}\left(b^1,b^2,b^3\right)$ and $\tilde{a}\left(a^1,a^2,a^3\right)$, the following operation is satisfied:

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Primary Indices	Secondary Indices	Tertiary Indices
Theoretical Soundness	Curriculum Setting	Plan Rationality
		Curriculum Systematicness
		Contemporariness
		Scientific Development
		Clarity of Purpose
	Demonstration by Teaching Process	Teaching Measures
		Teaching Methods
		Teaching Ways and Means
		Teaching Ability
		Teaching Quality and Attitude
		Teaching Contents
	Teaching Effect	Social Satisfaction
		Overall Quality Improvement
		Student Satisfaction
		Actual Progress Against the Plan
Practical Feasibility	Planning of Practical Activities	Rationality
		Scientificity
		Contemporariness
		Expansibility
	Implementation of Practical Activities	Appraisal Mode
		Practical Teaching Contents
		Practice Approaches
		Practice Contents and System
		Practice Management Mechanism
		System of Practice Methods
	Effect of Practical Mode	Practice Quality Improvement
		Practice Ability Improvement
		Practical Innovation Ability
		Social Service Capacity

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Primary Indices	Secondary Indices	Tertiary Indices
Integration Capacity	Integration of Implementation Processes	Scientificity and rationality of Institutional Settings
		Institutional Perfection and Development
		Staffing
		Mission Planning
	Platform Construction	Unity of Theory and Practice
		Construction and Improvement of Excellent Courses
		Quality of Supporting Software and Hardware
		Social Services
	Integration of Plan Implementations	Systematicness
		Innovation
		Effectiveness
		Scientificity
	Integration of Carriers	Consistency
		Adaptability
		Rationality
		Soft and Hard Power Integration
		Internal and External Environment Integration
	Integration Results	Demonstration by Scientific Research Results
		Demonstration by Educational Reform Results
		Rate of Outstanding Talents
		Ideological Improvement
		Political Consciousness Improvement
		Morality Improvement
		Mental Health
		Practicality

Table 1 – Performance Evaluation Index System of College Students' Ideological and Political Education

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1. Addition

$$\tilde{b}+\tilde{a}=\left(b^1+a^1,b^2+a^2,b^3+a^3\right) \tag{2}$$

2. Scalar Multiplication

$$k*\tilde{b}=\left(k*b^1,k*b^2,k*b^3\right) \tag{3}$$

Where, k is a real number.

3. Multiplication

$$\tilde{b}*\tilde{a}=\left(b^1*a^1,b^2*a^2,b^3*a^3\right) \tag{4}$$

4. Division

$$\tilde{b}/\tilde{a}=\left(b^1/a^3,b^2/a^2,b^3/a^1\right) \tag{5}$$

4.2. Triangular Fuzzy Number Normalization for Performance Evaluation Indices

During the performance evaluation of college students' ideological and political education, the diversified indices often have different dimensions. To make effective measurement, these indices should be normalized.

Assuming that the number of performance evaluation objects is *M*, the number of indices of the evaluation is N , and the triangular fuzzy value of the evaluation object i with respect to the index j is $\tilde{v}_{ij}\left(v_{ij}^1,v_{ij}^2,v_{ij}^3\right)$. If the index is a benefit-oriented decision-making index, the normalized triangular fuzzy value is $\tilde{r}_{ij}\left(r_{ij}^1,r_{ij}^2,r_{ij}^3\right)$, i.e.:

$$\tilde{r}_{ij}\left(r_{ij}^1,r_{ij}^2,r_{ij}^3\right)=\left(\frac{v_{ij}^1}{\max\limits_{1\le i\le M}\left(v_{ij}^3\right)},\frac{v_{ij}^2}{\max\limits_{1\le i\le M}\left(v_{ij}^3\right)},\frac{v_{ij}^3}{\max\limits_{1\le i\le M}\left(v_{ij}^3\right)}\right) \tag{6}$$

If the index is a cost-oriented decision-making index, the normalized triangular fuzzy value is $\tilde{r}_{ij}\left(r_{ij}^1,r_{ij}^2,r_{ij}^3\right)$, i.e.:

$$\tilde{r}_{ij}\left(r_{ij}^1,r_{ij}^2,r_{ij}^3\right)=\left(\frac{\min\limits_{1\le i\le M}\left(v_{ij}^1\right)}{v_{ij}^3},\frac{\min\limits_{1\le i\le M}\left(v_{ij}^1\right)}{v_{ij}^2},\frac{\min\limits_{1\le i\le M}\left(v_{ij}^1\right)}{v_{ij}^1}\right) \tag{7}$$

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The above normalization ensures that the triangular fuzzy number $\tilde{r}_{ij}\left(r_{ij}^1, r_{ij}^2, r_{ij}^3\right)$ satisfies the requirement of $0 \le r_{ij}^1 \le r_{ij}^2 \le r_{ij}^3 \le 1$, that is, all triangular fuzzy numbers have a uniform scale, which guarantees the reliability of the analysis results.

4.3. Similarity of Triangular Fuzzy Numbers

After the data statistics and analysis, the author acquires the triangular fuzzy value of different indices. With these indices, the author constructs the initial triangular fuzzy number matrix **V** for the performance evaluation of college students' ideological and political education.

$$\mathbf{V} = \begin{bmatrix} \tilde{v}_{11} & \cdots & \tilde{v}_{1j} & \cdots & \tilde{v}_{1N} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \tilde{v}_{i1} & \cdots & \tilde{v}_{ij} & \cdots & \tilde{v}_{iN} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \tilde{v}_{M1} & \cdots & \tilde{v}_{Mj} & \cdots & \tilde{v}_{MN} \end{bmatrix} \tag{8}$$

After normalization, the normalized triangular fuzzy number matrix R is obtained:

$$\mathbf{R} = \begin{bmatrix} \tilde{r}_{11} & \cdots & \tilde{r}_{1j} & \cdots & \tilde{r}_{1N} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \tilde{r}_{i1} & \cdots & \tilde{r}_{ij} & \cdots & \tilde{r}_{iN} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ \tilde{r}_{M1} & \cdots & \tilde{r}_{Mj} & \cdots & \tilde{r}_{MN} \end{bmatrix} \tag{9}$$

The author selects the maximum value on each row of the triangular fuzzy number matrix R, thus getting the optimal triangular fuzzy values of different indices. The optimal triangular fuzzy numbers of the indices are denoted as $\tilde{u}_{ij}\left(u_{ij}^1, u_{ij}^2, u_{ij}^3\right)$, i.e.

$$\tilde{u}_{ij}\left(u_{ij}^1, u_{ij}^2, u_{ij}^3\right) = \left(\max_{1 \le i \le M}\left(r_{ij}^1\right), \max_{1 \le i \le M}\left(r_{ij}^2\right), \max_{1 \le i \le M}\left(r_{ij}^3\right)\right) \tag{10}$$

Hence, the similarity between the triangular fuzzy value of the evaluation object i with respect to the index j and the optimal triangular fuzzy number $\tilde{u}_{ij}\left(u_{ij}^1, u_{ij}^2, u_{ij}^3\right)$ can be expressed as λ_{ij}^1:

$$\lambda_{ij}^1 = \frac{r_{ij}^1 * u_{ij}^1 + r_{ij}^2 * u_{ij}^2 + r_{ij}^3 * u_{ij}^3}{\max\left[\left(r_{ij}^1\right)^2 + \left(r_{ij}^2\right)^2 + \left(r_{ij}^3\right)^2, \left(u_{ij}^1\right)^2 + \left(u_{ij}^2\right)^2 + \left(u_{ij}^3\right)^2\right]} \tag{11}$$

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Or, the similarity between the triangular fuzzy value of the evaluation object i with respect to the index j and the optimal triangular fuzzy number $\tilde{u}_{ij}\left(u_{ij}^1, u_{ij}^2, u_{ij}^3\right)$ can be expressed as λ_{ij}^2 :

$$\lambda_{ij}^2 = \frac{min\left[\left(r_{ij}^1\right)^2 + \left(r_{ij}^2\right)^2 + \left(r_{ij}^3\right)^2, \left(u_{ij}^1\right)^2 + \left(u_{ij}^2\right)^2 + \left(u_{ij}^3\right)^2\right]}{r_{ij}^1 * u_{ij}^1 + r_{ij}^2 * u_{ij}^2 + r_{ij}^3 * u_{ij}^3} \tag{12}$$

In application, the analyzer can either choose to use one of expression, or obtain a similarity λ_{ij} through comprehensive treatment of the two expressions, i.e.:

$$\lambda_{ij} = \lambda_{ij}^1 + \left(1 - \xi\right) * \lambda_{ij}^2 \tag{13}$$

Where, $0 \le \xi \le 1$.

4.4. Performance Evaluation Model of College Students' Ideological and Political Education

From above, the author obtains γ_i, the similarity between the triangular fuzzy value of each evaluation object with respect to a certain index and the optimal triangular fuzzy number $\tilde{u}_{ij}\left(u_{ij}^1, u_{ij}^2, u_{ij}^3\right)$:

$$\gamma_i = \sum_{j=1}^{N}\left(w_j * \lambda_{ij}\right) \tag{14}$$

Thereby, the author establishes the performance evaluation model of college students' ideological and political education, i.e.;

$$\gamma_{max} = \max_{1 \le i \le M}\left(\gamma_i = \sum_{j=1}^{N}\left(w_j * \lambda_{ij}\right)\right) = \gamma_k \tag{15}$$

k stands for the object with the optimal performance.

4.5. Steps of Model Implementation

To sum up, the model implementation steps can be expressed as follows:

1. In light of the actual situation, select the reasonable evaluation indices targeted at the needs of the performance evaluation of college students' ideological and political education.
2. Obtain the triangular fuzzy value of each performance evaluation object with respect to the indices, forming the initial triangular fuzzy number matrix.
3. Normalize the initial data according to the type of the index and the triangular fuzzy number normalization model, acquiring the normalized triangular fuzzy number matrix $\mathbf{R}$.

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4. Obtain the optimal triangular fuzzy numbers of the indices based on triangular fuzzy number matrix **R** .
5. According to the calculation model for the similarity between triangular fuzzy numbers, obtain the similarity between the triangular fuzzy value of each evaluation object with respect to a certain index and the optimal triangular fuzzy number.
6. Select the appropriate weight acquisition method to determine the weight of different indices.
7. Calculate the comprehensive similarity between different performance evaluation objects with respect to a certain index and the optimal triangular fuzzy number.
8. Based on the performance evaluation model of university students' ideological and political education, analyze the comprehensive similarity and obtain the evaluation object with the best performance.

5. Conclusion and Prospect

This paper has two innovations during the preliminary discussion and the analysis of the performance evaluation of college students' ideological and political education. this main innovation spot manifests in two aspects.

1. From a more scientific, holistic, comprehensive and objective perspective, the author gives a new performance evaluation index system of college students' ideological and political education, and carries out comprehensive analysis of the theoretical soundness, practical feasibility and integration capacity of ideological and political education.
2. To ensure the practicality and reliability of the evaluation results, the author provides an improved fuzzy evaluation model of college students' ideological and political education, and conducts quantitative analysis of performance evaluation indices of various forms and types.

With the rapid social development, the existing evaluation index systems and models of ideological and political evaluation may more or less have limitations. Therefore, the systems and models ought to be improved and developed with the time. Keeping abreast with the times is the only way to effectively promote the capacity and level of ideological and political education.

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Comprehensive Evaluation of Eco - civilized City Construction in Jiangxi Province Based on Projection Pursuit Model

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Abstract: ecological and civilization construction appears to be the inevitable direction of modern urban development. To realize transformation towards ecological civilization, modern cities need to implement constant evaluations during their development. The research considers ecologically-civilized cities as multi-functional, multi-level, and multi-objective objects, establishing the ecological civilization evaluation system by standards of ecological economy, ecological society, ecological environment and ecological culture. This paper measured achievements of 11 cities of Jiangxi Province in ecological construction over the period from 2010-2014 through projection pursuit model based on genetic algorithm. As the outcome reveals, complex indexes of 11 cities are different, which indicate great differences in ecological construction. To be specific, 9 cities neighboring Poyang Lake Ecological Economic Zone perform better in comprehensive evaluation, illustrating promoting effect of the ecological economic zone.

Keywords: Ecological civilization; genetic algorithm; projection pursuit model

1. Introduction

Modern cities are making big strides towards ecological civilization which complies with fundamental requirements of development of human civilization. Ecological construction serves as an optimum approach to eliminate environment threats to humans and solve ecological problems of cities. As ecological civilization is a necessary aspect of sustainable development, China Communist Party stresses its prominent position in the Report to the Eighteenth National Congress of the Communist Party of China. Ecological construction shall be integrated to all aspects of economic, political, cultural and social constructions during the process of building a prosperous country and promoting sustainable development of Chinese people (Cui and Jin, 2014; Hernandez et al., 2016)

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At first, the academic circle regards ecological construction as an important countermeasure against ecological crisis. With development of new urbanization and deterioration of ecological environment, research on ecological civilization keeps on a rise. In researches on ecologically-civilized cities, how to evaluation status and nature of ecological civilization systems has become a major problem (Tang, 2010). Niccolucci introduced the concept of ecological footprint depth in 2008. Chronological records of ecological footprints on such a basis make dynamic prediction of ecological construction achievements much more accurate (Joss, 2011). Pickett proposes applying ecological technologies to sustainable development of ecologically-civilized cities in the background of global urbanization. He focuses on evaluation of green technologies used in ecological construction of modern cities (Pickett, 2015). Index evaluation systems applied to ecological construction mainly refer to two aspects. The first one index system is based on society, economy and nature. The second index system is established on basis of structural and functional coordination of urban ecological civilization system (Liu et al, 2016). To determine indexes of index systems, Ma draws experience from Synergism of Five Laws. He believes synergism is the best way to realize the objective, so he uses predict indexes by fuzzy estimation and ecological civilization index system which gives full consideration to five different factors (Ma, 2009). Wang points out 4 basic implications of natural ecological civilization. He focuses on green GDP while establish the index system. In addition, he attaches great important to ecological environment in terms of weighing of different indexes (Wang, 2012). Some scholars think quantification of indexes should be based on judgement of professionals. Moreover, the standard values can be also inferred by analyzing current situations of international ecologically-civilized cities (Gong et al, 2011).

Continuous exploration of numerous scholars has enriched researches on evaluation of ecological construction achievements of modern cities. Impacted by regional differences and complexity of ecological construction, some cities perform poorly in evaluation of their ecological construction. To be specific, the evaluation systems are unsatisfactory in terms of their extensibility and scientific rationality. In consideration of this problem, evaluation of ecological construction must give consideration to regional differences. Indexes applied to the evaluation shall vary from each other as requirements of dynamic nature. Judging from geological conditions, Jiangxi Province enjoys favorable ecological environment. Green ecology is considered favorable resource for Jiangxi Province. New type urbanization put forward by Jiangxi Province embodies requirements of ecological civilization. This paper studies ecological construction of 11 cities in Jiangxi Province to establish an index system for evaluation of ecologically-civilized cities. Original data between 2010 and 2014 are selected for empirical analysis and quantitative inspection of ecological construction of 11 cities.

2. Evaluation Systems of Ecologically-civilized cities

2.1. Implications of Ecologically-civilized cities

Ecological civilization requires modern cities to achieve the optimum status in terms of natural ecological system and social ecological system. In addition, Ecologically-civilized cities are supposed to realize sustainable development by coordinating economic growth

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and environment protection, material civilization and spiritual civilization, as well as natural ecology and human ecology (Wang, 2015). Ecologically-civilized cities shall meet the following 5 requirements in real sense. First, the cities shall drive development of ecological economy which serves as the foundation for ecological construction. Second, these cities should establish an ecological society by increasing investment to develop social causes, improve social environment, optimize residential environment, boost sustainable growth of population, and promote social ecology. Third, they must build ecological environment and pay attention to natural protection during urban development by coordinating economic growth rate and capacity of natural environment. Efficiency utilization and reasonable protection of natural resources can improve environment quality, environment capacity and natural ecological system of modern cities during their evolution process. Fourth, they must spread ecological culture. Ecological culture represents material and spiritual civilization in the natural and social dimensions. It is the impetus for construction of ecological civilization. Last, these cities should establish ecological systems. In other words, they need to implement and promote ecological construction in form of systems, because systems are effective guarantees for construction of ecologically-civilized cities. Urban transformation towards ecological civilization shall focus on preliminary ecological protection, intermediate production activities, and future living patterns. The transformation process must combine the 3 stages with implications of ecological civilization to establish systems for ecological constructions (Figure 1).

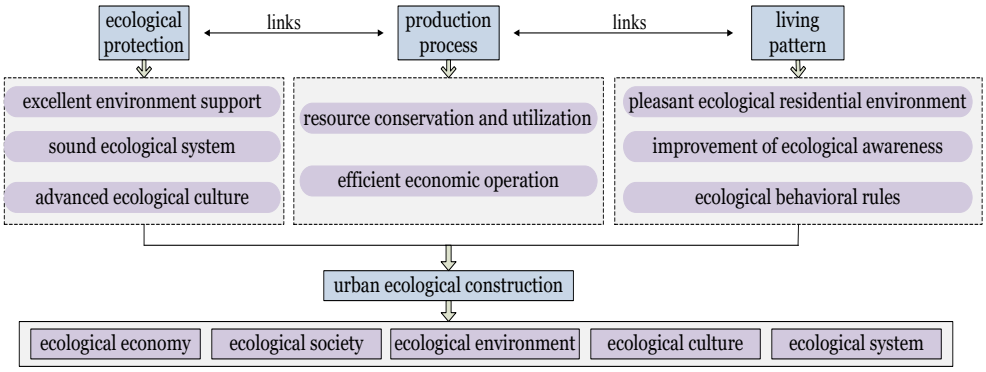

Figure 1 – Systems for Construction of Ecologically-Civilized Cities

2.2. Construction of Evaluations Systems for Ecologically-Civilized Cities

Ecological construction is a problem which involves different domains, various disciplines, and multiple regions. It appears very important for us to build a comprehensive index system for evaluation of urban ecological construction. Based on analysis about current index evaluation system, this paper combiners systematization with comprehensiveness, representativeness with uniqueness, quantification with qualitative determination. As well as practicality with operability, so as to establish an index system for evaluation

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of ecological construction of Jiangxi Province during the process of promoting green ecological development.

As required by implications of ecological civilization, the index system focuses on ecological economy, ecological society, ecological environment, and ecological culture. The 5 decision-making dimensions consist of 19 indexes shown in Table 1.

Objectives	Indexes	Units	Natures
Ecological Economy A	GDP (A1)	Yuan	+
	Proportion of Ecological Industries to GDP (A2)	%	+
	Unit GDP Consumption (A3)	t/10Thousand	-
	Utilization Rate of Ecological Energies (A4)	%	+
Ecological Society B	Urban Population Density (B1)	Person/km2	-
	Engel Coefficient (B2)	-	+
	Gini Coefficient (B3)	-	-
	Employment Rate (B4)	%	+
Ecological Environment C	The Numbers of Days with Standard API (C1)	Day	+
	Noise Control Rate (C2)	%	+
	Harmless Treatment Rate of Household Wastes (C3)	%	+
	Urban Greening Rate(C4)	%	+
	Ecological Land Use Rate (C5)	%	+
Ecological Culture D	Popularity of Ecological Education (D1)	%	+
	Residents' Satisfaction for Ecological Environment (D2)	%	+
	Proportion of Green Products to Consumable Goods (D3)	%	+
Ecological System E	The Number of Laws Concerning Environment Protection (E1)	Item	+
	Proportion of Ecological Environment Proposals (E2)	%	+
	ISO 14000 Certification Rate (E3)	%	+
	Processing Rate of Environment Problems (E4)	%	+

Table 1 – Evaluation System for Construction of Ecologically-Civilized Cities

3. Construction of Project Pursuit Evaluation Model

3.1. Research Areas

The research covers 11 cities of Jiangxi Province, including Nanchang City. Among these cities, Nanchang, Jiujiang, Jingdezhen, Yingtan, Xinyu, Fuzhou, Yichun, Shangrao, and Jian are adjacent to Poyang Lake Ecological Economic Zone. They enjoy favorable

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ecological conditions in developing local ecological industries and building ecology-oriented environment. The other 2 cities are Ganzhou and Pingxiang. As the biggest city in southern area of Jiangxi Province, Ganzhou strives to boost local green industries headed by nonferrous metal processing. Pingxiang has established wind energy and solar energy stations to realize its transformation from traditional coal mine industries. Original data of various indexes come from environment quality reports, urban statistical yearbooks, statistical bulletins of national economic and social development. The data cover the period from 2010 to 2014.

3.2. Dimension Reduction of Projection Pursuit Model

Projection pursuit model refers to a statistical method for analysis of high dimensional data. The model studies structural characteristics of high dimensional data by projecting high dimensional data to low dimensional subspace and analyzing changing characteristics of low dimensional data points. This method can solve part of nonlinear problems, such as classification of multi-index samples. While establishing the model, the researcher need to normalize sample indexes. According to the index system shown in Table 1, the researcher can establish sample set of various indexes as $\{x^*(i,j)/i=1\sim n, j=1\sim p\}$, where n standards for the number of samples and p represents the number of indexes. To eliminate dimensions of various indexes and unify variation range of the indexes, the researcher should normalize extreme value of equation (1). The $\min(x_j)$ and $\max(x_j)$ stand for extreme values of the index j. The $x(i,j)$ represents normalization sequence of index characteristic value (Yao, 2010).

$$\begin{cases} x(i,j)=\dfrac{x_{ij}^*-\min(x_j)}{\max(x_j)-\min(x_j)} \\ x(i,j)=\dfrac{\min(x_j)-x_{ij}}{\max(x_j)-\min(x_j)} \end{cases} \tag{1}$$

To establish index projection function $Q(a)$, the researcher should reduce dimension of the project pursuit model. The p-dimension data $\{x^*(i,j)/j=1\sim p\}$ could be synthesized to the 1 dimension projection value $z(i)$ of the projection direction $a=\{a(1),a(2),a(3),\ldots,a(p)\}$. Then, this paper implements classification according to 1 dimension scatter diagram of $\{z(i)/i=1\sim n\}$. While determining the project index, the local project point of projection value $z(i)$ should keep intensive. Global projection points and clusters shall be scattered. The dimension of high dimension data can be reduced by fitting projection index into the sample:

$$z(i)=\sum_{j=1}^{p}a(j)x(i,j) \quad (i=1\sim n) \tag{2}$$

3.3. Determination of Projection Pursuit Evaluation Model

Construction of projection index function appears to be an important step for project pursuit calculation. Project index function serves as the basis to find optimum projection direction. Comprehensive evaluation of urban ecological construction mainly

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evaluates levels of samples. Thus, the researcher can construct project index function by classification indexes, namely maximum cluster-distance and cluster density of project characteristic value at low dimension (1 dimension) subspace. According to basic characteristic of index value, the project index function equals to the nullification of the variance of project value $z(i)$ and local density, namely $Q(a) = S_z D_z$, variance of the project value and local density can be represented as:

$$s_z = \sqrt{\frac{\sum_{i=1}^{n}[z(i) - E(z)]^2}{n-1}} \tag{3}$$

$$D_z = \sum_{i=1}^{n}\sum_{j=1}^{n}[R - r(i,j)]u[R - r(i,j)] \tag{4}$$

According to characteristics of project pursuit, it can be found the best project direction shall expose structural characteristics of high dimension data. Therefore, the researcher need to optimize project index function. When sample set of various indexes is determined, the projection index function $Q(a)$ only changes with the project direction. Different project directions reflect different data structural characteristics. To guarantee the best projection direction, the researcher can find out the optimum direction by seeking maximum value of the projection index function. The optimized projection index function is shown as the equation (5):

$$\begin{cases} Max: Q(a^*) = S_z D_z \\ s.t: \sum_{j=1}^{p} a^2(j) = 1 \end{cases} \tag{5}$$

Comprehensive evaluation of urban ecological construction can be regarded as a complicated nonlinear optimization problem which takes $\{a(j) / j = 1 \sim p\}$ as optimization variable. This paper shall use genetic algorithm to find an optimum global solution according to law of the fittest system and swapping mechanism of inner cluster chromosome information. The optimum projection direction a^* calculated by project pursuit model could help the researcher conclude projection value $z^*(i)$ of each sample point after being substituted into the equation (2). Similarity of $z^*(i)$ and $z^*(j)$ shall be determined through comparison. At last, this paper arranges values of $z^*(i)$ in an increasing sequence, so as to determine the preferential order of sample data.

4. Analysis about Construction Level of Ecologically-Civilized Cities

4.1. Analysis about Comprehensive Construction Level

This paper concludes complex indexes of 11 cities of Jiangxi Province over the period from 2010 to 2014 according to projection pursuit comprehensive evaluation model

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of ecological civilization. On this basis, the research could get economy index, society index, environment index, culture index and system index (Table 2). Table 2 shows Nanchang City ranks first among 11 cities of Jiangxi Province with a complex index of 1.2194. Yingtan ranks last with a complex index of -0.1031. Different complex indexes reflect differences of 11 cities of Jiangxi Province in ecological construction. Local ecological development appears poorly balanced. At the same time, there are 3 cities with negative complex indexes in Jiangxi Province, namely Fuzhou, Pingxiang and Yingtan. This indicates there are big differences between cities of Jiangxi Province in ecological construction. Some cities even fail to meet the standard of ecological civilization.

Cities	Complex Index	Economy Index	Society Index	Environment Index	Culture Index	System Index
Nanchang	1.2194	0.5231	0.6532	0.0423	0.4877	0.2397
Ganzhou	1.1103	0.7129	0.3312	0.7214	0.1342	0.1281
Jiujiang	0.7622	0.4275	0.1265	0.4776	-0.032	0.0934
Xinyu	0.5791	0.2025	0.0322	0.357	0.2537	0.1324
Shangrao	0.5276	0.2297	0.1079	0.4421	0.1543	-0.004
Yichun	0.3109	0.1456	0.0342	0.6385	0.2219	0.0937
Jian	0.1432	0.3754	0.2473	0.1026	-0.0214	-0.067
Jingdezhen	0.0225	0.418	0.1234	-0.1015	0.0323	0.1049
Fuzhou	-0.0316	0.1023	-0.1035	-0.0709	-0.2041	0.0955
Pingxiang	-0.0922	-0.0241	-0.145	-0.1337	-0.0382	-0.1017
Yingtan	-0.1031	-0.0516	-0.2179	-0.0934	-0.1432	-0.0032

Table 2 – Complex Indexes of Ecological construction of Jiangxi Province and Average Indexes of Various Sub-Systems over the Period from 2010 to 2014

According to complex indexes of ecological construction of Jiangxi province and average values of indexes of various sub-systems (Figure 2), it can be found there are obvious differences between various cities in ecological construction. Average values of indexes of various cities vary from each in 5 sub-systems which form up the evaluation system of ecological construction. As to economy index, Ganzhou achieves 0.7129, ranking first in Jiangxi Province. This city threw great investment in new energies and Hakka tourism resources over past years, keeping improving the proportion of green GDP. For society index, Ganzhou is only second to Nanchang City with an index bigger than 0.5, which indicates poor ecological environment protection awareness, unsatisfactory ecological employment, and higher Gini coefficient of most cities in Jiangxi Province. With regard to environment index, Ganzhou and Yichun take the lead, because these 2 cities perform well in protection of local ecological environment. They have implemented effective measures in control of industrial emissions and downtown noise. Culture indexes of 11 cities of Jiangxi Province are lower than 0.5, which means insufficient ecological education and low utilization rate of green ecological products. These cities sill get a long way to go before realizing ecological civilization. System indexes of the 11 cities are similar to their culture indexes. They need to improve their systems and perfect

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their ecological protection laws, particularly establish strict and effective environment protection and monitoring system.

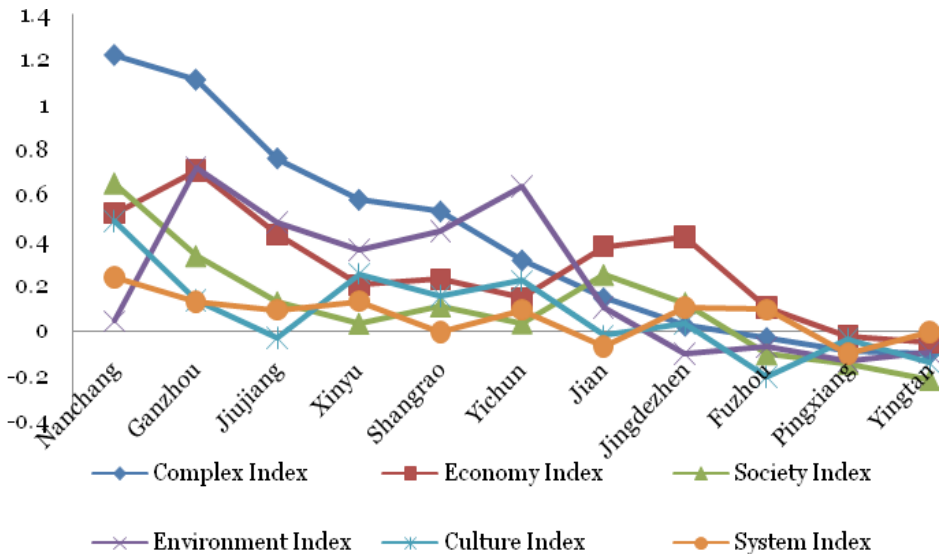

Figure 2 – Comparison between Complex Indexes of Ecological construction of Jiangxi Province and Average Indexes of Various Sub-Systems

4.2. Grading of Ecologically-Civilized Cities

To find out differences between evaluation objects through close observation, this paper classified average complex indexes of 11 cities between 2010 and 2014 into 5 grades according to normal distribution principles. The 5 grades include high distinction, distinction, average performance, poor performance and unsatisfactory performance. Details of classification standards and classification outcomes are shown in Table 3. The table shows those with a C-index of above 1 are high distinction cities, such as Nanchang and Ganzhou. Those with a C-index of $1 > C \geq 0.5$ are distinction cities, such as Jiujiang, Xinyu and Shangrao. Those with a C-index of $0.5 > C \geq 0.1$ are average performance cities, such as Yichun and Jian. Those with a C-index of $0.1 > C \geq 0$ are poor performance cities, such as Jingdezhen. Those with a C-index of $C < 0$ are unsatisfactory performance cities, such as Pingxiang and Yingtan. Classification of ecologically-civilized cities has clarified their differences. Those with poor performance need to eliminate their deficiencies in future construction of ecological civilization and their ecological civilization level in future development.

To verify accuracy of above classification, this paper drafts a scatter diagram of project characteristics (Figure 3) according to the characteristic values of optimum projects at various levels. Then, the paper uses the model established for evaluation of ecologically-civilized cities to analyze errors. At first, the researcher need to determine the optimum projection direction and components of the optimum direction. Actually, the

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Level	Grade	Judgment Standard	City
Ⅰ	High Distinction	$C \geq 1$	Nanchang, Ganzhou
Ⅱ	Distinction	$1 > C \geq 0.5$	Jiujiang, Xinyu, Shangrao
Ⅲ	Average Performance	$0.5 > C \geq 0.1$	Yichun, Jian
Ⅳ	Poor Performance	$0.1 > C \geq 0$	Jingdezhen
Ⅴ	Unsatisfactory Performance	$C < 0$	Pingxiang, Yingtan

Table 3 – Classification of Ecologically-Civilized Cities of Jiangxi Province

components can reflect the contribution of various indexes towards urban water ecology construction. Corresponding indexes of bigger values have more influence on evaluation outcomes. Mean absolute error and average relative error fitted according to differences between projection characteristic values and grade values are respectively 0.0771 and 1.19%. The verification outcome means higher judgement accuracy and more accurate overall evaluation outcome. In addition, it also illustrates the projection pursuit model is applicable to comprehensive evaluation of urban ecological construction.

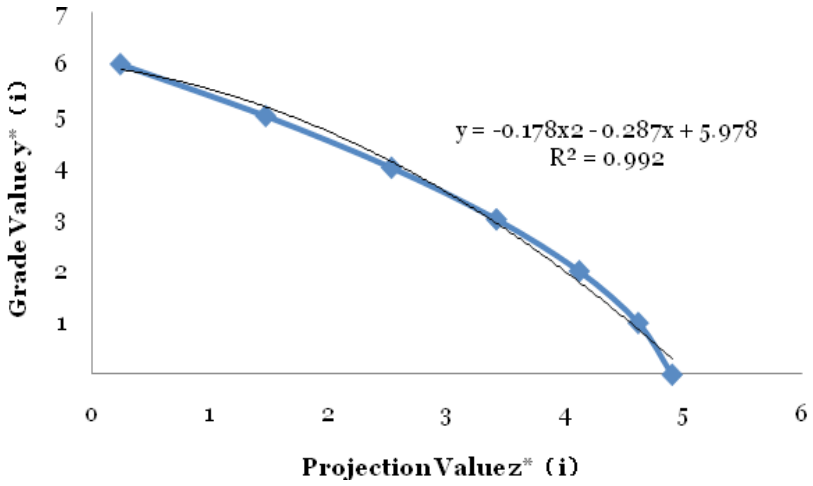

Figure 3 – Relationship between Projection Value and Grade Value of Ecological Construction

5. Conclusion

According to above analysis, it can be found the research outcome can accurately reflect ecological construction levels of 11 cities in Jiangxi Province. These cities present 2 basic characteristics in overall ecological construction. On one hand, they vary from each

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other in ecological construction level. With advantages in economic and environment conditions, Nanchang and Ganzhou take the lead in the whole province in terms of the complex index. However, Pingxiang and Yingtan lag behind in ecological construction due to backward industries and improper environment protection. There are big gaps between high distinction and poor performance cities. On the other hand, 9 cities neighboring Poyang Lake Ecological Economic Zone present higher ecological construction level. The spillover effect of spatial clustering appears obvious. This indicates Poyang Lake Ecological Economic Zone has given full play to its clustering effect. The economic zone uses its favorable ecological conditions to promote development and utilization of green resources. In addition, it also drives sustainable development of ecological culture by protecting ecological environment.

In consideration of current development of Jiangxi ecologically-civilized cities, this paper find solutions to their problems from the following aspects. First, the cities should adhere to core ideas of ecological civilization, give full consideration of ecological capacity, and confine economic growth to the ecological capacity. Then, the cities must provide detailed plans about ecological construction, integrating humans and nature into a single whole to realize sustainable and harmonious development of humans and nature. As required by this objective, the cities must consider harmonious development of humans and nature before making plans about ecological construction. In addition, the idea must be applied to various aspects of the construction. At last, during the process of ecological construction, the cities should give full play to government functions and strengthen policy guidance. When modifying the policies concerning ecological construction, government departments should direct ecological construction through policies. The ecological construction level of the cities can be further improved in this way.

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Countermeasures for Treatment of Support out of Model in 3D Printing

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Abstract: First, 3D printing supports are divided in the paper into supports in model (SIM) and supports out of model (SOM) based on the function. Then, the Cura software was used to simulate the 3D printing of a mechanical component with different SOM modes. Accordingly, the printing time and weight of consumables required for the SOM modes were obtained. After a comparative analysis of SOM conditions and component performance after print, the paper proposed countermeasures for treatment of support out of model, i.e. on the premise that the mechanical performance and surface quality of components meet demands, it is supposed to reduce the use of SOM as well as its surface contact with components as much as possible. In addition, the preferable sequence of this contact was found to be: non-contact surface, contact surface, friction surface, and fitting surface. Finally, the paper suggested to change the way of design thinking by designing a model adaptable to additive manufacturing (AM) technology, so that SOM utilization could be reduced from the source. In this way, not only will the model be more suitable for 3D printing, but the usage of 3D printing can be more efficient and reliable in quality.

Keywords: 3D printing, SOM, printing quality, additive manufacturing

1. Introduction

3D printing is also known as additive manufacturing (AM), or academically, rapid prototyping technology (Wang, 2013). It differentiates from the conventional material-removal-processing technology used in the manufacturing industry in that the former is used to create a three-dimensional object in which successive layers of material are formed under computer control like cocooning or nesting. 3D printing is also adaptable to components manufacturing or moulds manufacturing (Nicolau, 2010), obviating the need for cutting tools, fixture and machine tools. This cost efficient and short-term rapid prototyping technology has gained increasing application. Support structures supplement 3D printing. An inappropriate selection of supports will cause problems such as material waste, a prolonged period of printing, difficulty in follow-up supports treatment, and damage to model surface quality or even to the mechanical performance of components.

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2. The Function and Types of 3D Printing Supports

2.1. The Functions of 3D Printing Supports

The principle of 3D printing supports is: cut the cross sections of a 3D model firstly, and accordingly slide the model into 2D layers along axis Z(Zhang, 2015); Then, print the part layer by layer from underside to upside, until the whole model is synthesized (Wang, 2013). As the printing is down-to-top, one layer is superimposed on another. Under the action of gravity, a jetted layer of material will be suspended due to lack of support received from the next layer. The model printed out will have its filaments droop slightly and its overhang deform a little if the overhanging distance is short. By contrast, too long overhang distance will cause the filament to fall off and frustrate the formation of structures over the suspension part as well, which will finally lead to the failure of localized printing or even the entire printing (Goyanesm 2014). What is more, when establishing a horizontal layer, the 3D printer will extrude staggered filaments that improve the strength of the layer. Whilst the connection between vertical layers rests on the cohesive force generated from filament clotting. Since the force changes with the extrusion temperature of filaments and the environmental temperature, the actual printing effect is always poorer than the structural strength of horizontal layers (Seitzm 2005; Campbell, 2013). Therefore, when slicing a component, a reasonable selection of the direction of Z axis (namely the direction of the base plane XOY) is a guarantee to the component's mechanical performance. In this case, a suitable base plane for 3D printing with a favorable support treatment mode is conducive to the realization of high-quality model in 3D (Atzeni, 2012; Uriondo, 2015; Fortes et al., 2016).

2.2. Types of 3D Printing Supports

According to its location (Hopkinson, 2006), the 3D printing support (Wang, 2013) can be divided into supports in model (SIM) and supports out of model (SOM). SIM refers to the support structure inside a large solid model. It is unnecessary for the internal part of such models to be printed out solid, but instead, the upper and lower surfaces of the models should be printed flawlessly by use of a specific spatial structure which is designed according to practical conditions (Günther, 2014). This case is not discussed here. SOM is adoptable when the print object is a model with its own suspended structure which requires extra support. The additional materials are attached to the undersurface of the suspension before the next layer is printed. All the SOM should be removed as an inoperative support. SOM usage amount will directly influence the time for printing, materials consumption, and the quality of component surface (Lu, 2014). This case will be discussed in the following sections of the paper.

3. Comparative Analysis of Printing under Different Types of Supports and Its Treatment Countermeasures

Despite great advantages, present-stage 3D printing has a large number of noticeable flaws, e.g. low printing speed, difficulty to print some products due to support constraints. In the paper, the reasonable mode of support treatment was obtained on the basis of the printing time, consumptions weight, etc. for machine parts with different support

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conditions. A machine vice was used as the objective component for printing in the paper. Figure 1 is the drawing of the adjustable vice body. Surface A, the sliding friction surface, slides along the fixed vice part. Surface B, the symmetrical fitting surface, cooperate with the fixed vice part. Surface C is the contact surface (the lower parts can be cut off). Surface D is the mounting face for installation of jaw plate. The E scalariform pitting is used necessarily to install bolts. F is the fitting hole for tailor-made nuts. The rest of the vice parts are non-working surfaces and/or non-contact surfaces.

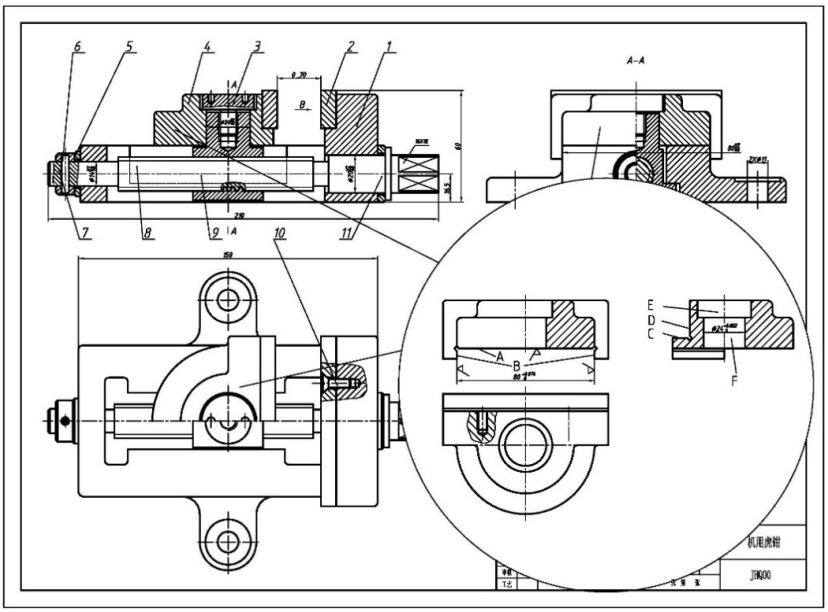

Figure 1 – The drawing of the adjustable vice body

3.1. Cura Simulation and Printing

Cura, a 3D printing software, can understand any exported files in a STL, OMF or OBJ file format, and realize the model in 3D. Figure 2 shows the related printing parameters.

3.2. Printing Result Analysis and Support Treatment Countermeasures

Table 1 shows the printing results with different arrangements in Cura simulation.

3.2.1. Printing Result Analysis

For No. 1, the flat side is positioned horizontally. The circular hole printed in this way is of good quality and costs the least time. The quantity of materials consumed is relatively large because of the big undersurface. Surface A is the contact surface of the support and the component. For No.2, the flat side is positioned horizontally. The circular

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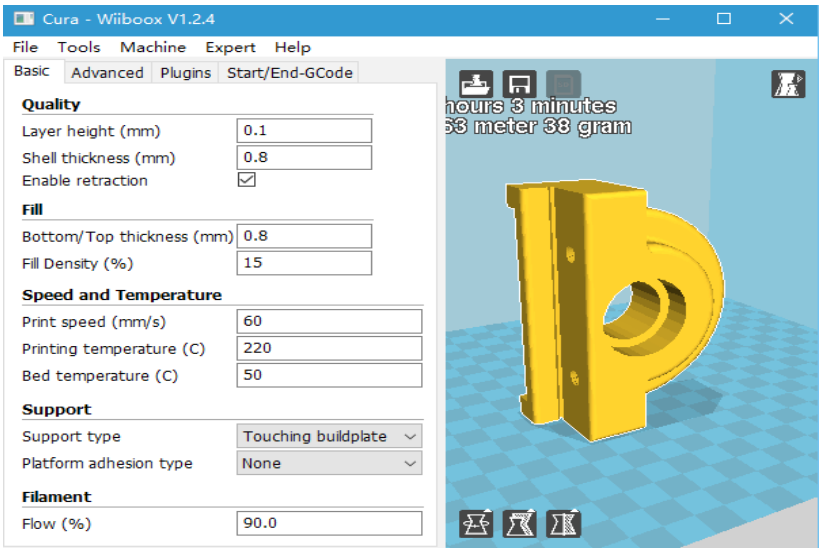

Figure 2 – TPrinting parameters

hole printed in this way is of good quality. The quantity of materials consumed is the maximum, because there are plenty of support materials to consume. The internal hole F, the left side of Surface C and the bottom of the flat surface are supported, whilst the fitting surface and the friction surface are free of support. For No.3, the flat side is positioned vertically. In spite of SOM omission, the circular hole in this case is poorly printed. It requires less time and the least number of supports. Be it as it may, the fitting surface B acts as the bearing surface. For No.4, the flat side is positioned vertically. In spite of SOM omission, the circular hole in this case is poorly printed. It requires more time and supports as the contact surface is the bearing surface.

In light of the printing quality, the supports on the friction surface and the fitting surface for No.1 and No.3 interfere with friction performance and fitting performance. No. 2 and No.4 have no supports for the friction surface and the fitting surface, with no damaging effect on the contact surface by the corresponding supports. Therefore, No.2 and No.4 take the priority. Through further analysis in relation to time consumption, as No.4 costs more time and is of poorer quality than No.2 does, No.2 wins out finally. The advantages of No.2 will be strengthened by follow-up modification.

3.2.2. Countermeasures for Support Treatment

1. The fitting surface of a component should be the least consideration as the contact surface between SOM and the component, which is followed by the friction surface and the other contact surface between the component and other components in order. Non-contact surfaces are the first choice. In summary, the preferable sequence of this contact, if unavoidable, is: non-contact surface, contact surface, friction surface, and fitting surface.

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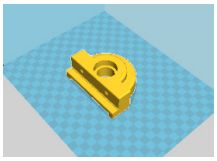
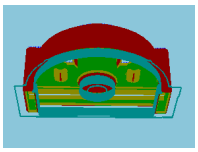
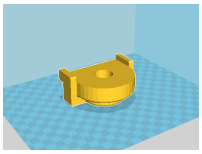
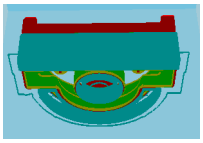
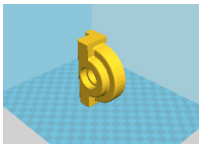
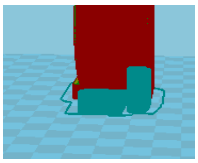
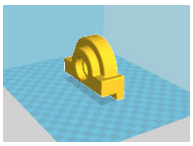
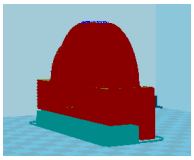
No.	Arrangement	Time for printing (h/m)	Consumption weight (g)	Support(shaded area)
1		17/9	115	
2		18/14	118	
3		17/49	104	
4		18/22	112	

Table 1 – The printing results in Cura simulation

2. The SOM usage and the contact area between SOM and the component should be as few as possible. For a model with cantilever construction, SOM usage reduction can be realized by rotating the cantilever off the vertical direction.
3. For models with requirements of structural strength, it should be avoidable that the torque or shear force falls on the vertical plane. For the thin ones among such models, the largest non-contact surface is the most recommended as the base surface for printing, and it will achieve better mechanical performance if printed along the length direction.

4. Changes About The Way of Design Thinking

As can be seen from the said comparative analysis, SOM, more or less, is a must for the component under any arrangements. The reason is that the component itself is designed to comply with the traditional thought of subtractive manufacturing. A component can be printed with less SOM or even without SOM if being modified according to the idea of additive manufacturing. As shown in Figure 3, no SOM is needed any more when the sections below surface C are eliminated, when F swallows E and runs through to the top surface, and when the outer semi-circular plane transits to a conic plane (or has its upper semi-circular part enlarged to the size of the lower one, so that SAM replaces SOM).

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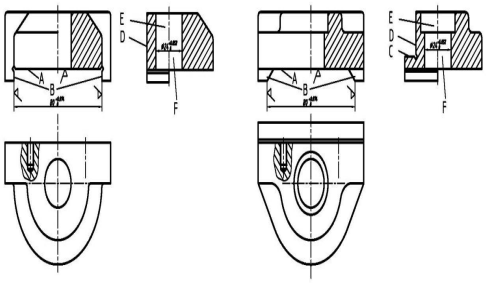

Figure 3 – The AM-style model with a suspension removal structure

Here is another modification scheme (Figure 4): a diagonal-built structure is added on Surface B on the basis of the original component, and the fillet radius of the flat surface is extended at the same time. The quality of the component printed by this scheme is slightly poor, but no SOM is required during the process of 3D printing. It is important to notice that as there are some modifications that affect kits design, associated design can be taken into account when necessary.

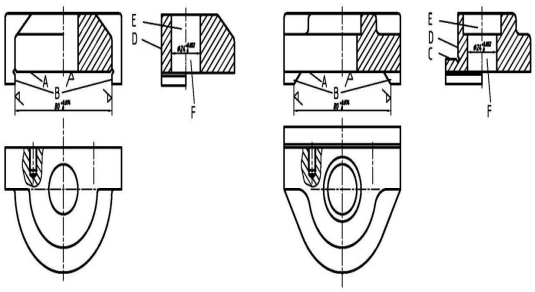

Figure 4 – The AM-style model with the addition of a diagonal-built structure

The mode of component processing should be considering in the design, so that SOM utilization can be reduced from the source or be replaced with SIM. In this way, not only will the model be more suitable for 3D printing, but the usage of 3D printing can be more efficient and reliable in quality.

5. Conclusions

The 3D printing is of prominent advantages but rests greatly on support treatment. The general principles for SOM treatment countermeasures are: on the premise that the mechanical performance and surface quality of components meet demands, it is supposed to reduce the use of SOM as well as its surface contact with components as

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much as possible. In addition, the preferable sequence of this contact, if unavoidable, should be: non-contact surface, contact surface, friction surface, and fitting surface. Finally, the paper suggests to change the way of design thinking by designing a model adaptable to additive manufacturing (AM) technology, so that SOM utilization can be reduced from the source. In this way, not only will the model be more suitable for 3D printing, but the usage of 3D printing can be more efficient and reliable in quality.

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Research on Path of Improving the College Students' Ideological and Political Education Based on Computer Network Technology

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Abstract: This paper mainly adopts the research method of combining theory with practice as well as integration of analysis and synthesis, discusses the related problems of college students' ideological and political education under the context of network communication, and analyzes the prominent features of network communication compared with traditional communication methods, points out that the life picture constituted by network communication already became an important discourse context for college students' ideological and political education, further from the three aspects of students self-management level is not high, ideological and political education has paid less attention to the development of network communication, network environment supervision system is not perfect, this paper explores the causes of the low effectiveness of college students' ideological and political education and the declining of prestige, and finds out the root cause of the "network aphasia" in ideological and political education. On this basis, the effective path of enhancing ideological and political education under the context of network communication is proposed.

Keywords: computer network, ideological and political education, network supervision, self-management.

1. Introduction

In information age, the network has an increasingly profound impact on the form of society and individual survival method. Network communication has become a necessary means for people to communicate with others and communicate with the external world. The information dependency relationship established by network communication has become an important method of propaganda and education of social organizations and plays a unique role in the formation of public opinion. The ideological and political education of college students should be integrated into the context of information age, focus on solving the dilemma when college students engage in network communication, so as to promote modernization and adaptation of the traditional ideological and political education, further to enhance the educational function of ideological and political education.

Regarding to domestic, the reference of this topic mainly comes from three aspects, the first is the ideological and political education network research, the second is the

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communication and ideological and political education research, the third is the status of college students' network communication research (Tang, 2012). The correlation research of network and ideological and political education has gradually become a system, "network ideological and political education" has become an important academic research topics (Brunold, 2006; Gonçalves et al., 2016). In the book《Modern mode of ideological and political education—Discussion on construction of the network ideological and political education》, Liu Mei for the first time put forward the concept of "ideological and political education": "which is based on the theory of communication and ideological propaganda, the use of computer network to perform ideological and political education." The monographs about "network ideological and political education" usually aim at constructing the branch of network ideological and political education under the ideological and political education, performs by centring on the necessity and importance, status analysis, the construction of disciplines (nature and function, subject-object relationship, principle, content and method) and other theory and application problem of network ideological and political education, explores the regularity of network ideological and political education(Xiao, 2009). Such as《Research on Network of Ideological and Political Education》(2009) written by Zhangzaixin; 《Network Ideological and Political Education》(2003) written by Yangliying;《Network Culture and College Students' Ideological and Political Education》(2006) written by Songyuanlin, Chenchunping (Levy, 2014); 《Theory and Method of College Students' Ideological and Political Education》(2010) written by Xu Jianjun and other research results. The researches on the basic theory of network ideological and political education help to grasp the relationship between network communication and ideological and political education, and deeply understand the situation and outlet of moral education in network environment (Hakhverdian et al., 2012; Quinonez et al., 2016).

Internet industry started early in abroad compared with domestic, they have a higher degree of social development of the network. There is no theoretical research on the ideological and political education in abroad, but the researches on the social impact of the network, the individual value of the network and the ethics of the network have achieved a lot of research findings, which is of great reference value to the writing of this paper. For example, the impact of the Internet on social development,《The Three Episodes of the Information Age: Economy, Society and Culture》, three volumes of books (2003) written by Manuel Custer, the first volume 《The Rise of the Internet Society》 analyzed the communication phenomenon from the point of view of the Internet as an intermediary, thought that the Internet is helpful for expansion and strengthening of hundreds of thousands of weak link, and created the basic level of social interaction for the people living in advanced technology world, besides the network created a greater degree of the interactive society. In another example, in the discussion of double-sided impact of network communication on the human, Howard Lyndhringer's book 《Virtual Communities》 discussed the social dimension of the Internet, in the sense that whether Internet will promotes new communities, virtual Community development, or will lead to personal isolation, make the individuals separate from society. While Mark Slukka is severely accusing the computer, for the dehumanization of social relations brought by computer, due to online life seems to be a shortcut to escape from real life. Negroponte's 《Digital Survival》(1997) suggested that computers are no longer just computer-related,

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it determined our survival. Nowadays, the network becomes the new ruling power of the human society, and the rational reflection on the technical is further deepened, which is worth our thinking and can be used as reference (Julian, 2000).

2. Features of network communication

1. Anonymity and Virtuality

The anonymity of Network creates a more relaxed and open communication environment, self-presentation of people is relatively more daring and direct than in real life, performance of good and evil is more clearly. People can choose to log in or exit according to their own preferences and needs in the cyberspace, when the feeling of discomfort or boredom occurring, even can tear down and reconstruction their network identity.

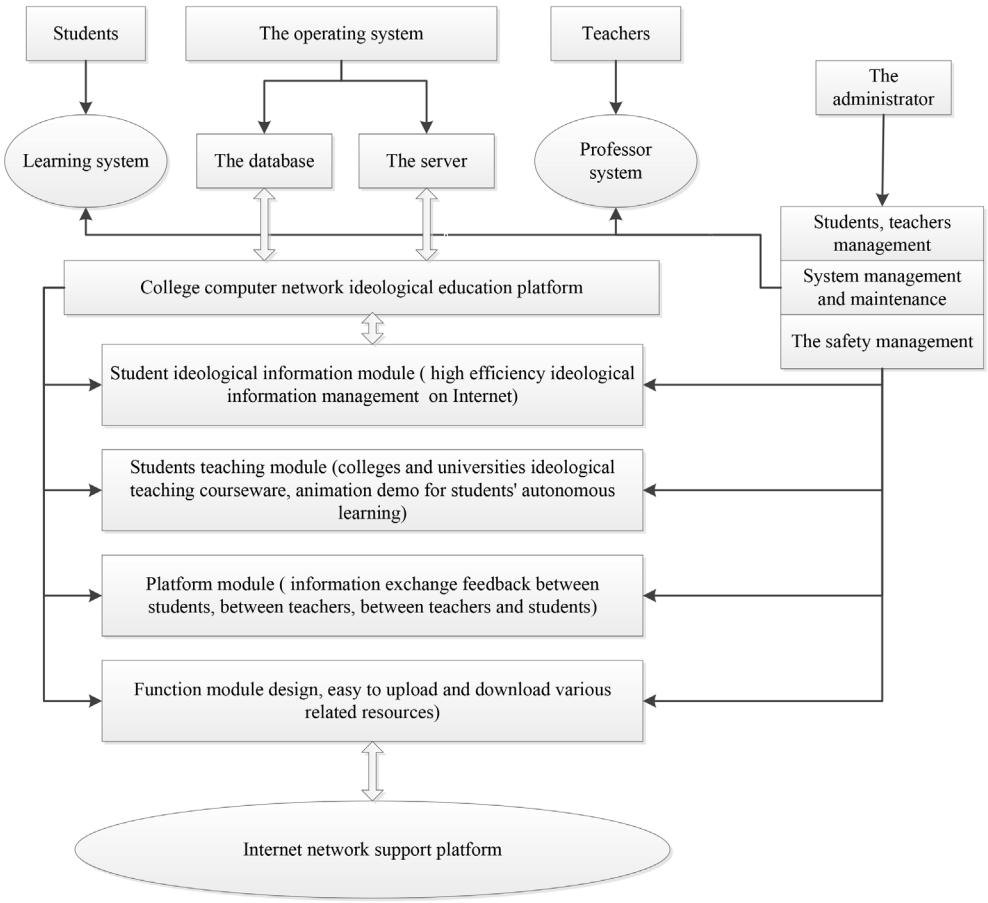

Figure 1 – College environment of network teaching platform structure

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2. Time-space cross and Globality

Under the combination effect of network data information and human life experience as well as imagination, people go beyond the current living environment, fully experience the local conditions and customs of rest of the world, and even to talk with strangers. The network has narrowed the physical distance between people, weakened the influence of time on people's communication activities, has demonstrated excellent time-space cross and globality.

3. Equality and autonomy

The communication circle of network strangers has broken through the social relationship network which is based on blood relationship, geography relationship and profession boundary relationship in the real life, with relatively stability, and its communication scope is limited in Figure 1. Being in the network, interest and need are the most important driving factors for communication. The communication relationship established through the network is usually dominated by strangers, and the type is various and changeable. In the network communication, people show more and more initiative, selectivity and creativity.

4. Diversity and interactivity

Network platform has created a very open field for information communication, and built a bridge of information spread and feedback for diversity communication subjects. Individuals, social organizations, nation can become a worldwide universal communication hub, there exist diverse communication relationships between each other, for those main subjects on information network nodes have become the creators and enjoyers of internet culture. Open speech, open information resources, open comments and feedback, all of this have greatly promoted the prosperity and development of diversification internet culture.

3. Students' ideological and political education activities separate from the network communication context

3.1. The lack of realistic educational content

The information field of the social culture collides with the campus culture created by college students' network communication, has creates abundant educational opportunity for college students' ideological and political education. Combining theoretical teaching with social practice is an important requirement to enhance the effectiveness of ideological and political education (GREGORY, 2003). The formation of people's moral character, values, political views are based on reality, if separate from the social real life, ideological and political education will become water without a source (Dung, 2005). The ideological and political education of Chinese college student is guided by Marxism, aim at arming people with scientific theories and guiding people with high spirits, in this way, the college students as social elite group will have excellent ideological and political standpoints, high ideological and moral consciousness(Lai-Yang and Liu, 2014). Furthermore, the college students will establish lofty ideals and beliefs, the pursuit of personal all-round development. However, from the point of view of teaching content,

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there is problem such as too much focus on the dominant political theory and abstract moral knowledge, lacking of guidance content which is closely related to real life, separation of theory and practice. At present, ideological and political theory course in some colleges and universities is still copy the book, apply mechanically and cramming education mode, is independent of social practice development and is not synchronized with updating of student information, while the students rarely have the opportunity to participate in social practice, this approach has not enhanced theoretical persuasion, but pull away the distance between ideological and political theory and youth students, resulting in ineffective of education(Eck, 2008).

3.2. Lack of integration of educational carrier

Ideological and political education activities should be carried out with the help of certain carriers, the carriers are the relay station for spreading of the value of ideological and political education, are also the intermediary of educational activities (Yang, 2010). The platform or activities which carrying the ideological and political education information, creating opportunities for educators and educators to communicate with each other all can be called the carriers of ideological and political education. In the ideological and political education of college students, there are many kinds of educational carriers, such as teaching activities, subject lectures, conference learning, individual conversation, routine management, campus culture, mass media, social practice and so on, in which classroom teaching is the most important and basic carrier form. The interaction between different carriers affects the effect of the goal of ideological and political education. At present, the classroom teaching is a dominant trend, the effect of interaction and supplement between different carriers is not obvious, the resultant force of the carrier is not sufficiently excavated, as shown in Figure 2. Network media has become the main channel of information dissemination in nowadays, the spread power of the "fourth media" can't be underestimated, Weibo as the representative of the social software in the field of social life, the function of its cast out the wicked and cherish the virtuous, exhibit virtue and expose vice more to be displayed. It is an important outlet for the ideological and political education to strengthen the permeability of the network media.

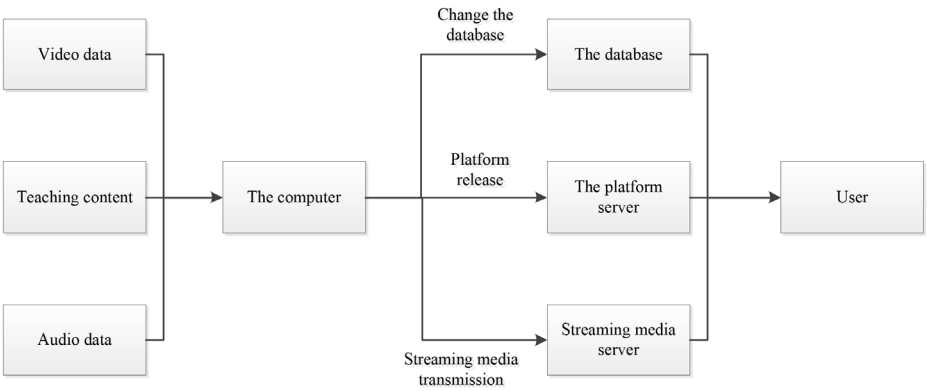

Figure 2 – Realization of the computer aided teaching modules

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3.3. Lack of interactive during education process

Ideological and political education is a kind of social activities with distinctive ideological color. It is a teaching practice that organized and implemented by the educators with purpose, presupposition and plan. However it is also a communication activity between the educator and the educated person, as well as the "human nature" activities of people-oriented, the benefit of the people (Hakhverdian et al., 2012). This process can't be separated from the intercourse between people, it is also inseparable from speaking and listening, interaction and understanding, which is an important condition for the consensus of ideas. However, the lack of interactive problems in the process of ideological and political education of college students are obvious, such as the one-way activities, which are indoctrinated in theory, the interaction of teaching and learning is weak; the subjects and objects are clearly divided, the inter-subjectivity is insufficient played; The characteristics of intellectual education are obvious, and moving with emotion are slightly inferior; the teaching communication is the main factor, the life interaction is not enough; the teachers and students get along with each other for a little while, mutual understanding is not deep. Many college students' ideological and political education is still continuing the idea of separation between subject and object, emphasizing rationality, indoctrination, ignoring the subjectivity of students as the education object, reducing the human charm of ideological and political education (seen as Figure 3). The antagonism between the subject identity and the object identity impedes the further development of teacher-student interaction (Euben, 1999). Teachers have became "the defenders of discipline, the judges of behavior and spokespersons of moral standards, the relationship between educators and educated person becomes the Educators one-way restrict and control relationship", thus the distance between teachers and students is further widen (Journell and Castro, 2011). While in the network communication of college students, the educators are often in a state of absence, show less interest in new things on the network, no time to take into account the ideological dynamics of students reflected in the network of information, these is not only connected with educator's lacking of attention to the network media and low media literacy, but also reflects the situation that lacking of communication view in ideological and political education.

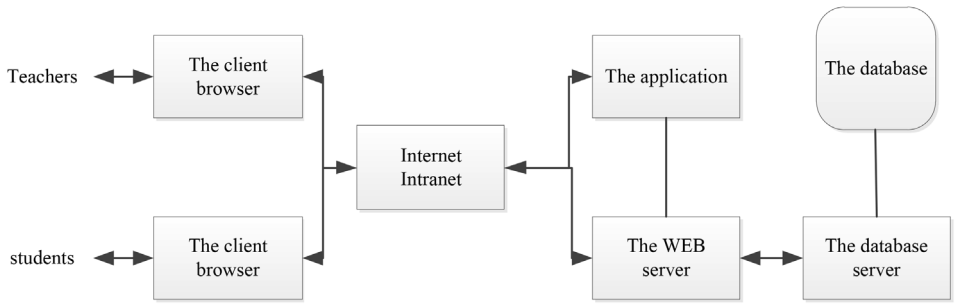

Figure 3 – Computer teaching platform structure

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4. The countermeasures of strengthening ideological and political education of college students in the context of network interaction

4.1. To improve the level of self-management of college students

Improving the network literacy of college students is the necessary support to enhance their self-management ability in network communication. Colleges and universities should pay full attention to improve the network literacy of college students, including correct understanding of network value, complying with network rules and moral standards, learning to adjust their own network psychological, with independent judgment for network information (Yu, 2012). Strengthening the network literacy of college students is conducive to play the positive effects of new media, enhance the students' learning ability and quality of life. Give a man a fish, and you have fed him for today; teach a man to fish, and you have fed him for a lifetime. The ideological and political education of college students should take the media literacy education into account in the teaching system, enhance the students' critical understanding of the network tools, improve the critical ability of the media, learn the rational thinking to judge the merits of the information, cultivate behavior of consciously abide by the laws and regulations and social morality, regulate their own network communication behavior.

4.2. To enhance the attraction of socialist core values education

In the network communication, with the aggravating of western ideological infiltration, individualism, hedonism, anarchism and other multicultural thought trend and the mainstream values vigorously promoted by ideological and political education are contend for concept recognition of youth. Whether it is in the clear-cut ideological conflict debate, or in the subtle value output of rich network cultural products, the Western values wrapped in a gorgeous cultural shell enclave wantonly poured into, it has become a strong opponent and an opponent can't be ignored of China's mainstream values in the network voice fight. In addition, Internet pornography, violence, vulgar information, Internet rumors and cyber illegal and criminal activities are running counter to social mainstream values, at the same time they have polluted the cyberspace. The core values of socialism have a strong cultural foundation and social foundation, which is the important cultural core to unite the social consensus and promote the healthy development of the society. If the ideological and political education in colleges and universities wants to enhance the attraction of the socialist core values to the college students, we must promote the socialist core values education and combing with Chinese traditional culture education, national conditions education, so as to enhance students' cultural awareness and cultural self-confidence, to guide the patriotism enthusiasm of college students to love of socialism, further to combine ideal of serve the country and social practice together. To optimize publicity form of core value, neither kitsch, but also cater to the audience psychology of the students, we must against the "empty words" and "stereotyped", against the false the heroic model of "high, big, complete" pattern, it shall not only reflect national conditions, but also close to reality and deep into the lives of college students. We shall reason to convince people, touch people by feeling. Good at using the discourse way that students are delighted to hear and see, it shall has

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clear stand, but also approachable and easy to be understood, we shall also enhance the appeal of discourse. As pointed out by Professor Xuwen, "ideological and political education should be an important carrier for improving the popularization of advanced culture of socialism with Chinese characteristics, in the light of the truth of its content, the new of its appearance, the beauty of its form, the sincerity of its emotion and the reality of its effect.

4.3. To strengthen the regulation and guidance of college students' network communication

At first, the ideological and political educators are the designers, organizers and supervisors of the ideological and political education activities of college students. They are the leaders of students' ideological and moral cultivation and political accomplishment. They are also teachers respected by students as well as the friends popular with students. Educators should deepen into the students' network communication world, experience the characteristics of network communication, make a rational assessment of the network value and risk, improve the ability to use the network to work, and be fully prepared for regulating students' network behavior. The educator should raise the attentions on the college students' network communication behavior. Simply consider the network behavior of college students as leisure after school has been far from adaption of "from shallow to deep" changes of the network impact (Winter, 2002). College students through the network communication to obtain news and information, maintain interpersonal relationships, express inner feelings, the develop hobby and expertise, release psychological pressure, purchase life material and so on, almost every aspect of life has been "Clean Sweep", Network communication affects their value identity, way of thinking, interpersonal communication skills, mental health level, personality improvement and so on. If left Network communication unchecked, it will affects the effect of ideological and political education.

Secondly, educators shall enhance their ability to participate in network communication, play a leading role in thinking (Monteiro and Daniel, 2011). Attention on concept is the premise, improvement on the ability is necessary preparation. Ideological and political education workers should have a certain degree of network media literacy, be able to keep abreast of the trend of technological progress, to understand what students are using and what students are concerned about, to prevent communication barriers caused by "network gap". Through professional training and life experience of the network new media technology, enhance their own ability to network communication, permeate into college students' network communication world, so as to grasp their ideological trends, and then carry forward the main theme or perform psychological counseling targeted.

Finally, to comply with the rules of network communication, and strive to build an equal and harmonious atmosphere of teachers and students exchanges. The main bodies of the network communication are equal, all are speakers as well as listeners, at the same time must comply with network communication rules. This de-central, parallel discourse model, to a certain extent, reduces the distance led by the role of teachers and students, weaken the authority status of educators. Educators should strive to adapt to the context of network discourse, more emotional guidance less interception to students, more care

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for students' life less intervention, educators should really consider students as equal communication subjects, learn from each other and promote each other.

5. Conclusions

The network communication constructs a digital world which is connected by the information pipeline. It is a virtual space that surpasses the human survival experience, and is also a life world closely related to the human realistic living. Decentralized fishing nets structure makes the world flattened, there have an infinite path from every point of Information intersection to other place, making it possible for people to communicate with each other in different places and at different time. This information platform almost by the whole human participation, sharing, co-building, contains a huge energy to cause social change. Human interaction is the first step of human-machine dialogue. In modern times, the human's activities already can't separated from the network environment, Network communication makes "man- man" dialogue first manifested as "man-machine" dialogue, Digital information replaces the language, expression and action and other more intuitive information in direct communication then to build a bridge of communication between people, in this way, people can more easily establish a wide range of weak ties, but will also experience loneliness in the depths of the world. The new dilemma is accompanied by new energies, which is the eternal situation in the process of the continuous development of human society. The contemporary college students are the most active and backbone in the network society and also are the aboriginal people in the information age. In order to better surviving in the network era which is coexistence of light and darkness, hope and despair, it is necessary to constantly improve their network media diathesis, enhance network moral self-discipline, enhance self-management ability, as well as rational use of the network. Network communication has promoted the change of the way of thinking, values and behavior pattern of contemporary college students. It affects their physical and mental health and the growth of their talent, shapes public opinion atmosphere and cultural environment of ideological and political education which is different from the previous, it has become an unneglectable mark of the era. If the ideological and political education of college students wants to grasp the initiative in the plural mixing network information environment, we should enhance the adaptability of educational activities to the context of network communication, improve the attraction and persuasion of mainstream values to college students, enrich the content, improve the structure, enhance effectiveness, pour the spirit of humanistic care into the education process, in the new historical conditions to play a good function value of value guidance, building consensus, educating people to survive.

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The Establishment and Application of the Evaluation Index System of Hotels Core Competitiveness Based on Data Mining

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Abstract: The hotel industry, as one of the most representative industries in service industry has its own management characteristics and product features, which will definitely shows its own features in the construction and selection the hotel core competence. Studying profoundly and mastering effectively the connotation, construction, evaluation and judgement of hotel core competitiveness contributes to improving the theories of the core competence and instructing practices. The hotel industrial is one of the three pillars of tourist industry, as a result, it is of more practical meaning to study and analyses and evaluate the core competence of the hotel industry from the aspect of industrial characteristics.

Keywords: Evaluation Index System, Hotels Core Competitiveness, APH

1. Introduction

The core competitiveness is the strategic asset of the hotel. The assets of the hotel include physical assets and intangible assets. Some intangible assets such as merchandise rights, land use rights and business reputation are the basic elements that construct the entity of the hotel and their meaning of existence lies in their own power. But they can be imitated and their value is quite flexible. Nevertheless, the core competitiveness, as a kind of brand new intangible asset, its value locked can make the hotel in an advantageous position in terms of the level of production and technology, the cost of production, product characteristics, and quality of service and marketing (Chatzoglou, 2009; Fortes et al., 2016).

Secondly, the competitiveness is the strategic core of the enduring development of the hotel. The success of a hotel in competition is no more a result of luxurious decorations, advanced hardware equipment, transient product development strategies and market developing strategies, instead, it is a reflection that the enterprise is equipped with the special capacity to develop new products continuously and develop new market. The special capacity can create high-quality brand and bring great word-of-mouth effect for the hotel, and thus it can bring customer source and wealth, and this is the core competitiveness of the hotel and is the source that can make the hotel set foot in international market. Finally, the core competitiveness is the basis of the multiple

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management strategies of the hotel (Huang and Huang, 2005; Gonçalves et al., 2015). The power of the core competitiveness determines the business scope of the hotel and determines especially the breadth and depth of the enterprise's multi- operation. Only the multiple management on the basis of the core competitiveness can perform well and be advantageous in the fierce market competition. The construction of the evaluation index system of the core competitiveness of hotels contributes to the scientific evaluation of the core competitiveness of the hotel and the hotel's making of pointed enterprise management strategies (Huang and Huang, 2005).

2. The construction of the index system

2.1. The method of selecting indexes

1. The level of customer value mainly refers to the product quality of enterprises and other value of products and it is an object reflection of the realization degree of the core competence of enterprises. Customers (the subjects of experiences), as the co-producers of hotel products, exert important and positive influences on the construction of the ultimate experience value. The realization of customer value creates in the cooperation between customers and hotels and the ultimate result is the hotel product.
   As a result, the product quality and value in other aspects construct the final link of customer value. Consequently, the product quality index includes synthetic indexes: product feature, properties of products, efficiency and skills of service, environment and atmosphere. And other value index of products includes synthetic indexes: the uniqueness of products, product combination and the competence of product price.

2. It refers to the strategic management ability, the fundamental structure and resource, human resource ability and hotel organization, and it is the specific reflection of the strength of hotel core competence and is the core of the evaluation of the core competence(Mi, 2013). The strategic resources and ability is the most basic foundation of the hotel core competence and the products and customer value provided by hotels rely on this most basic foundation. The interactivity between hotel services and customers and the ability to provide products of each department of the hotel are dependent on this level (Kinanga and Kandi, 2013).
   It refers to the level of the enterprise's ability of standardized management, cost management and customer relations. Although the strategic resources and ability in the basic foundation of hotel core competence, every hotel has its own enterprise strategy resource and ability. And whether their enterprise culture is scientific and of high level, strategy resource and ability is no more than the determinant of the level of the core competence and it is not the most salient element that causes the difference of the core competence (Li and Xu, 2011). On the contrary, if a hotel has its own unique knowledge and skills on the basis of the possession the brilliant strategy resource and ability, its core competence is steady and difficult to be imitated. The ability of standardized management, cost management and customer relations are supplements of the indexes in other levels.

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The target layer	Primary index and weight	Secondary indexes and weights	The third level indicators		The final weight
4 The hotel core competitiveness	Unique knowledge And skills X1 0.296	Standardized management ability X110.241	The quality of the product	X111	0.284
			Product performance	X112	0.458
			Service efficiency and skill	X113	0.254
			The environment and atmosphere	X114	0.256
		Service trade ability X12 0.257	Product uniqueness	X121	0.269
			Product portfolio	X122	0.152
			Product price competitiveness	X123	0.265
		Customer relationship management (CRM) X13 0.244	Hotel management philosophy	X131	0.248
			Hotel management methods and procedures	X132	0.258
			The network work system	X133	0.269
			Information technology systems	X134	0.154
			Customer database	X135	0.169
	The quality of the product X2 0.411	Customer value X21 0.246	Organizational culture of the hotel	X211	0.125
			Organizational communication	X212	0.136
			Organizational learning capability	X213	0.198
			Organizational structure and system	X214	0.175
			Internal strategic resource integration	X215	0.145
			The knowledge and skills of integration	X216	0.165
	Strategic information Source and the ability to X3 0.25	Other products value X220.589	Brand and reputation	X221	0.213
			supplier	X222	0.201
			partners	X223	0.194
			Our customer base	X224	0.185
		Infrastructure resources X210.18	Corporate mission and objectives	X231	0.169
			Strategic planning and adjustment ability	X232	0.362
			Strategic decision-making	X233	0.312
		Hotel organization X24 0.235	General manager of ability	X241	0.259
			Employee creativity	X242	0.348
			Business knowledge and skills	X243	0.198
			Management skills	X244	0.254
			Training ability	X245	0.269
			Human resource planning ability	X246	0.364
		Market resources X31 0.254	Quality standard	X311	0.347
			Operating standards	X312	0.159
			Management mode	X313	0.256
		Strategic management ability X32 0.136	Scientific cost management system	X314	0.365
			Cost management innovation	X315	0.369
			The new technology	X316	0.254
		Strategic management ability X33 0.254	The service reliability and consistency	X321	0.156
			A response to customer needs	X322	0.125
			Personalized service ability	X323	0.245
			Employee self-management level	X324	0.259
	Competition X4 0.214	Standardized management ability X41 0.168	Customer relationship orientation	X411	0.123
			Customer service customization	X412	0.258
			Customer relationship repair management	X413	0.021
			The market localization	X414	0.125
			Marketing ability	X415	0.125
		Cost management X42 0.156	Public relations	X421	0.36
			The market share	X422	0.213
			Market reputation	X423	0.365
			Financing ability	X424	0.254

Table 1 – The hotel core competitiveness evaluation index system and index weight

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2.2. Determining the index weight

Because the AHP will be used to determine the weight of every index and it is not necessary to calculate the average weighted results exactly according to the empirical results, the round off method is applied to every third class index, which is round off the weighted results as 1, 3, 5, 7, and 9 respectively. For example, the exact weighted result of the product characteristic of the index X111 is 5.683, and it is closer to 5 than 7, so the ultimate weighted result of the index X111 is 5. Another example is index X12, the exact weighted result of the uniqueness of products is 6.103, which is closer to 7 than 5, so the ultimate weighted result is 7. And the ultimate weighted result of every third class indexes can be deduced by this analogy. And then the weighted results of the second class indexes can be calculated on the basis of the weighted results of the third class indexes and then the weighted results of the first class indexes can be calculated on the basis of those of the second class indexes, what is got is the ultimate weighted result of all indexes.

2.3. Determining the index weight by APH

According to the weighted average results, the letter "D" is used to represent the weighted average result. For example, according to the weighted results, the weighted result of the first-class index is Di=(37/7, 33/6, 81/3, 30/7). First, establishing the matrix of customer value, strategic resource and ability, unique knowledge and skills and competitive market on the basis of hotel core competence. Table 2 is the matrix of the first-class index. And the matrix of index of other classes can be deduced in this way.

C	C1	C2	C3	C4
C1	D1/D1	D1/D2	D1/D3	D1/D4
C2	D2/D1	D2/D2	D2/D3	D2/D4
C3	D3/D1	D3/D2	D3/D3	D3/D4
C4	D4/D1	D4/D2	D4/D3	D4/D4

Table 2 – The primary index of the pairwise comparison matrix So, the matrix is obtained

$$C=\begin{pmatrix} D_1/D_1 & D_1/D_2 & D_1/D_3 & D_1/D_4 \\ D_2/D_1 & D_2/D_2 & D_2/D_3 & D_2/D_4 \\ D_3/D_1 & D_3/D_2 & D_3/D_3 & D_3/D_4 \\ D_4/D_1 & D_4/D_2 & D_4/D_3 & D_4/D_4 \end{pmatrix}=\begin{pmatrix} 1.000 & 0.936 & 0.865 & 1.236 \\ 1.041 & 1.000 & 0.854 & 1.258 \\ 1.175 & 1.325 & 1.000 & 1.456 \\ 0.841 & 0.779 & 0.685 & 1.000 \end{pmatrix} \quad (1)$$

And then assimilating the judgement matrix, which is the matrix whose column sum is 1:

$$B=\begin{pmatrix} 0.254 & 0.265 & 0.254 & 0.248 \\ 0.265 & 0.248 & 0.269 & 0.258 \\ 0.269 & 0.398 & 0.298 & 0.295 \\ 0.313 & 0.246 & 0.247 & 0.236 \end{pmatrix} \quad (2)$$

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And then sum up data of the line and get the vector quantity

$$V = \begin{pmatrix} 0.958 \\ 1.325 \\ 1.365 \\ 0.958 \end{pmatrix} \tag{3}$$

w_i=(0.236,0.258,0.2369,0.2541). And then normalizing it and the weight of the first-class index is obtained: W1=(0.236, 0.258, 0.2369, and 0.2541). And the consistency test must be done towards it.

$$C.I = \lambda \max - n / n - 1, \lambda \max = \frac{1}{n} \sum_{i=1}^{n} \frac{CW}{w_i} \tag{4}$$

$$\sum_{i=1}^{n} \frac{CW}{w_i} = \begin{pmatrix} 1.000 & 0.936 & 0.865 & 1.236 \\ 1.041 & 1.000 & 0.856 & 1.258 \\ 1.175 & 1.325 & 1.000 & 1.456 \\ 0.841 & 0.779 & 0.685 & 1.000 \end{pmatrix} \bullet \begin{pmatrix} 0.958 \\ 1.325 \\ 1.365 \\ 0.958 \end{pmatrix} = \begin{pmatrix} 0.991 \\ 1.026 \\ 1.169 \\ 0.858 \end{pmatrix} \tag{5}$$

3. The application of Fuzzy Evaluation Method

3.1. The establishment of Fuzzy Evaluation Method

1. Evaluation grade set is a set that is made up of various evaluation results possibly made by the valuators towards the evaluation objects, that is E=(E1, E2,...,Em). Ej is the evaluation result of J and m is the grade of the evaluation result. For enterprise core competence and its evaluation index, four grade standards are provided and they are excellent (4-5), good (3-4), average (2-3) and weak (0-2). As a result, m=5, E= (E1, E2, E3, E4) = (excellence, good, average, bad).
2. The evaluation method

To make the evaluation results more objective and accurate, it is necessary to consult experts by using the Delphi method. Experts' questionnaire I of the evaluation of enterprise core competence are designed and N (usually an integral number that is between 30 and 50) experts are invited to make grade evaluation of the second-class indexes and the third-class indexes in Table 1.

Calculating the subordination degree of the second-class indexes to the third-class indexes. Assuming that there are N questionnaires actually recovered and the subordination matrix of the second-class indexes to the third-class indexes can be obtained by counting and analyzing the results of the questionnaires.

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3.2. The application examples

Nanchang Jiangxi hotel located on the middle of bustling Bayi road where is the economic and cultural center area in Nanchang city, It with new appearance is one of the best luxury business hotel in the local after the refurbishment. It opened in 1961 and has 243 rooms, including 24 suites. According to the different needs of guests, it is equipped with different standard suites, luxury suites, executive suites, suites and presidential suites, tea art, KTV, sauna, and hairdressing services. Jiangxi hotel provide guests with Jiangxi cuisine, Cantonese cuisine, Hangzhou cuisines, Brazil barbecue and gourmet food, what`s more, the hotel has conference hall, banquet halls, which can hold large activities. Because the geographical position is superior (near Bayi square), after new decoration in 2007, the hotel guest rooms and food is more superior than the average level of the same star hotel in Nanchang city, the hotel now is rated as five-star hotel.

As for the enterprise core competence and its evaluation indexes, there are four ranks, which are excellent (4-5), good (3-4), average (2-3) and weak (0-2), are offered and they are the basis of grades and evaluation. The Evaluation Index System of Hotels Core Competence is applied to make evaluation of the core competence of Jiangxi Hotel. And the specific evaluation results are listed in Table 3.

The evaluation results show that the general core competence of Jiangxi Hotel is good (3.372). The results also show that Jiangxi Hotel are good in terms of customer value, strategic resources and ability competence, but it only reaches the average level in terms of unique knowledge and skills. Among all the second-level indexes, Jiangxi Hotel only reaches the average level in the following aspects: other value of products, strategic management ability, standardized management, cost management and customer relation management. It has reached more than the level of good in other aspects, among which the market resource is excellent (4.623). The evaluation results are in accordance with Jiangxi hotel's performance in market.

4. Conclusion

This thesis elaborates the development and the current development situation of core competence theory and illustrates the characteristics of service industry, especially hotel industry, and It establishes the Evaluation Index System of Hotels Core Competitiveness on the basis of the study of the connotations and constructions of hotel core competence and uses Analytical Hierarchy process to determine the weight of every index in this system. And the mathematical methods of AHP and FEM are used to evaluate hotel core competence. There are inevitably some unavoidable subjective elements in the evaluation process, but the establishment of the evaluation index system and the getting of the evaluation results are conducted in an objective process and are based on objective facts, so the evaluation results are of high credibility. This thesis chooses Jiangxi Hotel as the sample and evaluates the core competence of it. The evaluation results show that the established hotel core competence is scientific and operable, and the core competence of Jiangxi Hotel is good, which is in accordance with its performance in market.

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The target layer	Primary index and weight	Secondary indexes and weights	The third level indicators		The weight
The hotel core competitiveness	Unique knowledge And skills X1 0.225	Standardized management ability X110.241	The quality of the product	X111	0.269
			Product performance	X112	0.365
			Service efficiency and skill	X113	0.254
			The environment and atmosphere	X114	0.287
		Service trade ability X12 0.257	Product uniqueness	X121	0.121
			Product portfolio	X122	0.365
			Product price competitiveness	X123	0.142
		Customer relationship management (CRM) (0.2140.244)	Hotel management philosophy	X131	0.254
			Hotel management methods	X132	0.236
			The network work system	X133	0.251
			Information technology systems	X134	0.236
			Customer database	X135	0.283
	The quality of the product X2 0.211	Customer value (0.221 0.246)	Organizational culture of the hotel	X211	0.147
			Organizational communication	X212	0.159
			Organizational learning capability	X213	0.156
			Organizational structure and system	X214	0.125
			Internal strategic resource integration	X215	0.139
			The knowledge and skills of integration	X216	0.185
	Strategic information Source and the ability to X3 0.351	Other products value (0.258,0.581)	Brand and reputation	X221	0.246
			supplier	X222	0.259
			partners	X223	0.271
			Our customer base	X224	0.236
		Infrastructure resources (0.1210.183)	Corporate mission and objectives	X231	0.251
			Strategic planning and adjustment ability	X232	0.121
			Strategic decision-making	X233	0.265
		Hotel organization (0.224 0.231)	General manager of ability	X241	0.302
			Employee creativity	X242	0.152
			Business knowledge and skills	X243	0.302
			Management skills	X244	0.314
			Training ability	X245	0.269
			Human resource planning ability	X246	0.314
	Competition X4 0.225	Market resources X31 0.254	Quality standard	X311	0.169
			Operating standards	X312	0.126
			Management mode	X313	0.159
		Strategic management ability (0.215 0.235)	Scientific cost management system	X314	0.236
			Cost management innovation	X315	0.254
			The new technology	X316	0.254
		Strategic management ability (0.333 0.254)	The service reliability and consistency	X321	0.159
			A response to customer needs	X322	0.148
			Personalized service ability	X323	0.258
			Employee self-management level	X324	0.269
		Standardized management ability (0.258 0.251)	Customer relationship orientation	X411	0.258
			Customer service customization	X412	0.236
			Customer relationship repair management	X413	0.314
			The market localization	X414	0.247
			Marketing ability	X415	0.258
		Cost management (0.242 0.156)	Public relations	X421	0.269
			The market share	X422	0.258
			Market reputation	X423	0.236
			Financing ability	X424	0.252

Table 3 – Evaluation Result of fuzzy evaluation Method

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Evaluation on Regional Water Ecological Civilization and its Space-varying Characteristics Based on Big Data

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Pages: 299–310

Abstract: How to reconcile water ecological civilization construction with big data technology has become one of the most critical points of the research projects. Our research was based on the domestic and foreign research data of China's water conservancy development trends. Based on the inter-provincial panel data in 2015, this paper employed the entropy weight method to analyze the weight of six tier-two indexes (i.e. water resource, water safety, water efficiency, water utilization, waterscape, and aquatic culture) and 23 tier-three indexes, as well as their mutual inhabitation effect and interaction with each other. Meanwhile, the data of water ecological civilization construction in 22 Chinese provinces, 5 autonomous regions, and 4 direct-controlled municipalities were summarized and analyzed from the perspective of spatial differentiation. The research results show that the overall level of the sustainable development capacity is low, that the provincial-level difference is remarkable and space-varying, and that all regions are confronted with the pressure of water ecological civilization construction, albeit of different degrees.

Keywords: water ecological civilization, space-varying characteristics, big data.

1. Introduction

Big data technology will become the major cognitive access to the world in the future. In the course of water conservation reform and development, an advanced idea of water ecological civilization highlights the contribution of big data to the study of harmonious coexistence between water systems and human beings and to the accelerated development of people's livelihood and water conservation, which strongly promotes the construction of water ecological civilization. Zhang Yanhui et al., deemed that in a relatively fixed ecological areas, water ecology referred to the state of coexistence, interdependence and interaction between aquatic biocenoses and naturally occurring body of water (Zhang et al., 2014). According to their opinions, aquatic ecology was a vital constituent of the ecological system. Tang Kewang held that water ecological civilization is an extension of the concept of ecological civilization, and is equal to the sum of all kinds of physical and mental wealth required for the protection of water ecological system and for the realization of human-water harmony (Tang, 2013; Fortes et al., 2016).

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Therefore, the criteria of water ecology at the big data level is preferably presented as data knowledge, data value and data civilization on the basis of data integration and analysis. By integrating big data with the evaluation index system of regional water ecology civilization construction, we inject more nutrients to the theoretical studies on ecological civilization, to the construction of civilized city, to the theoretical scopes of national aquatic science research, and to the extension of the academic field of traditional water science. It is of great significance to assess and perfect aquatic ecosystems by quantifying the indicators of regional water ecological civilization, which can directly enrich the theory of water ecological civilization construction.

2. Research reviews

2.1. Water ecological civilization in the context of big data

Ecological civilization, as what mankind pursues for future development, is a form of civilization founded on information base. Any of its manufacturing mode, technology, system or concept can be converted into data information for data processing. In terms of research work on water ecological civilization in the context of big data, Liu Jianzhong believed that all living organisms in a fixed catchment have the potential to form an entity and a water ecosystem with certain functions and structures, via the interaction between the organisms and the aquatic environment as well as the effect of energy flow and materials (Liu, 2007). According to Liu Jianzhong's research findings, the water ecological civilization system is composed of four factors, i.e. water resources, water ecology, the society and economy (Liu, 2011).

2.2. Water ecological civilization evaluation index

The big data collected before was used to assess the construction of water ecological civilization, for which we necessarily established a set of all-sided quantitative assessment index system. Chen Jin deemed that water ecological civilization indicators could be summarized into three aspects: to guarantee life safety and happiness of people, to utilize water resources sustainably, and to have good aquatic ecosystems (Chen, 2013). Gao Hua, Cao Xianyu & Cai Baoguo listed the indispensable components of the water ecological civilization city evaluation system: water resources system, water ecological system, waterscape system evaluation, water engineering system evaluation, and water management system (Gao et al., 2013).

We drew reference from "Opinions of the Ministry of water resources on accelerating the construction of water ecological civilization" and "Ministry of environmental protection. Ecological County, ecological city, ecological province construction index", where the index system was built up with such tier-one indices as water ecosystem, water economic system and water social system. Accordingly, the three systems are considered synergetic, symbiotic and balanced. On this basis, we summarized the frequent, representative indices of the index systems established by some of the early-stage scholars. After deletion and addition, we obtained 6 tier-two indices (vide supra) and 23 tier-three indices to construct a regional water ecological civilization construction

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evaluation index system, whose weights were calculated and evaluated in the context of big data (Gonçalves et al., 2015).

3. The regional water ecological civilization construction evaluation methods

Entropy weight method is a familiar weighed objectives method. In the process of calculation, each evaluation index will provide the corresponding information for the generation of a comprehensive index which synthesizes all the information. According to the range of the numerical value of the index, entropy is used to obtain the entropy weight of each index, before obtaining the synthetic weight of all indices on the basis of the entropy weight of each evaluation index. In this way, the evaluation result is relatively reasonable and true. The entropy weight method is as follows:

1. Construct the initial evaluation matrix

$$A = \begin{pmatrix} X_{11} & \cdots & X_{1m} \\ \vdots & \vdots & \vdots \\ X_{n1} & \cdots & X_{nm} \end{pmatrix}_{n\times m} \tag{1}$$

2. Normalize the indexes in the water ecological civilization construction evaluation index system

The index is regarded as a positive index if "the larger, the better"

$$X_{ij}^{'} = \frac{X_{ij} - \min(X_{1j}, X_{2j}, \cdots, X_{nj})}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} + 1 \quad ,i = 1,2,\cdots,n;\ j = 1,2,\cdots,m \tag{2}$$

The index is regarded as a negative index if "the smaller, the better"

$$X_{ij}^{'} = \frac{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - X_{ij}}{\max(X_{1j}, X_{2j}, \cdots, X_{nj}) - \min(X_{1j}, X_{2j}, \cdots, X_{nj})} + 1 \quad ,i = 1,2,\cdots,n;\ j = 1,2,\cdots,m \tag{3}$$

As a matter of convenience, we record the non-negative treated data as X_{ij}

3. Calculate the weight of the ith scheme in the jth index

$$P_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} \qquad (j = 1,2,\cdots m) \tag{4}$$

4. Calculate the entropy value of the jth index

$$e_j = -k\sum_{i=1}^{n} p_{ij}\ln(p_{ij}), \qquad ,\ k = 1/\ln(n),\ e_j \geq 0 \tag{5}$$

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5. Calculate the difference coefficient of the jth index

For the jth index, the larger the difference of the index value X_{ij} is, the stronger effect it exerts on the scheme evaluation, and the smaller the entropy is.

$g_j = 1 - ej$, thus, the larger g_j is, the more weight the index is assigned.

6. Determine the weight

$$W_j = \frac{g_j}{\sum_{j=1}^{m} g_j} \quad , j = 1,2 \cdots m \tag{6}$$

7. Calculate the synthetic score of all evaluation schemes

$$S_i = \sum_{j=1}^{m} W_j * P_{ij} \quad (i = 1,2,\cdots n) \tag{7}$$

4. Comprehensive evaluation on 2015 regional water ecological civilization construction

4.1. Data source and index weight calculation

4.2. The results of the analysis

4.2.1. Aquatic ecosystems

Table 1 shows that the proportion of water ecosystem's influence on the construction of regional water ecological civilization is 47.68%. Among it, the proportions of the influence of water resource (positive index) is 36.19%, water safety (positive index) is 18.20%, and water ecology (negative index) are all 45.61%. This indicates that water ecology has been negatively impacted on in the process of economic development in China, with large demand for water resources and little public concern of water security. The causes to this phenomenon also include geological constraints, high cost of disposal and recycle, and failing technology. With the advancement of water ecological civilization construction, it is imperative for China to construct tailor-made water resources management system and to take measures to develop and utilize water resources properly, as a response to the deepened recognition of short supply of water resources and water resource reuse.

As can be seen from Table 2, the regions with the highest and lowest scores are respective Tibet (0.7532), the most underdeveloped economy-related province, and Beijing (0.4426), the center of national economy, politics and culture. The sheer contrast of water ecology score reflects the negative correlation between economic progress and water ecological civilization construction. In recent years, China has advocated the coordinated development of economy and environment, adhering to the idea of sustainable development. Despite the great improvements attained, water resources protection is still out of the ideal state of leverage balance. It is our recommendation

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Objective layer	System layer	Tier-two index	Tier-three index	Unit	Index property	Weight
regional water ecological civilization construction evaluation system (A)	*waterecosystem (B)* *0.4768*	*Water resource (B1)* *0.3619*	B11 the total volume of water resources	hundred million m3	positive index	0.0905
			B12 the total volume of water resources per capita	m3	positive index	0.0909
			B13 urban water surface ratio	%	positive index	0.0906
			B14 the volume of groundwater resources	hundred million m3	positive index	0.0900
		Water safety (B2)0.1820	B15 the pass rate of water quality in the urban water function zone	%	positive index	0.0906
			B16 the pass rate of water quality in the centralized drinking water source site	%	positive index	0.0914
		Water ecology (B3) *0.4561*	B17 the area of land for control on water loss and soil erosion	km2	negative index	0.0910
			B18 the proportion of ecological environment water consumption	%	negative index	0.0913
			B19 the total volume of waste water emitted	Hundredmillion ton	negative index	0.0913
			B20 the total volume of domestic sewage discharged	hundred million ton	negative index	0.0913
			B21 the volume of industrial waste water discharged	hundred million ton	negative index	0.0913
	Water economic system (C)0.3057	*Water utilization (C1)* *0.7141*	C11 water consumption per ten thousand GDP	m3	negative index	0.1427
			C12 the proportion of agricultural field irrigation area to arable land area	%	positive index	0.1425
			C13 the annual amount of domestic water per capita	m3	negative index	0.1430
			C14 the total amount of industrial water	hundred million m3	negative index	0.1429
			C15 water consumption required for the additional profit of ten thousand yuan for the industry at a scale larger than ...	m3	negative index	0.1429
		Water efficiency (C2)0.2859	C16 reclamation rate of urban polluted water	%	positive index	0.1431
			C17 innocent disposal rate of domestic garbage	%	positive index	0.1429
	Water social system (D) *0.2176*	*Waterscape and aquatic culture (D1)*	D11 the number of national water ecological scenic spot	/	positive index	0.1997
			D12 urban green coverage rate	%	positive index	0.2003
			D13 the proportion of natural protection area	%	positive index	0.1994
			D14 the public green area per capita	m2	positive index	0.2001
			D15 the popularization rate of aquatic culture propagation	%	positive index	0.2004

Table 1 – 2015 regional water ecological civilization index weight

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that in the future, efforts should be strengthened to research, develop and introduce industrial technologies according to the regional characteristics of water resource, and that the level of water safety should be lifted towards the direction of construction of ideal water ecological system.

4.2.2. Water economic system

As shown in Table 1, the proportion of water economic system's influence on the construction of regional water ecological civilization is 30.57%. Among it, the proportions of the influence of water utilization (negative index, except for index C12: the proportion of agricultural field irrigation area to arable land area) are all 71.41%, and water efficiency (positive index) are all 28.59%. This result shows that China's current economic development rests heavily on water resources, and that the actual efficiency of water resource utilization is such low as to fail to reach the goal of highly-efficient utilization of water resources. In spite of the recently intensified management on water resources, the economic benefits generated from water resources are far from our expectations, according to the current situations.

As can be seen from Table 2, the regions with the highest and lowest scores of water economic system are respective Beijing (0.8394) and Tibet (0.3667). The gap between the two provinces is more than 2 times, which indicates the great disparities of water economic development at the regional level. Such being the case, it is necessary for the government to actively guide the rational flow of production factors across regions and to intensify the policy support to backward regions. Guided by the principle of pursuing economic growth while preserving resource benefits, the regional pattern should develop with complementary advantages, benign interactions and coordinated development. Meanwhile, more research focuses should be water resource utilization. With novel technologies, the water resource consumption is expected to lower down, such that providing an ultimate solution to the problem of economic benefits of water resources.

4.2.3. Water social system

As can be seen from Table 1, the proportion of water social system's influence on the construction of regional water ecological civilization is 21.76%, which reflects the important role of water social development in promoting water ecological civilization construction. Water social development and water economic progress are important guarantees to promote the construction of water ecological civilization. In view of the unbalanced and uncoordinated development of water economy and water society, it is supposed to adjust the structural strategy of water ecological civilization construction. We should change the awkward situation of ignoring water social construction in favor of water economic development, by means of converting part of water economic achievements into water social construction. In order to enhance the sustainability of water resources, we recommend a full-scale bid to balance the three systems of water ecological civilization.

According to Table 2, the regions with the highest and lowest scores of water social system are Shandong (0.4654) and Hainan (0.1766), respectively. Their scores are nearly 3 times different from those of coastal regions, with the score of water social system hitting the bottom of the whole evaluation system. This phenomenon indicates the close

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relationship between water society development and water economy. It also reflects the low-level water social development across the country as well as the broadened gap between regions. At the present stage, water society construction is still a challenging problem demanding long-term treatment. Administratively and institutionally, the government should help reach the consensus of water ecological civilization construction, should combine modernized urban construction with water ecological civilization construction, and should establish supervisory mechanism and reward & punishment system of water ecological civilization construction, so as to form a sustainable water ecological development pattern. The government should also strengthen the publicity and education of water ecological civilization, and enhance people's awareness of water ecological civilization so as to develop into water ecological civilization culture.

4.2.4. Composite index.

The composite index represents the comprehensive score of the construction of regional water ecological civilization. As can be seen from Figure 1, regional scores are at the middle level in the year of 2015. Among them, regions with the highest and lowest scores are Guangdong (0.6100) and Heilongjiang (0.4742). Their different performances result from the gap between economic development and the awareness of water ecology. Guangdong is a major port city in China, with a developed economy and a gradually modernized manufacturing industry. As a comparison, Heilongjiang is located in the northeast area of China, whose backward economy is dominated by agriculture. They take into account different economic benefits in terms of water resources utilization, and thus progress in ecological civilization construction in different speeds. It should be noted that in the recent decades of water ecological civilization construction, there appears the phenomenon of sided development appears. Some regions emphasize water ecology, water economy or water society single-facet, which unbalances the three systems and further affects the sustainable development of water ecology. Therefore, the central government should pay attention to the comprehensive development of regional water ecological civilization construction. While implementing construction measures, it should monitor the dynamic trends of various regions and timely adjust the proportion of subsystems, so as to promote the construction of the water ecological civilization.

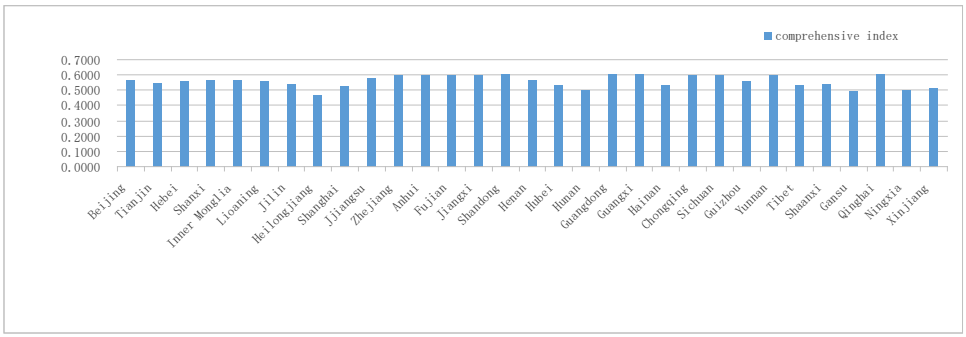

Figure 1 – China's regional water eco-civilization construction composite index ranking in 2015

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Region	B		C		D		A	
	Water ecosystem	Order	Water economic system	Order	Water social system	Order	Composite index	Order
Beijing	0.4426	31	0.8394	1	0.4607	2	0.5701	16
Tianjin	0.5192	26	0.7994	4	0.2536	27	0.5498	20
Hebei	0.5348	24	0.7698	6	0.3363	11	0.5659	17
Shanxi	0.5681	21	0.7620	8	0.2954	21	0.5703	15
Inner Mongolia	0.5824	15	0.7339	15	0.3155	13	0.5724	14
Liaoning	0.5688	20	0.7346	14	0.3012	18	0.5632	19
Jilin	0.5704	19	0.6818	23	0.2990	19	0.5473	21
Heilongjiang	0.5547	22	0.4685	30	0.2980	20	0.4742	31
Shanghai	0.5128	27	0.7079	20	0.3047	15	0.5293	26
Jiangsu	0.5946	14	0.6876	22	0.3885	3	0.5799	12
Zhejiang	0.6055	13	0.8037	3	0.3014	17	0.6013	7
Anhui	0.6318	7	0.7427	11	0.3343	12	0.6027	6
Fujian	0.6204	11	0.7723	5	0.3042	16	0.5996	9
Jiangxi	0.6373	6	0.7230	19	0.3516	9	0.6031	5
Shandong	0.5297	25	0.8287	2	0.4654	1	0.6093	2
Henan	0.5822	16	0.7516	9	0.2904	23	0.5726	13
Hubei	0.5805	17	0.6444	26	0.2748	26	0.5352	25
Hunan	0.4554	30	0.7370	13	0.2785	25	0.5031	29
Guangdong	0.6437	5	0.7284	17	0.3635	7	0.6100	1
Guangxi	0.6958	2	0.7306	16	0.2353	29	0.6072	3
Hainan	0.6272	9	0.6516	25	0.1766	31	0.5388	23
Chongqing	0.6112	12	0.7626	7	0.3372	10	0.5998	8
Sichuan	0.6664	3	0.6538	24	0.3652	6	0.5980	11
Guizhou	0.6280	8	0.6962	21	0.2287	30	0.5636	18
Yunnan	0.6485	4	0.7239	18	0.3115	14	0.5991	10
Tibet	0.7532	1	0.3667	31	0.2906	22	0.5359	24
Shaanxi	0.5001	28	0.7374	12	0.3517	8	0.5425	22
Gansu	0.4631	29	0.6195	28	0.3685	4	0.4922	30
Qinghai	0.6237	10	0.7429	10	0.3662	5	0.6056	4
Ningxia	0.5381	23	0.6327	27	0.2373	28	0.5041	28
Xinjiang	0.5727	18	0.5800	29	0.2879	24	0.5142	27

Table 2 – The comprehensive evaluation results and ordering of China's regional sustainability

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5. The spatial difference between the development levels of regional water ecological civilization

5.1. System cluster analysis

In order to further analyze the spatial differentiation characteristics of water ecological civilization construction in China, this paper uses the system clustering method to analyze the comprehensive evaluation of water ecological civilization construction at the regional level. By using SPSS (version 23. 0) software, we select four subsystems of water ecological civilization construction as the samples. With inter-group links and Squared Euclidean Distance, we obtain the clustering tree diagram as shown in Figure 2. According to the results of cluster analysis, we divide the 31 regions into 5 categories of sustainable development zones, as listed in the table.

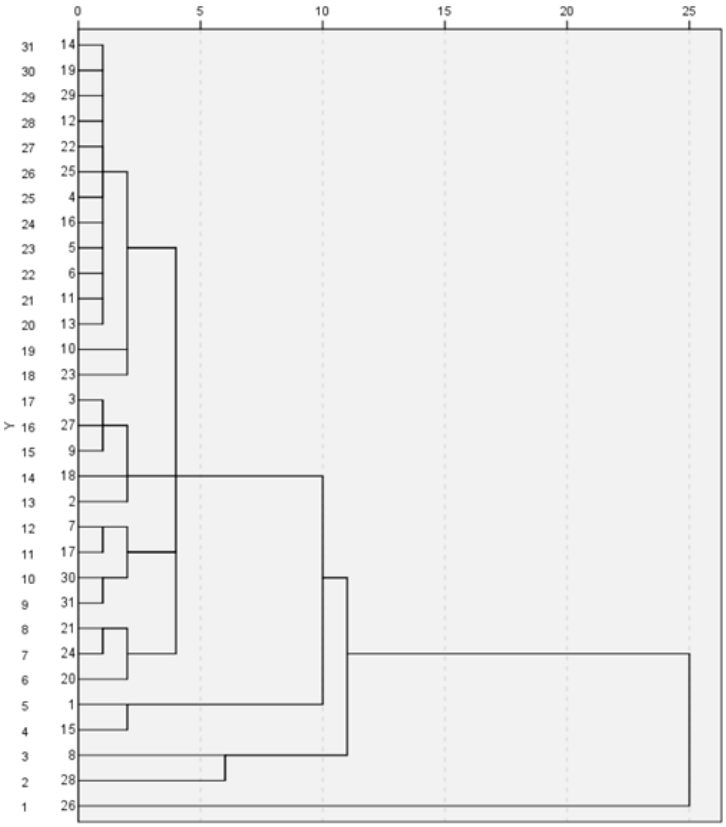

Figure 2 – Tree diagram of cluster analysis

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5.2. The spatial differentiation characteristics

As can be seen from the table, the above-mentioned 31 regions' sustainable development capacity presents remarkable spatial differentiation characteristics. Specifically speaking,

5.2.1. Ⅰ **area (Beijing, Shandong, Heilongjiang, Gansu, Tibet)**, where all but region Shandong are inland provinces. Except for Heilongjiang, all of them have one or two high-ranking systems among water ecology, water economy, and water society. The economically developed provinces Beijing and Shandong rank high in water economy and water society, but low in water ecology. In order for the comprehensive evaluation on sustainable development of water resources, their future directions of development are construction of water ecology system while maintaining the momentum and position of economic growth. Heilongjiang, Gansu and Tibet are graded low in comprehensive system evaluation, among which province Tibet obtains the highest score of water ecosystem while province Gansu ranks high in water society system. The economic foundation of the three provinces is relatively weak. For future development, we suggest to take advantage of their unique climate conditions, land resources, and the superior resources of agriculture and animal husbandry. Meanwhile, the water ecological system should be a future focus, with measures to improve its sustainability.

5.2.2. Ⅱ **area (Guangxi, Henan, Guizhou)**, located in southern China. These three regions rank low in water society system, high in water ecosystem, and less high in water economic system, which reflects their backwardness in water economy and water society. Their future steps should be towards the attraction of foreign funds and advanced technologies in providing extra impetus to and uplifting the level of water economy and water society, so that water ecology will come into play. Guangxi and Guizhou are inland provinces. The agricultural province of Guangxi should step up efforts to phase out traditional agricultural economy to agriculture, and to accelerate agricultural modernization; the industrial province of Guizhou is supposed to positively develop high-tech industries and accelerate the pace of industrial structure optimization and upgrading. Henan is a coastal city with the pillar of tourism industry. It fully utilizes the advantageous resources to construct industries with local characteristics. Meanwhile, the government should scale up supportive policies, projects, capitals, talents, infrastructure ancillaries, and technology-related RD, as a way to assist these provinces.

5.2.3. Ⅲ **area (Jilin, Hubei, Ningxia, Xinjiang)**, located inland in the northeastern, northwestern and south-central areas in China. They almost rank the bottom of the list of comprehensive water ecological civilization construction. All scores except for the score of water ecosystem are in the last several places on the national list. In addition to Hubei, most of the other provinces are economically supported by traditional manufacturing industry at the cost of high pollution and high energy consumption, in the mode of industrialization. Therefore, in order to enhance the sustainability of regions in this area, efforts are required for the implementation of the strictest resource control and for continuous optimization on resource allocation, so as to simultaneously promote the construction of water economy and water society and play a role in water ecology. In addition, the central government should be more supportive to the area in its establishing a hi-tech based modernized industry aimed at leading the industry transformation and

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industry upgrading. With governmental supports and its own efforts, the gaps of water economy and water society between III area and other areas are expected to be narrowed.

5.2.4. Ⅳ area (Shanghai, Tianjin, Hebei, Hunan, Shaanxi). In these five provinces, Shanghai and Tianjin are coastal provinces, while Hebei, Hunan, and Shaanxi are inland provinces. The water economic system of Tianjin and Hebei ranks top, and their water ecosystem and water social system rank lower. In the other three provinces, except for the satisfactory ranks in Shanghai's and Shaanxi's water social systems and in Hunan's water economic system, all the ranks are unsatisfactory. In the process of economic development, Tianjin and Hebei should focus on the protection of water ecology and on the development of water society as a means of modernization and urbanization development. Limited by water resource volume and population problems, Shanghai, Shaanxi and Hunan are water ecological pressure areas. In this case, necessary measures should be taken for resource management, adjustment and optimization, so as to improve the sustainable development of water resources.

5.2.5. Ⅴ area (Guangdong, Jiangsu, Zhejiang, Fujian, Liaoning, Jiangxi, Shanxi, Inner Mongolia, Anhui, Henan, Chongqing, Sichuan, Yunnan and Qinghai). Guangdong, Jiangsu, Zhejiang, Fujian, and Liaoning are coastal regions, while the rest are inland zones. This area has well sustainable water resources and objective indexes of water ecological system. Nevertheless, great disparities exist in the water economic system and the water social system of the same region. Among them, the water economic systems of Zhejiang, Fujian, Liaoning, Jiangxi, Anhui, Chongqing, Henan rank higher than their water social system, whilst the rest of the regions have the opposite sequence. For the former ones, not only should the water economy continue developing sustainably, but the water social construction should be implemented simultaneously, such as to promoting the persistence of the sustainable development of local water resource. For the latter ones, the development direction should lie in water conservation, waterscapes and water culture, on the premise that the water resource sustainability is unaffected by water economic development.

6. Conclusions and Suggestions

Typical of information technology, big data has become the inevitable element of water ecological civilization construction. This paper constructs the evaluation index system of regional water ecological civilization construction under the background of big data. The 2015 data is applied to the measurement, evaluation and space-varying characteristics analysis of 31 regions in China. The results show that: First, the sustainable development capacity is generally low and space-varying of different provinces, autonomous regions and municipalities in China. The highest degree of water ecological civilization construction is Guangdong (0.6100), and the lowest is Heilongjiang (0.4742). Second, the regional sustainable development capacity has obvious spatial differentiation characteristics. All regions except for Guangdong, Guangxi and Shandong are confronted with different degrees of water ecological civilization construction pressure.

To respond to the strategic requirement of accelerating the promotion of water ecological civilization construction, we propose the following several suggestions: from the perspective of reconciling economic development, social progress and water ecology, the

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government can set the thresholds of water ecological protection, formulate river & lake function zone planning, and improve the carrying capacity of regional water ecological environment; from the water-saving and highly-efficient-water-utilization perspective, the government should promote the water-saving society construction, and accelerate water source protection and overall water consumption management; the government is supposed to involve the public in water control, step up the popularization efforts of water ecological civilization construction, so as to cultivate a positively supportive atmosphere of water ecological civilization construction.

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Design and Realization of Computer Assisted English Teaching Software based on Big Data Corpus Management

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Abstract: This paper introduces the basic concept of corpus, common statistical parameters and analytic statistics method of corpus as well as common corpus index software and its basic functions. In the following, in the several specific application methods of corpus in the field of computer assisted English teaching, construct video corpus to assist English teaching; assisted teaching with combination of English video material and video corpus can create two vivid contexts for learners. The paper designs a tool used for deleting useless information for constructing corpus in subtitle file based on analyzing the subtitle file structure in format. One video corpus for teaching including over 110 films and over 1.1 million words of documentary film and total amount has been established with adoption of this tool and online subtitle file resource, which provides conditions for English teaching.

Keywords: computer assisted teaching, English teaching software, big data corpus management.

1. Introduction

Corpus is a big electronic library with certain capacity established based on certain linguistic principles, with adoption of random sampling method and through collecting continuous language use texts or discourse segments appeared naturally. Applying corpus to English teaching can provide rich context for learners and is good for the language knowledge construction for the learners (Granger, 2002). The idea of making use of rich context of corpus to assist learners to accomplish active construction for language knowledge and the idea of teaching design based on constructivism stressing the important function of "context" for meaning construction is consistent. Researches about corpus in recent years have achieved great development, but there is certain technical difficulty in the application of powerful English corpus. Therefore, in the mainly applications in abstract linguistic research field, dictionary compilation field as well as propositional work of important examinations, the majority of teachers lack necessary understanding of corpus. This situation produces extremely low application rate of corpus in the field of computer assisted English teaching and its application potentiality has not been well explored (Atwell, 2000). There are also few researches on

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the important application value of corpus in assisting English teaching in educational technology circle.

With the continuous improvement of computer performance and continuous decrease of price as well as the rich English electronic publications and network English text resources and the popularization of scanner in teaching field, it is possible for individual teachers or small teaching collective to construct corpus for teaching (Davies, 2010; Miramontes et al., 2016). Applying corpus into English teaching can help to change the traditional teaching mode focusing on teacher and assist the application of data driven learning model based on constructivism.

2. Basic function of corpus index software

2.1. KWIC index

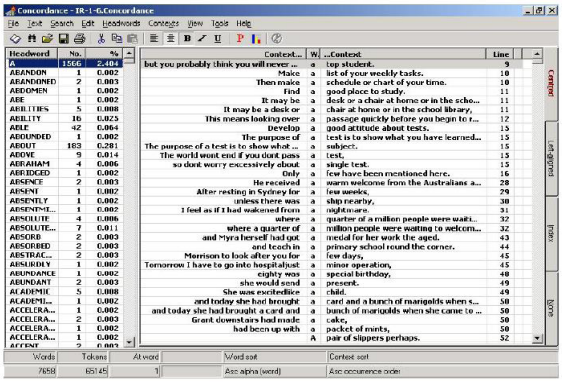

图 2-1　按关键词的字母顺序排列的 KWIC 索引

Figure 1 – According to the keywords of the KWIC alphabetical index

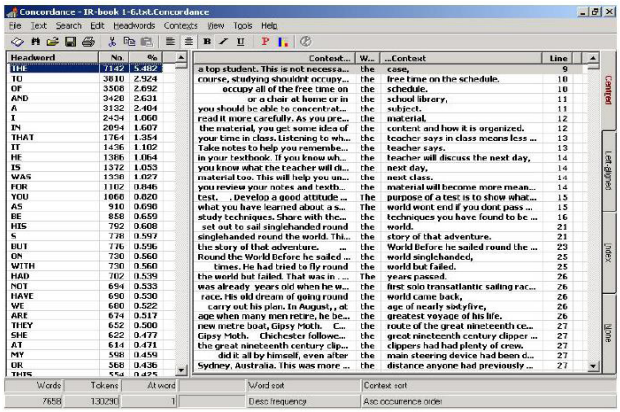

图 2-2　按关键词的频率顺序排列 KWIC 索引

Figure 2 – frequency of keywords KWIC index

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The basic analysis methods of corpus are full text retrieval and word index. Word index form in most of corpus index software is KWIC index, which is “keyword search with context”. Different corpus index software has different naming for key words and the key word in Concordance 3.2 is called as Headword. The following Figure is the KWIC index (making use of Make Full Concordance function) attained from full text retrieval for 1-6 text books of college English intensive reading with adoption of Concordance 3.2, in which Figure 1 is the alphabetical order of key words and Figure 2 is frequency order of key words.

2.2. Corpus basic parameters statistics

Concordance 3.2 includes some statistical functions for the basic parameters of corpus. Figure 3 is the statistical results for the basic properties of 1-6 text books of college English intensive reading with adoption of Concordance 3.2:

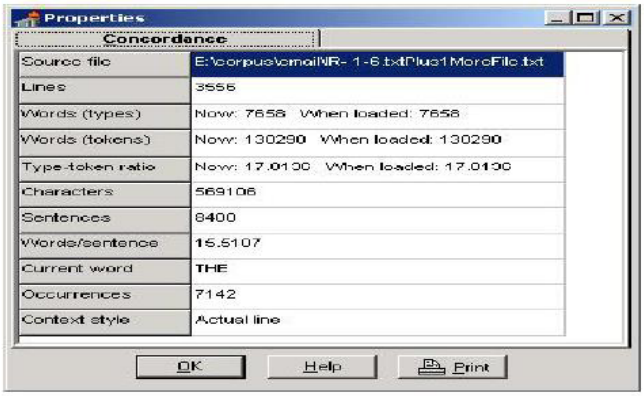

图 2-3 语料属性

Figure 3 – Corpus properties

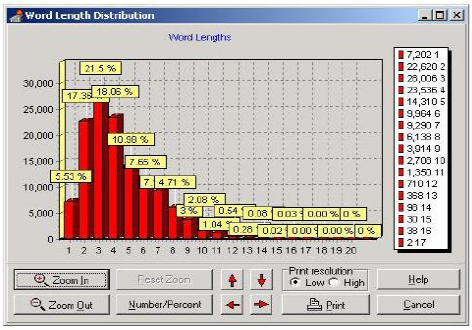

图 2-4 单词长度分布图

Figure 4 – Word length distribution

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In which, it includes types, tokens, type-token ratio, words/sentences and other parameters mentioned in the former introduction of common statistical parameters in corpus.

Make statistics for the word length distribution situation in corpus with word length distribution function, which is with important reference value for judging the difficulty of corpus text and language style. Figure 4 is the word length distribution map of 1-6 text books of college English intensive reading with adoption of wordlength distribution.

It can be seen from Figure 4 that there are 235364 tokens with word length at 4, accounting for 18.06% of the total tokens; there are 39149 tokens with word length at 9, accounting for 9% of the total tokens.

2.3. Collocation statistics of key words

Most of corpus retrieval software provides statistics for the frequency of collocation of key words and other parameters and some also provide the calculation function of collocation force between collocation words and key words. Figure 5 is the statistical result for the collocation words of key word able in 1-6 text books of college English intensive reading with adoption of the collocation function of Concordance 3.2 (Jones and Mewhort, 2004).

It can be seen from the results that collocation function offers the statistical results of four words of one key word before and after the collocation position. It can be seen from the example that the appearing frequency of be at 1-left position and to at 1-right position is obviously higher than other collocation words (Rooy and Schäfer, 2003; Gonçalves et al., 2015). After making lemmatization for various forms of verb be, the situation becomes more obvious. It explains that in 1-6 text books of college English intensive reading, the fixed collocation “be able to” is with the highest appearing frequency among

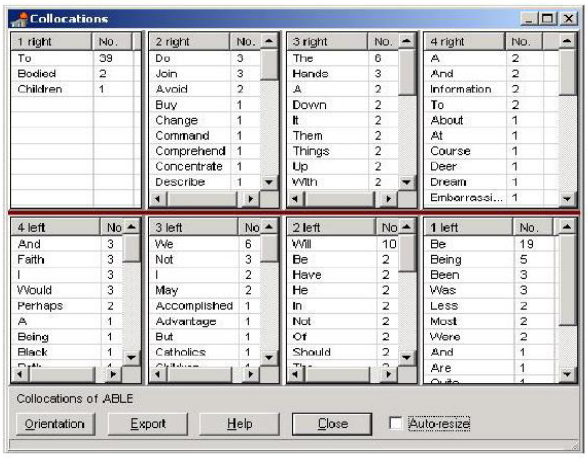

图 2-5 关键词 able 的搭配词的统计结果

Figure 5 – The statistical results of key words collocation

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various uses of word able and should be emphasized. This frequency information can't be attained when searching the usage of one word in English dictionary, while if this frequency advantage is very distinctive, it is very necessary for the construction of language knowledge and skills.

3. Source of corpus

3.1. Electronic publications

With the increasingly rich electronic publications, it becomes very convenient and efficient to make use of the text provided by electronic publications as the source of corpus in teaching, especially some English learning materials, English texts and encyclopedia etc. in the form of electronic text (Sanz, 2011).

Mp3 voices and corresponding texts are usually provided in English learning materials, such as various kinds of published VOA, BBC news English learning CDs as well as electronic discs of English salons and English abstracts; all of them can extract the text as corpus.

Some special English corpuses provide literature in text form and academic article, which can be used as an important source of corpus. For example, English Classics 1000 published by Fudan University Press provide two searching methods based on works name and author name, covering famous literature and academic works of English history, which is a valuable source of corpus.

English news is in close relationship with current affairs and life, which can timely reflect the changes and developments of contemporary English and represent the characteristics of contemporary English; therefore, it is an important source of corpus for English teaching. English news text can be collected from some famous English news websites and English news learning websites both at home and abroad.

3.2. Film subtitles

Use film subtitles to construct an audio and visual corpus for English learning is a field that has been ignored for a long time. This kind of corpus can be combined with related film and television resources and can be used to improve the English reading ability, translation ability and listening ability (Axelsson, 2000). There are usually two ways to attain subtitles (Shirato and Stapleton, 2007); one is to extract dialogue from script text and the other is the extract from the plug-in subtitle file of film and television material.

Subtitles of most film and television materials on current network adopt plug-in form. Plug-in subtitle files focus on srt files, which can be opened directly by notepad as text file and is good to be used as the source of audio and visual corpus. We take the plug-in subtitles of the second part of film the Sound of Music as example to explain the structure of srt file.

It can be seen from this example that the plug-in subtitle file structure of srt form consists of three parts; the first part is number, which is the subtitles appearance order, as 1, 2, 3, 4 in above example; the second part is the duration time of this subtitle on

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screen, such as 00:00:15,975 --> 00:00:18,808 in above example, indicating that the following subtitles will be displayed on screen from 00:00:15,975 to 00:00:18,808; the third part is subtitle content, such as "Dear Father, now I know why you sent me here" in above example. This kind of subtitle file in srt form can be found on internet and usually Chinese-English corresponding subtitle can be found. There are many good websites providing subtitle downloading service for free and one of the comprehensive and famous websites is shooter website (http://www.shooter.com.cn).

3.3. Scan written text

At present, scanner can be attained easily for most of teachers. The error rate of transferring English written text into electronic text is very low, which can be accepted completely. When the teachers have English books, newspapers and other written materials suitable to be added into corpus on hand, while corresponding electronic text can't be attained from electronic resources and network resources due to copyright issue, adopting scanner will be the first choice.

4. Application corpus for teaching

Collect constructed text corpus for teaching with adoption of corpus index system and some other computer software tools with combination of above methods and many specific functions can be realized. We take Concordance 3.2 as example to explore some specific application mode of corpus for teaching.

4.1. Review vocabulary through KWIC index of intensive reading textbooks

In the former, we have introduced the KWIC index of all types in teaching material through indexing intensive reading textbooks. This can be a good material and tool for learners to review words (Manetta, 2007). Through KWIC index, the learners can realize the construction and strengthening of language knowledge in a better way with the assistance of the specific application environment of each word in teaching material. Produce KWIC index into webpage form to upload to related websites assisting learners, as the tool of assisting learners to construct vocabulary knowledge.

4.2. Vocabulary learning model of learning environment model based on the constructivism of Jonathan

Vocabulary learning model of learning environment model based on the constructivism of Jonathan stresses the active construction of learners for vocabulary knowledge under the guidance of teachers. In the process of vocabulary knowledge construction, rich and real example sentence with context for one or some key words is an essential condition. The learners need to make full exploration and consideration for example sentence and context and attain own conclusions. There can be adequate cooperation and discussion among members within the team (Grieve, 2012). Main conclusion of this group can be proposed by taking this group as a unit to mutual reference and discussion among each group. Teachers can offer necessary help and guidance when necessary. It can also be verified in English dictionary. But it should be realized that not all the vocabulary information in dictionary is comprehensive

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and adequate (Osborne and Bridge, 1994). The significance of this learning mode lies in that realize active vocabulary meaning construction through exploring a lot of real contexts where vocabulary appears, but not lies in whether the summarization of learner is comprehensive and perfect; most of discussions are open and not taking seeking for standard answer as purpose. The following example is used to explain vocabulary learning model of learning environment model based on the constructivism of Jonathan.

Figure 6 is to guide the students to make usage classification process for round with adoption of all contexts for round (32 in total) extracted from 1-6 text books of college English intensive reading. Figure 7 is deleting key word interest and used to guide students to make exercise of filling in blanks with adoption of all contexts for interest (10 in total) extracted from 1-6 text books of college English intensive reading with adoption of concordance 3.2. It has to point out that the main purpose of exercise of filling in blanks is reading and speculation for context and it is not important whether it can attain the deleted key word. On one hand, the context provided by the teacher is not adequate enough, which can attain the key words easily, under this situation, it is difficult to get results. But the exploration and discussion of learners within the team for context reaches the purpose of study and communication; on the other hand, the answer of filling in blanks is not the sole and can be open (especially under the situation with less co-occurrence times of context), all the answers can be accepted as long as meeting grammar, logic and context condition. It can be seen that this kind of vocabulary learning model of learning environment model based on the constructivism of Jonathan is on the contrary to traditional indoctrinate vocabulary teaching. Real corpus, open problem and discussion and cooperation among team members are good for improving the interest and enthusiasm of learner. This method also provides a new idea for computer assisted English teaching.

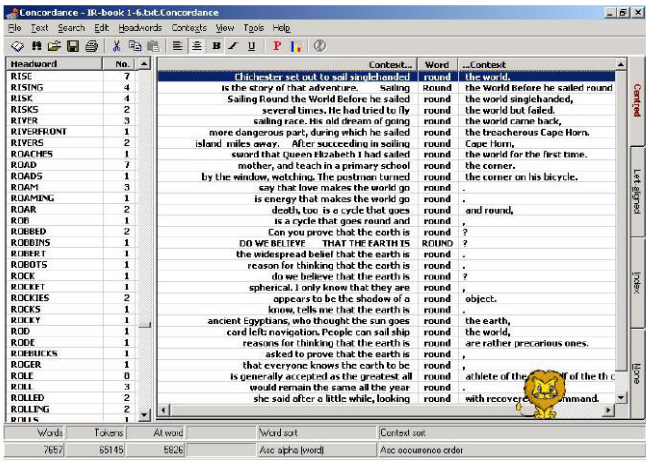

图 4-2 round 在精读教材语料库中的语境

Figure 6 – Round in intensive reading materials corpus in the context

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at the row of puddings with great	.
may of his ideas still of great	to us.
theorist. He didnt have the slightest	in the practical application of his ideas and theories.
expose corruption or to promote the public	.
science thus becomes a matter of self	to scientists.
distinguish himself. He partied, took a great	in rowing and studied only an hour or so a day.
be drawn from those results. Of primary	in business and technical research reports is the valid
not of the most intense and fascinating	to anyone with whom he came in contact.
better way, he argues, to stimulate their	in thing scientific?
on among scientists. Big arguments stimulate their	,

图 4-3　interest 在精读教材语料库中的语境

Figure 7 – Interest in intensive reading materials corpus in the context

4.3. Assisted teaching with combination of English film and television information and film and television corpus

Assisted teaching with combination of English film and television information and film and television corpus can create two vivid contexts for learners. One is audio and visual context composed of film and television information and the second is textual context which is easy to check and compare and composed of film and television subtitle text and corpus. It is in line with that teaching design of constructivism "stressing on the important role of context for meaning construction". Film and television material assisted English teaching needs to possess two conditions. One is English dialogue and the other is English subtitles (it is better to have Chinese subtitles and make it easy for reference). A lot of English films in DVD form provide two kinds of subtitles of Chinese and English. If play the film files in other forms (such as avi or rmvb), it can consider about using MPC (Multi-Player Classic) with plug-in subtitle to reach the purpose of selecting Chinese and English subtitles. It must pay attention that when use plug-in subtitles, plug-in subtitles must has the same name as its corresponding film file and also in the same file. Figure 8 is the KWIC form of this corpus.

at the row of puddings with great	.
may of his ideas still of great	to us.
theorist. He didnt have the slightest	in the practical application of his ideas and theories.
expose corruption or to promote the public	.
science thus becomes a matter of self	to scientists.
distinguish himself. He partied, took a great	in rowing and studied only an hour or so a day.
be drawn from those results. Of primary	in business and technical research reports is the valid
not of the most intense and fascinating	to anyone with whom he came in contact.
better way, he argues, to stimulate their	in thing scientific?
on among scientists. Big arguments stimulate their	,

图 4-3　interest 在精读教材语料库中的语境

Figure 8 – Interest in intensive reading materials in the context

5. Conclusions

In a long term run, corpus is mainly controlled by linguists as well as compliers of major examination proposition groups and dictionary as a powerful weapon for foreign language learning and research. Its potentiality in the field of computer assisted teaching has not

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been well explored and the popularity degree is very low. There are active researches on computer assisted teaching field, which is with wide application and weak disciplinary uniqueness in education technology circle, while neglect the researches that corpus assisted English teaching has great significance in certain discipline teaching field.

This paper introduces related knowledge and theory of corpus, discusses the theoretical basis of computer assisted English teaching based on corpus and makes preliminary discussion on the classification of teaching corpus as well as the application method of corpus with different contents in English teaching aroused by classification thought. It makes pioneering attempt in adopting film subtitle file to extract corpus for assisted teaching and constructs one film corpus library containing over 110 films with English subtitle and with over 1.1 million words. It is hoped to play the role of trigger and arouse the interest and emphasis of education technology circle for corpus assisted English teaching with great potentiality.

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Research on Music Production Based on Computer Analysis and Recognition Technology

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Abstract: Based on the researches and improvement of the main melody recognition technology of music, this paper constructs the music feature space model, and the characteristic parameters of the model feature space are marked, furthermore on this basis, the music emotion computer automatic recognition model is studied, and design and simulation of automatic recognition system are achieved based on the MATLAB platform. This paper also proposes an automatic recognition model by using BP neural network algorithm. Experimental results show that the proposed BP neural network is effective in music emotion recognition after comparing it with the statistical classification algorithm.

Keywords: computer analysis, computer recognition technology, music production, emotion analysis

1. Introduction

In recent years, with the interaction development of computer technology, communication technology and multimedia technology becoming more and more mature, the computer as a powerful tool for calculation and analysis is widely used in all areas of society. At the same time, people are increasingly expecting to use computers to simulate, analyze and express human's various subjective intelligence activities, such as human thinking, emotion, etc., so as to better understand and reproduce the inward world of human who are social subject. With the computer technology full research and application in the field of multimedia, thus multimedia business has achieved rapid development and become one of the fastest growing as well as one of the largest industries in 21st century (Cascone, 2000). Content-based multimedia information processing technology is an important research hotspot in this field, especially after the introduction of dynamic media such as animation, audio, video, multimedia technology greatly enriched the expression of human emotions by computer.

Audio data of multimedia is same with video data, also has a large amount of information related to the content, which is closely linked with human perception factors. While as the most important expression of multimedia audio data, music is an elegant art that expresses human emotions, which ingenious combines the various elements of music with computer to show a rich emotional world (Gresham-Lancaster, 1998). Sweet music can not only make people feel comfortable, but also can improve people's

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work efficiency, and even improve people's faith in life. In the history of human music, emotional catharsis and externalization is an eternal theme. Emotion is the essential characteristics of music, the real purpose to create music, in fact, is to convey some emotion in the heart (Reck, 2016; Maritza et al., 2016).

The effect and significance of this paper involved research will be reflected in: (1) As music is the most important form of multimedia, intelligence and digitization of music emotion have important significance for enhancing emotional interaction performance of multimedia products in the market(Knapp and Lusted, 1990); (2) Providing the thought extension of the emotion recognition for the research of artificial intelligence, and providing the innovative possibility for the application of emotion-driven music and stage arrangement (Miranda et al., 2011); (3) The in-depth study of recognition technology will promotes its reverse process, that is, music automatic generation technology research, through the method of a certain emotional constraints to generate a new music sequence with specific emotional, so as to achieve innovative breakthroughs in automatic composition and other artistic and technical cross-cutting areas (Garnett, 2001); (4) Music is one of the main patterns of human expression and external emotion, and the research of music emotion will be helpful to speed up the development of intelligent human-computer interaction technology which is aim at the natural emotion of mankind.

2. Basic characteristics of music emotion information

Music emotion information is actually the external characteristics reflect of the audience psychological perception to music, it is the basis for studying music emotion cognitive analysis model. From the information theory point of view, the whole process of music psychological perception is a process of information acquisition, transformation, transmission, processing and storage. While from the control theory point of view, each composer, performer, or audience can be viewed as a steady biological system with emotion-aware behavior and self-control behavior. According to the study of music theory, music psychology science and art emotion science, the performance, transmission and cognitive process of music emotion information have the following characteristics:

1. Subjectivity.

Musical works are reflection of reality through mapping and selection of artists' mind, which are with highly Subjectivity. Due to cultural, environmental, habits and personality differences, the psychology structure of emotion information transmission at both ends is often in a different modes, this subjectivity reflects all aspects of emotional transformation system. Creators by using different methods of variation or deformation to form different artistic expressions, that is to generate different artistic genres; At the same time the appreciator will produce different emotional experience under the effect of different methods of variation or deformation (Anderson and Kuivila, 1990). Study from the perspective of psychological perception, this is the result of the variation or deformation of artistic perceptions together with the effect of emotion.

2. Hierarchical

In the process of characteristic cognition of music, style and emotion are the highest and the deepest level of cognition. After this stage, the music will be transformed into

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a kind of psychological feeling of human, which will affect people's mental state and may become an inspiration element for composer to re-creation of the music. Human cognitive of music emotion shows a hierarchical feature, as shown in Figure 1.

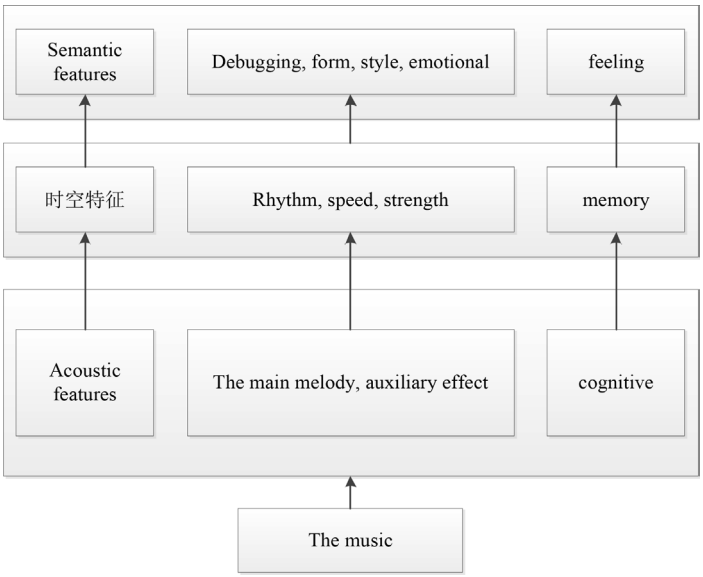

Figure 1 – Hierarchical feature of music emotional cognitive

3. Objectivity

Pure emotion only exists in the human heart, in order to make others have the same feeling, we must borrow artistic symbols which with the common structure of emotional to express. Musical expressive symbol system is the carrier for feature space in music emotion recognition. As early as the middle of 19th century to the beginning of 20th century, music theorist, composer and performer and other practitioners pointed out that the different tonality and the chord determine different emotional response (Jot, 1997). In the publication 《music language》 musician Derek Kirk had clearly put forward music works can be decomposed into melody, rhythm, beat and other 13 kinds of expression elements. These expression elements constitute the feature space of music, and the music emotion is expressed by these musical characteristics.

4. Fuzziness

Emotion is implicit knowledge of artistic forms, which can be deconstructed by means of multi-source information fusion method based on expressive symbol system, while these artistic symbols are measurable, simple perceptible or inferential primary substance material (Smoliar, 1992). However, the corresponding relationship between artistic symbols such as musical works and emotion is not absolutely definite and fixed, but is loose and fuzzy, in other words, there is volatility and ambiguity in logical reduction. For example, different combination pattern of music elements and context relationship will make their

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relationship with the emotional occurring endless changes. Therefore, the establishment and reasoning process of emotion cognition model must reflect the feature of fuzziness.

5. Integrity

In the creation and appreciation of music, emotion is not performed and grasped by independent notes, but by overall grasping to perform and experience the effect of each note on the theme emotion. Music emotion is the result of the multi-source information fusion based on the sensation of emotional material. If we are isolated to perceive rhythm, interval and timbre and other music material, we couldn't feel the emotion nature (Burtner, 2002). The integrity of music emotion, which is produced from "composite perceptual representation" of aesthetic psychology, is a kind of special comprehensive ability. In a certain period of time, various artistic factors such as emotion, reason, form and spirit are composited to produce a kind of complete emotional experience (Scaletti, 2002).

6. Motility

Human emotion is moving, each emotion has a process of production, development to quiet down. At the same time artistic works in the time axis will also have this motility. Music is presented in the form of sound movement. Movement is a common element of music and emotion, and then music will imitate emotion in the form of sound movement (Chew et al, 2004). In the creation, performing and listening process of music, the emotion is accompanied by music, constantly changing and moving, so as to forming a chain of movement.

3. Automatic recognition model of music emotion

From the mathematical point of view, music emotion recognition is equivalent to pattern recognition, it needs to complete a correct mapping process from high-dimensional music feature space mapping to the low-dimensional emotional space. The mapping block diagram shown in Figure 2. The music emotion recognition system needs according to a certain number of music samples with emotional annotations, to find

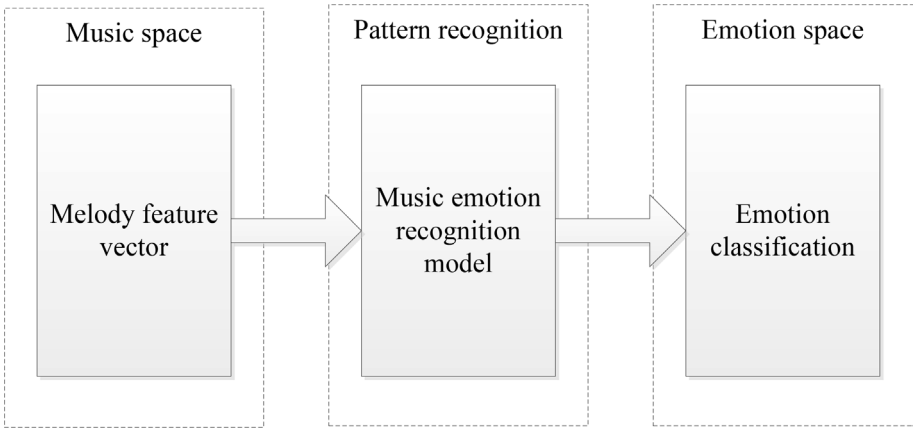

Figure 2 – Mapping figure of music emotion recognition

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out the regularity of the emotion recognition by certain method, further to establish the cognitive discriminant and the discriminant rule. Thereby, the new music sample can be effectively discriminated, to determine their emotional classification. Therefore, the key of this system is to build a recognition model with high recognition accuracy.

3.1. Automatic recognition model based on neural network

We extract three elements of the pitch, sound intensity and tone length, as the basic elements which constitute music feature space, in accordance with character vector model of representation main theme emotion introduced in Chapter 3, hereby we hope to constitute a eight-dimensional vector space, the elements are: {voice, intensity, intensity stability, intensity direction, the direction of melody, pitch stability, interval stability, interval span} (Ostertag, 2002). However, among a large number of samples, the sound intensity of same song showed a uniform distribution trend, so the intensity stability, intensity direction of different emotional music has not much difference. Their contribution to music emotion classification is relatively small, which means that the outline of music emotion connotation is represented by a few characteristic elements with more important status. In this paper, we reduce the eight-dimensional feature space to six-dimensional, and remove the two vectors of intensity stability, intensity direction.

3.2. The establishment of the sample

Under the guidance of project related teachers from Shanghai Jiaotong University Digital Library, as well as the help of Graduate Students from Composition Major of Shanghai Conservatory of Music, through professional and popular music website, Shanghai Conservatory of Music electronic music library and other channel resources, a total of 580 MIDI music works are obtained. According to the typical emotion expression of music and the production effect of MIDI file, 190 songs were selected, among which 48 are sad class, 51 are happy class, 50 are holy class, 41 are forward class. The approximate distribution is shown in Table 1 below.

The music type	Number
Sad	48
Happy	51
Holy	50
Forward	41

Table 1 – Test music

3.3. Recognition results

First of all, BP network training, MATLAB run results is shown in Figure 3: When the iteration step is 63, the network training error is less than 0.0001, and thus convergence.

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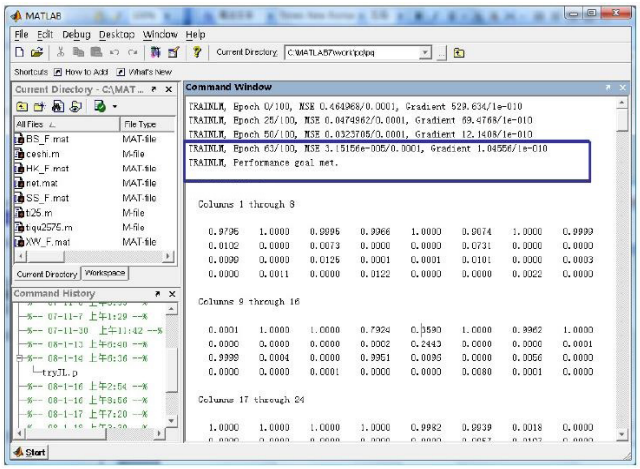

图 4-7　BP 网络的训练结果

Figure 3 – The training result of BP network

The training process of the BP network in MATLAB is shown in Figure 4：

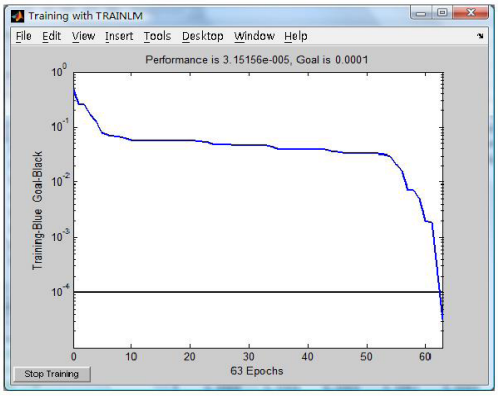

图 4-8　BP 网络的训练过程

FIG 4-8 Training of BP Network

Figure 4 – Training of BP network

For now, BP network training process is complete. Next, we selected 131 sets of data to test, among which the first 22 samples is holy class, followed by 37 samples of happy class, and then the 39 samples is forward class, the last 33 samples is sad class. The discrimination result is shown in Figure5. In the BP network, using four different groups of element column vector, represents corresponding four different music emotions,

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respectively: [0,0,0,0] represents holy; [0,1,0,0] represents happy; [0,0,1,0] represents forward; [0,0,0,1] represents sad. As can be seen from the figure, since the recognition model can't achieve 100% recognition accuracy, thus each emotion may have different miscarriage of justice.

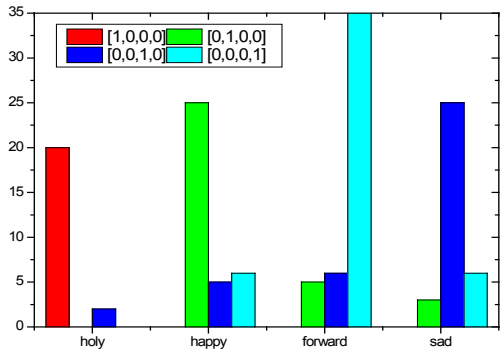

Figure 5 – Recognition result of neural network

4. Comparison of recognition results

4.1. The effect of traditional recognition method

We also will pre-processing the sample data, and then adopting the Fisher discriminant method to construct music emotion recognition model in MATLAB, and 131 of these samples were also discriminated, finally the obtained recognition results are shown in Figure 6:

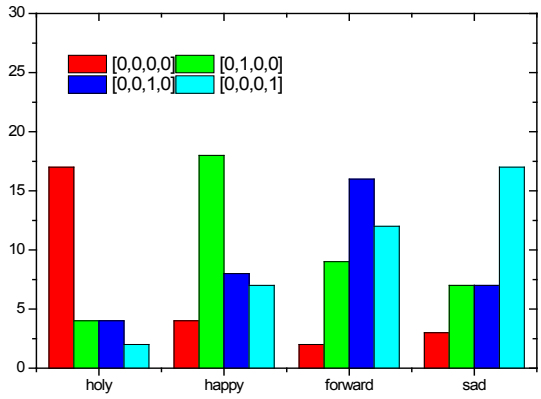

Figure 6 – Recognition of statistic

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4.2. Recognition model comparison and analysis

The results of two recognition models are compared and analyzed as follows: After the data is pro-processed, the run result of MATLAB is shown in Figure 7.

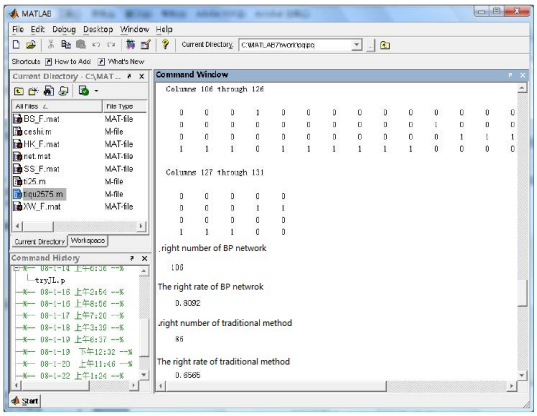

图 4-11　数据处理后的 MATLAB 运行结果

Figure 7 – MATLAB results after data processing

The results of the music emotion recognition by the BP network recognition model and the statistical classification recognition model are statistically analyzed, as shown in Figure 8.

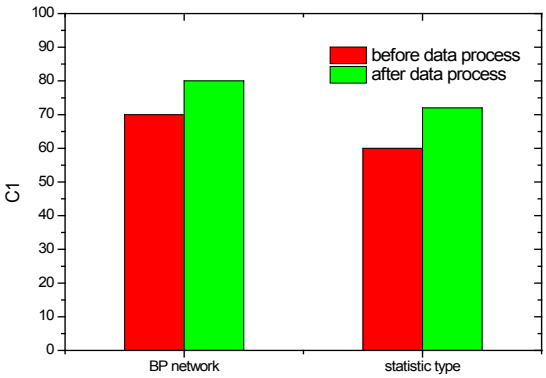

Figure 8 – Comparison of test result between with and without data pre-processing

It can be seen that the results of neural network classification after data processing (accuracy rate 80.9%) is obviously superior to the results before data processing (71%). However, despite the fact that the data have been processed, the actual error is still unavoidable, therefore 80.9% of the calculation accuracy is a good recognition results.

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On the other hand, the classification results of Fisher discriminant method after data processing are only about 2% higher than that before the data processing.

We can get the following conclusions:

1. It is not difficult to find that, due to the data error, all kinds of emotional data points in the vector space will occur the case of interleaving, since the mapping process is a linear transformation. When using Fisher discriminant method to map vector, the data fusion situation will cause a large impact on the accuracy.
2. In fact, Fisher discriminant method is suitable for dealing with linear separable problem, which is similar to the linear neural network. While the BP network can handle the complex nonlinear problems very well, once the data error is not too large, the classification results will be very satisfactory.
3. In terms of the fault tolerance, error of one data would has certain effect on classification of Fisher discriminant method, but has almost no effect on BP network, because the destruction of several neuron does not affect the overall characteristics of the network, therefore, BP network is more competent for data with noises.
4. BP network has a relatively strong self-adaptability. In other words, it is able to classify the scrambled data without the rigid classification rule, it has stronger adaptability than the other classification methods which in the case of the unknown results, a classification principle need be set. Furthermore, the results are more accurate.
5. In terms of the physical meaning of the problem, the neural network is to imitate the human way of thinking by using fuzzy logic. Therefore, the neural network is more valuable than the statistical method for the fuzzy classification problem similar to emotional classification.
6. In The time of computation aspect, since the neural network is a numerical iterative method, in this way the speed must be slower than the statistical classification, but for the problem without particularly large size, the disadvantage on time is acceptable. At the same time, after the data are pre-processing, the problems such as the iteration trapped in the local minimum or the network learning and memory instability have not appeared, the classification results are satisfactory.

The recognition results show that the statistical method can be used to identify the basic emotion based on the basic prosodic information. Although the recognition result needs to be further improved, but it can be applied to the music emotion recognition system in which the recognition accuracy is not very strict. Furthermore, we can use the neural network method to make more accurate recognition of emotion information by using a more sufficient feature parameter set, and use it to improve the recognition rate and robustness of the music recognition system and realize more humanize and intelligent Human-computer interaction.

5. Conclusions

The general analysis process of music emotion recognition mainly includes three aspects of content: Namely, the feature model in the music feature space, the emotion model in

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the emotion space, and the cognitive model based on the sample space. On the basis of the analysis and modeling of music feature space and emotion space, this paper focuses on the computer automatic recognition model of music emotion. The experiment system of BP neural network and statistical classification algorithm which are suitable for music emotion recognition are designed, the algorithms are validated and contrast analysis through the sample. The test results show that BP network has a high possibility of application in emotion recognition, and prove the rationality and universality of BP network designed in this paper.

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Research on Image Rectification Algorithm Based on Stereoscopic Image Pair

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Abstract: In stereovision system, the matched searching range is limited in a pixel row, which can only be reached with sophisticated adjusting devices and careful operation. This paper proposes a type of image rectification algorithm based on stereoscopic image pair. Firstly, this method removes lens distortion and then conducts reprojection on images. After that, these two images are projected on two image planes of virtual camera according to certain transformation. The experimental results indicate that good results can be obtained through this rectification algorithm.

Keywords: stereovision system; stereoscopic image; lens distortion rectification; image rectification;

1. Introduction

With the development of visualization technology, projection instruments have been more and more applied in daily life. An ideal stereovision system must satisfy the following conditions: (1) no lens distortion of cameras; (2) consistent intrinsic parameters; (3) coplane of planes and parallel of line of photographic unit array. The corresponding matching points of images shot by two cameras are in the same pixel line of two images respectively. The key is that the matched searching range must be limited in a pixel row (Fusiello et al., 2000; Oram, 2001). However, these three conditions can only be satisfied with sophisticated adjusting devices and careful operation. Therefore, in practical application, this purpose is achieved by stereo rectification of images.

The existing stereoscopic image pair rectification methods can be roughly classified into two categories, applying calibration parameters and not applying calibration parameters. The general idea of the method of applying calibration parameters is that to conduct reprojection of images and then project two images on two image planes of virtual camera according to certain transformation. these two images satisfy the above three conditions, so the images after reprojection bear the characteristics that the corresponding points are in the same pixel line (Zhang et al., 2004; Moravec, 1996; Zhang, 2016). The method of not applying calibration parameters conducts weak calibration, which is to calculate the fundamental matrix of reflecting points and corresponding epipolar line relationship applying the correspondence of points in two images. And then, make all epipolar lines

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parallel with each other to achieve the purpose that the corresponding points are in the same pixel line (Zhang, 2016; Hou and Qi, 2008; Hernandez et al., 2016).

This paper adopts the rectification algorithm based on camera calibration parameters and proposes a type of rectification algorithm based on stereoscopic image pair. Firstly, this method removes lens distortion and then conducts reprojection on images. After that, these two images are projected on two image planes of virtual camera according to certain transformation. these two virtual cameras satisfy the requirement of stereovision system.

2. Rectification of Lens Distortion

The basis of epipolar constraint is pinhole model, but the distortion of wide-angle lens cannot be ignored. Therefore, we need to remove lens distortion before stereo rectification. Then, we transform two images into new images applying two rectification matrixes and the subsequent matching treatment is conducted in new images (Zhu et al., 2012).

The basis of lens distortion rectification is distortion model:

$$\begin{aligned} x_d &= (u - u_0) d_x' s_x^{-1} \\ y_d &= (v - v_0) d_y \end{aligned} \tag{1}$$

$$\begin{aligned} x_u &= x_d + \delta_x \\ y_u &= y_d + \delta_y \end{aligned} \tag{2}$$

$$\begin{aligned} u' &= u_0 + s_x d_x' x_u \\ v' &= v_0 + d_y y_u \end{aligned} \tag{3}$$

Based on above formulas, we transform an image point (u,v) in original image into the corresponding point (u',v') in the image after distortion rectification.

3. Stereo Rectification Algorithm

To conduct matching more precisely and improve operation efficiency, we need to conduct rectification of stereo images after obtaining the intrinsic and extrinsic parameters of cameras. The process of rectification is to project the image onto a public image plane and the image plane direction of this image plane is determined by the cross of the base line of binocular stereovision system and the intersection of two original image planes (Deri, 2004; Fusco et al., 2006).

For one feature point $w = \begin{bmatrix} x & y & z & 1 \end{bmatrix}^T$ and its corresponding image point $m = \begin{bmatrix} u & v & 1 \end{bmatrix}^T$, the correspondence can be expressed as:

$$m \cong Pw \tag{4}$$

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$\cong$ represents the equivalence under unknown scale significance.

P is a 3×4 matrix and we call it perspective projection matrix.

$$P = A\begin{bmatrix} R & t \end{bmatrix} \tag{5}$$

A is the intrinsic parameter matrix of cameras. R and t are rotation matrix and translation vector respectively. We can express it in the following form

$$P = \begin{bmatrix} q_1^T & q_{14} \\ q_2^T & q_{24} \\ q_3^T & q_{34} \end{bmatrix} = \begin{bmatrix} Q & q \end{bmatrix} \tag{6}$$

The optic center coordinate is:

$$c = -Q^{-1}q \tag{7}$$

In undistorted model, the feature point is in the ligature of image point and optic center, and thus

$$w = c + \lambda Q^{-1}m \tag{8}$$

For calibrated binocular visual system, the perspective projection matrix of two cameras P_{ol} and P_{or} are known. We can find out respective intrinsic parameter matrix, rotation matrix and translation vector applying QR decomposition.

Define two virtual cameras and assume the perspective projection matrixes are

$$P_{nl} = A[R \quad -Rc_l],\ P_{nr} = A[R \ -Rc_r] \tag{9}$$

The intrinsic parameter matrix of two cameras are identical so we can choose arbitrarily in theory. However, to reduce the distortion brought by the rectification, we need to choose as close as possible to actual parameters. Here, we select the average value of actual intrinsic parameters of two cameras. The position of the optic center of two cameras is identical to that of actual optical center. The rotation matrixes of two cameras are identical, and we have the following definition.

$$R = \begin{bmatrix} r_1^T \\ r_2^T \\ r_3^T \end{bmatrix} \tag{10}$$

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Three row vectors represent the x, y and z axis of camera coordinate system, and the solving steps are as follow:

a: The x axis is parallel to base line, and thus we select $r_1 = (c_1 - c_2)/\|c_1 - c_2\|$;

b: y axis is vertical to x axis, and we make y axis vertical to z axis of original left camera (expressed in k), so we have $r_2 = k \times r_1$;

c: z axis is vertical to x axis and y axis, and thus we have $r_3 = r_1 \times r_2$.

For the same feature point w, the following relationship can be observed between the feature point m_{ol} on the imaging plane of original left camera and the feature point m_{nl} on the imaging plane of virtual left camera

$$\begin{aligned} w &= c_l + \lambda_o Q_{ol}^{-1} m_{ol} \\ w &= c_l + \lambda_n Q_{nl}^{-1} m_{nl} \end{aligned} \tag{11}$$

Therefore

$$m_{nl} = \lambda Q_{nl} Q_{ol}^{-1} m_{ol}, \ \lambda = \frac{\lambda_o}{\lambda_n} \tag{12}$$

In this way, we can conduct the reprojection of left image after distortion rectification to obtain the rectified left image and similar rectification of right image can also be conducted.

4. Experimental Results

4.1. Experimental Results

To verify the validity of this rectification algorithm, we can conduct rectification on (a) and (b) in the image shot in the laboratory (Figure 1). (a) is original left image and (b) is original right image. The rectified results applying this algorithm are shown in (c) and (d) in Figure 1. (c) is rectified left image and (d) is rectified right image.

4.2. Experimental Analysis

To improve the efficiency of rectification computation, we build the look-up table for original left image and original right image respectively. The look-up table reflects the correspondence of pixel points before and after the stereo rectification and we can establish rectified images based on original images directly, which avoids the calculation using rectification matrix every time.

Although stereo rectification can make the corresponding points in images of stereovision system with any configuration in the same pixel row, the distortion of images in the rectification process cannot be avoided, which will undoubtedly influence the accuracy of matching. Therefore, in practical application, we need to adjust as much as possible to approach the 3 conditions of ideal stereovision system. In this way, we can reduce the distortion in the rectification.

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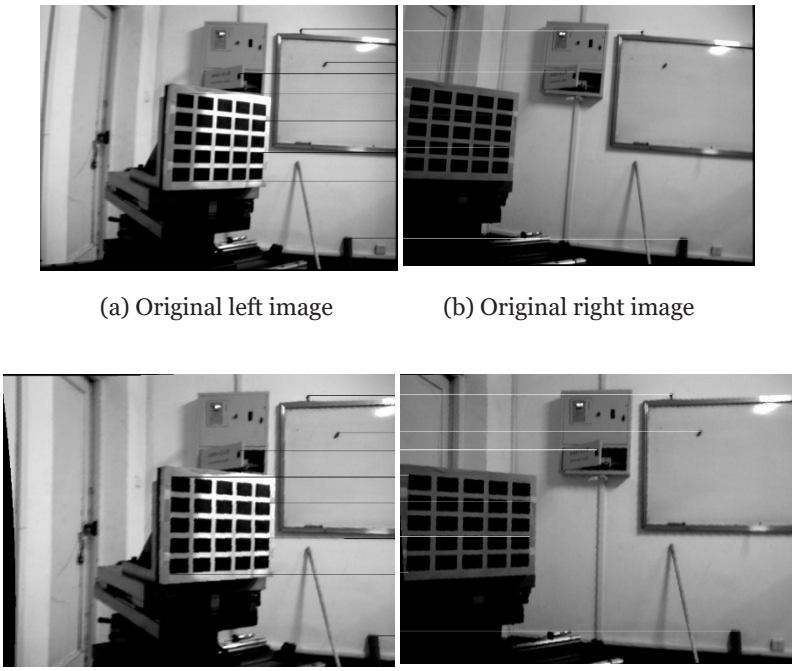

(a) Original left image (b) Original right image

(c) Rectified left image (d) Rectified right image

Figure 1 – An example of stereo pairs rectification

5. Conclusion

This paper proposes a type of image rectification algorithm based on stereoscopic image pair and makes the corresponding points of two images in the same pixel row through stereo image rectification. The epipolar constraint is the most important geometric constraint in stereoscopic vision and the future efforts should be exerted in studying the multi-stage matching algorithm based on geometric constrain on the basis of stereo rectification.

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Design and Application of Intelligent English Speech Training Software based on Big Date Platform

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Abstract: First, this paper makes deep research on related theories of speech recognition, discusses speech score and pronunciation correction algorithm and then proposes one auxiliary learning system based on AP scoring method and speak resonance peak contrast technology for the problem of inaccurate pronunciation score of speech recognition technology applied to oral English learning as well as lacking of effective feedback. Second, one set of feasible technical scheme has been developed for oral English training system based on the characteristics of Android platform. Last, in Eclipse integrated environment and taking Java as programming language, related algorithms and software interactive interface have been realized through programming and also realized through operation on ZTE V880AndroidOS 2.2 mobile phone platform. After testing, the accuracy of pronunciation scoring of this system is relatively high, for the pronunciations of vowels and words, the similarity with expert scoring is over 90%; the efficiency rate of pronunciation correction is 80%, which can improve the pronunciation level of learners to some extent.

Keywords: intelligent English speech training, software development, net platform, intelligent system design.

1. Introduction

With the deepening of economic globalization and development of openness progress of China, there are more and more communications between China and all countries in the world. As the language with the most extensive use in the world, English has become one of the indispensable tools of people's daily work and life. As more and more Chinese start to learn English, more and more English training organizations and English learning tools have come out. According to the statistics, till 2011, there are over 450 million people in China learning English, but the oral English level of English learners is commonly weak and oral English of only 13.2% people are qualified. Oral English is a difficult problem of Chinese people in English learning. The main reasons lie in following three aspects:

1. There is great difference in pronunciation methods between Chinese and English. The Chinese people are grown up in an environment with Chinese as the mother language and they will meet a lot of pronunciation errors without notice during English study. "Chinglish" and other non-standard oral English will be formed if they can't be corrected at the beginning (Deterding, 1997).
2. Domestic schools lack qualified oral English teacher. Even in middle schools and elementary schools in big and medium sized cities, they also lack English

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teachers with standard pronunciation, who can also instruct oral English pronunciation correctly at the same time. General multimedia teaching can only teach in a single way and the teachers can seldom make interactive oral English teaching for the special situations of students; therefore, there is no effective function.

3. Lack of time and environment for exercising oral English. Language is a communication method and the most important is to pronounce more and practice more. But in traditional English learning, people usually spend a lot of time in English reading and writing, while lack assurance in time and practice opportunity in oral English pronunciation (Alice and David, 2000).

Mobile internet technology develops rapidly in current society. Mobile communication extends network to the pocket of each person and realizes ubiquitous effect, which provides stage for the application of smart phone. Smart phone is not only with the functions of traditional mobile phone such as voice call etc, but also with stronger data processing ability, more colorful graphical user interface and stronger software lading ability. More importantly, there is no big difference in price between smart phone and common phone, so the popularization of smart phone is an inevitable trend. Compared the traditional computer software with software based on smart phone platform, it is with great convenience and practicality (Henderson et al, 2012). As an excellent smart phone operation system, Android system develops rapidly in recent years, which accounts for over 80% in the occupancy rate of smart phone. Therefore, developing an intelligent oral English learning software with pronunciation feedback function based on Android smart phone platform can improve the efficiency of oral English learning greatly and it is with great social significance and economic value (Saran, 2009; Miramontes et al., 2016).

2. Design of system speech recognition algorithm

2.1. Endpoint detection of speech signal

1. Short time average energy

Short time average energy reflects the rule that speech amplitude or energy change slowly with time. Express the short time energy of No. n frame speech signal xn (m) as En and the calculation formula is (in which N is the length of frame):

$$En = \sum_{m=0}^{N-1} x_n^2(m), 0 \le m \le N-1 \tag{1}$$

The difference between speech and noise mainly presents in energy. As speech is closer to sound receiver, the energy of signal is commonly high. In the environment with very high signal-noise ratio, speech signal can be recognized based on pure short time energy; but under the situation with low signal-noise ratio, the reliability of this method will decrease.

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2. Short time zero-crossing rate

Short time zero-crossing rate expresses the times of speech signal waveform crossing horizontal axis in one frame speech. For continuous signals, zero-crossing rate means time domain waveform crossing time axis; for scattered time signal, when the adjacent two samplings are positive and negative values, and then it expresses one time zero-crossing (Stanfill, 1987; Lino et al., 2016). The short-time zero-crossing rate of speech signal xn (m) can be defined as:

$$Z_n = \frac{1}{2}\sum_{m=0}^{N-1}\left|\mathrm{sgn}\left[x_n(m)\right] - \mathrm{sgn}\left[x_n(m-1)\right]\right| \tag{2}$$

In the formula, agn[] is signal function, that is

$$\mathrm{sgn}\left[x\right] = \begin{cases} 1, (\mathrm{x} \geq 0) \\ -1, (x \leq 0) \end{cases} \tag{3}$$

Sonant energy frequency is relatively low with lower zero-crossing rate, while the frequency of surd energy is relatively high with higher zero-crossing rate. Generally speaking, the zero-crossing rate at speech segment is relatively stable compared with environmental noise and each sound section can be judged roughly through short time zero-crossing rate.

For the characteristics of Android platform and functional demand of system, this subject has adopted endpoint detection method based on the combination of short time energy and short time zero-crossing rate. Endpoint detection technology based on short time energy and short time zero-crossing rate technology belongs to time domain analysis (Eckstein, 2007). The method is relatively simple with small calculation amount; at the same time, it can ensure certain reliability.

Figure 1 is schematic of endpoint detection of one speech. It can be seen from the Figure that the combination of short time energy and short time zero-crossing rate can well confirm the start point and end point of speech segment and make good preparation for further processing of signal in the following.

2.2. MFCC feature extraction

Mel frequency represents the feeling degree of human ears for frequency. Research has shown that the sound level perceived by human ears is not in line with the actual frequency of sound. The auditory system of people is actually one special non-linear system, which has different auditory sensitivity for signals of different frequencie (Gilakjani, 2012). In low frequency part, the human year perception is relatively sensitive; while in high frequency part, the human year perception is more and more rough. Below 1000Hz, perception sensitivity and frequency present linear relationship while present approximate logarithmic growth relationship above 1000Hz. Formula 4 is the relationship between the two and Figure 2 is relationship map of the two.

There is following relationship between Mel scale and frequency (in the formula, f is the real frequency of signal):

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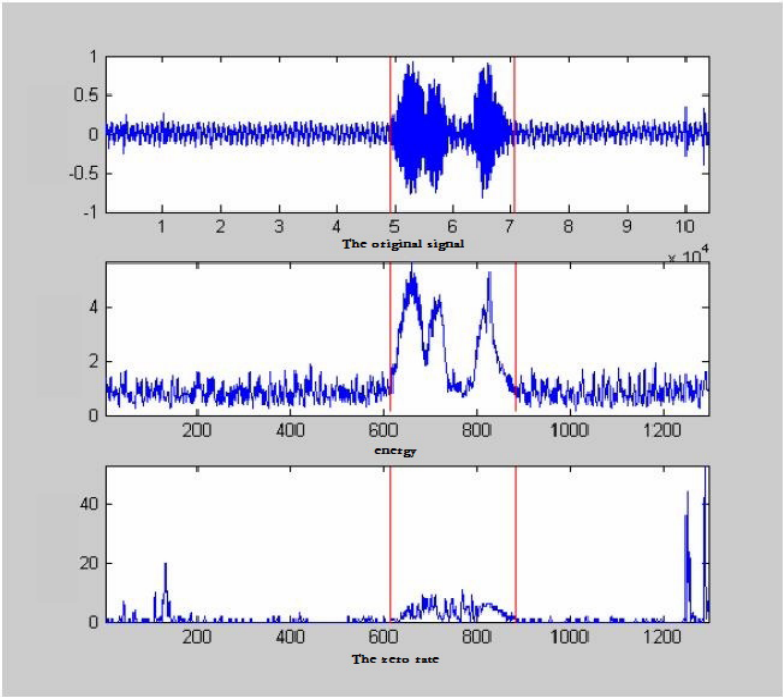

图 3. 2 语音信号的端点检测

Figure 1 – Endpoint detection of speech signals

$$f_{mel} = 2595 * \log_{10}(1 + f/700) \tag{4}$$

The calculation process of MFCC is as shown in the Figure. Extract MFCC feature parameters as following steps (as shown in Figure 3).

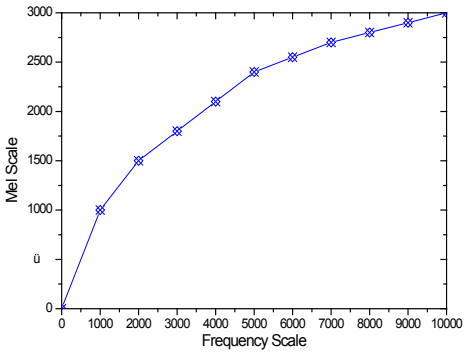

Figure 2 – MEL scale and frequency of the diagram

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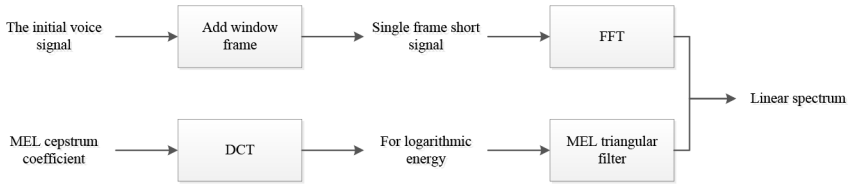

Figure 3 – MFCC parameters extraction process

3. Design and realization of system

3.1. System analysis

The main function of intelligent English pronunciation training system based on Android phone platform is realizing pronunciation learning and training of English phonogram and words in the forms of animation, voice, Figure and text, realizing effective feedback for the pronunciation of learners, instruct and correct learners to make continuous training and improving oral English pronunciation level and providing friendly, intuitive and simple operation interface. Based on demand analysis, confirm the main functions of the system as following:

1. Pronunciation demonstration. Pronunciation demonstration refers to that when make pronunciation learning, first, play video of standard pronunciation animation or standard pronunciation sound; at the same time, make learners have correct understanding of this pronunciation with adoption of pronunciation mouth structure and introduction words etc, fully understand the key points of pronunciation as well as motion features of mouth shape and tongue position etc.
2. Repeat pronunciation. Repeat pronunciation is the main exercising path for learners to make oral English pronunciation. The system will play correct pronunciation animation or pronunciation sound firstly and then remind the learners to repeat; learners repeat the pronunciation based on reminder and at the same time, the system records the pronunciation of learners to cell phone memory for following processing.
3. Pronunciation comparison. The system firstly plays animation video or sound with standard pronunciation moth and then play the record pronunciation of the learner (Reed, 2012).. The pronunciation comparison function mainly compares standard pronunciation and learner pronunciation and makes the user have a direct understanding of pronunciation and standard sound.
4. Pronunciation scoring. Pronunciation scoring is one of the core functions of system, which mainly makes quantitative evaluation for the pronunciation results of learners with adoption of speed recognition technology and related pronunciation scoring algorithm (Cucchiarini et al, 2011). Accurate and reliable pronunciation scoring can make learners have accurate understanding of own pronunciation scores and then make continuous improvement and improve own pronunciation level continuously.

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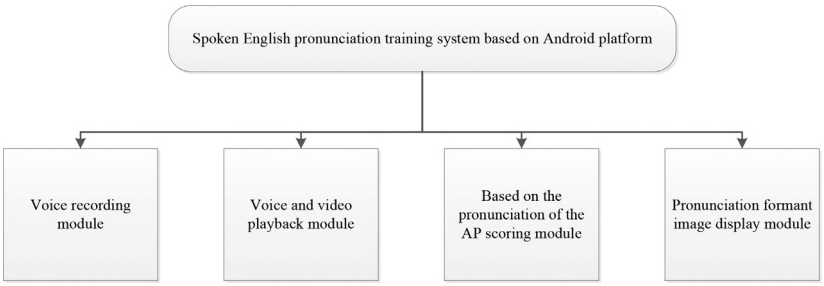

Figure 4 – Module structure of the system

5. Image display of pronunciation results. The image display of pronunciation results mainly reflects and compares pronunciation of learners and standard pronunciation in way of image feedback. The system adopts comparison map of vocal resonance peak to reflect the difference between standard pronunciation and vocal resonance peak of learners. Based on the relationship between resonance peak and mouth shape and tongue position of pronunciation, the reference map reflects the pronunciation mouth shapes of learners' pronunciation and standard pronunciation as well as the motion features of tongue position.

The cores of the system should include following few modules through analyzing the functional demand of system: voice recording module, voice and video play module, pronunciation scoring module based on AP, image display module of vocal resonance peak, as shown in Figure 4, in which pronunciation scoring module based on AP and image display module of vocal resonance peak are the cores of the system and also the main work amount and difficulties of the system.

3.2. Design of scoring module

System scoring module adopts pronunciation scoring technology based on AP. The module includes scoring parameter generation part and pronunciation scoring part, which are the core modules of the system, in charge of adaptive generation of scoring parameters as well as correct scoring of learners' pronunciation. The working process of these two is as shown in Figure 5.

The combination point of scoring parameter generation part and pronunciation scoring part lies in that for the correct transmission of scoring parameters, the parameter generation part must ensure to transfer the parameter to pronunciation scoring part reliably after scoring parameters are generated. To save the related parameters of evaluation function eternally (not lose due to the shutdown of system program), the system selects Shared Preferences component commonly used in Android data storage to save the key parameters of scoring function (Khamkhien, 2010). Share Preferences component is actually generating one xml file under the same category of Android. This file stores several key-value pairs of the placed position; as long the file not disappear, all the stored data will exist eternally. This storage method can ensure the eternity

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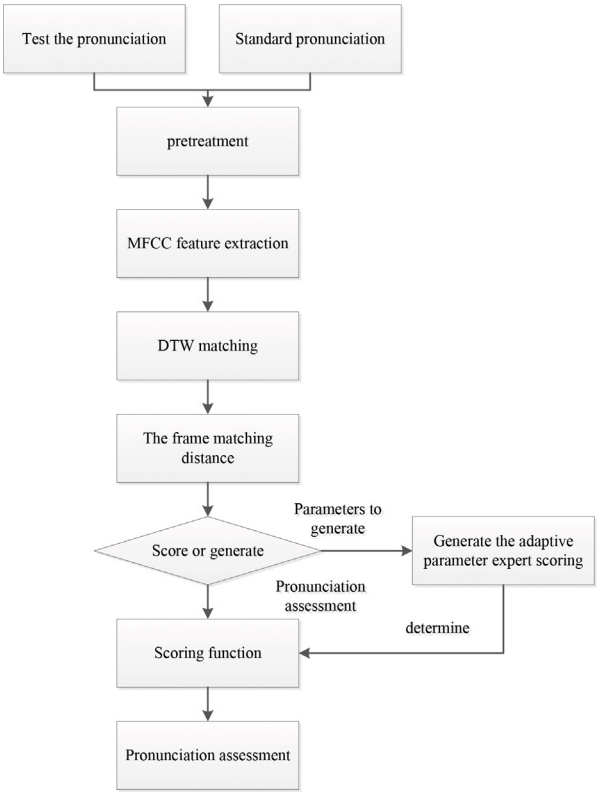

Figure 5 – pronunciation assessment system flow chart

of function parameter storage. For the system, it only needs one generation process of adaptive parameter, and then it can adopt this scoring function eternally to score pronunciation.

3.3. Design of feedback module

The image display module of vocal resonance peak is mainly responsible for describing the resonance peak change situation between standard reference pronunciation and learner pronunciation with the passing of time in the form of image, and then reflects the differences between this two in pronunciation mouths qualitatively. The work process of resonance peak is as shown in Figure 6:

The system attains resonance peak information of learner pronunciation and standard reference pronunciation through preptreatment, FFT transfer, resonance peak extraction and other process. To display this resonance peak information on Android platform in the form of image, the system adopts AchartEngine. AchartEngine is an open source chart generating class library for Android program development, supporting line chart, bar chart and pie chart etc. Adopting this kind of system can display pronunciation resonance peak comparison map.

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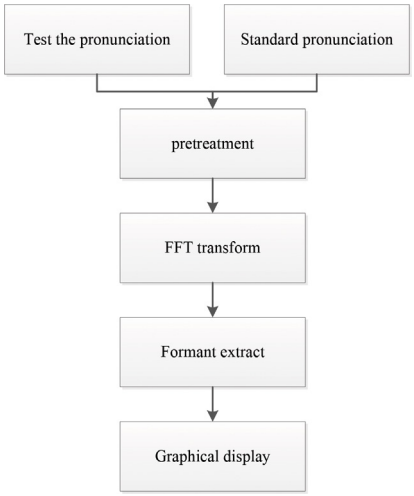

Figure 6 – Flow charts of formant comparison

3.4. Design of user interface

This English speech training system is an application program developed on Android platform. Interact with learners based on the need of learning software, therefore, it is very important improve the experience effect of users under the premise of ensuring system function. Good system interface can not only make the software operation easy and convenient, but also arouse the interest of learners and improve learning effect. Based on the functional analysis of system, the user interface structure of design system is as shown in Figure 7.

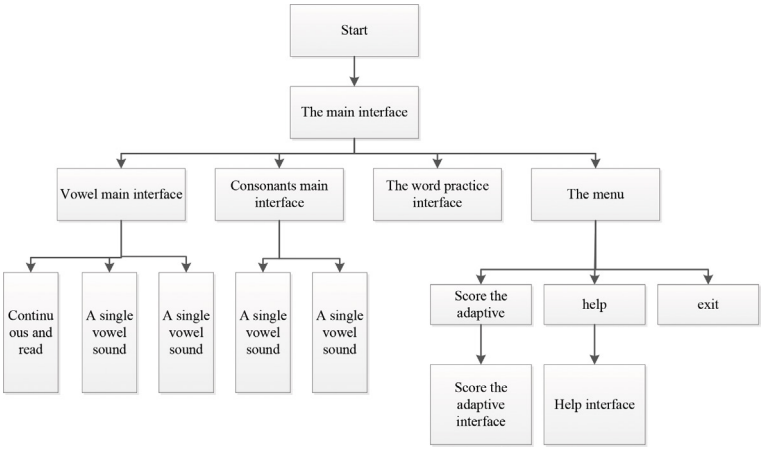

Figure 7 – The user interface structure

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Click cell phone "MENU" button on software on main interface of the system and then pop up the menu. The system menu includes three buttons of "adaptive scoring parameters", "help" and "exit". Because the adaptive generation function of scoring parameters is used with small frequency for pronunciation learning; therefore, the system sets this function in the menu, which is usually used after system installation and needs to make scoring parameter adaptive generation. Click "help" button, the using suggestion and help information of this software will be popped up. Click "exit" button, the system will end operation and back to the cell phone interface.

4. System test

4.1. Speech input test

Test project explanation: test if the system can recognize and input corresponding pronunciations when user repeats pronunciation.

Test sample data: 20 vowels, 24 consonants and 12 words. Select the first pronunciation as the test.

Test result definition: success rate=number of successful samples/total number of test samples. Test results are as shown in table 1 and 2.

The test case information			
Pronunciation type	**vowels**	**consonants**	**The word**
The number	**20**	**25**	**15**

Table 1 – The test case

The test result information			
Pronunciation type	**vowels**	**consonants**	**The word**
The number	**100%**	**92.3%**	**100%**

Table 2 – The test result

Test result analysis: the system can make correct input for vowels and words and can't make correct recognition and input for consonants due to short pronunciation time and small pronunciation energy.

4.2. Scoring accuracy test

Test project explanation: test the similarity of the system for automatic scoring of pronunciation and expert artificial scoring and verify its reliability.

Test sample data: 20 vowel pronunciation scores, 24 consonant pronunciation scores and 12 word pronunciation scores. Test results are as shown in table 3 and 4.

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Test result analysis: the system has higher accuracy rate of pronunciation scoring in vowels and words and the similarity degree is with high reliability, over 90% with expert experience scoring; for consonant pronunciation, the scoring accuracy rate is 75.26% due to the limitations of short pronunciation time, small energy etc. which can reflect pronunciation quality to some extent but it is not ideal.

The test case information			
Pronunciation type	**vowels**	**consonants**	**The word**
The number	**20**	**25**	**15**

Table 3 – The test case

The test result information			
Pronunciation type	**vowels**	**consonants**	**The word**
The number	95.2%	78.3%	92.4%

Table 4 – The test result

Conclusions

This paper selects Android smart phone as system platform and makes systematic design and development under this premise. The main working contents and research results are as following:

1. Learn and study Android development technology. System structure, advantages feature, application components and work mechanism of Android system have been analyzed mainly. Features of Android have been analyzed; superiority of system and feasibility of system development have been confirmed.
2. Study related theories of speech recognition, design system recognition algorithm based on features of the system and propose a suitable pronunciation scoring and feedback correction method, which provides a set of practical and feasible design program for intelligent English speech training system based on Android platform.
3. Based on system design program, develop and realize related algorithm and software interactive interface and realized through operation on ZTE V880AndroidOS 2.2 mobile phone platform. After test, the effect of system pronunciation evaluation and pronunciation correction is good and the system realizes the expected basic functions, which can improve the pronunciation level of learners to some extent.

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Research on the Influence of Computer Network Status on College Students' Mental Health

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Abstract: The emergence of Internet, open a new era of human digital survival. The virtual world build by Internet, profoundly and extensively affect our study, work and life, it has an increasingly greater influence especially for the psychological development of college students. Therefore, the exact understanding of the status of college students contact and utilization of network, analyzing the negative influence of network on the psychological health of college students, studying the characteristics and law of mental health education at Internet era, have great significance on the construction of college students mental health education system as well as creating new pattern of ideological and political work in colleges at network era.

Keywords: internet, college students' mental health, psychological guidance, ideological education.

1. Introduction

With the rapid rise of China's economy, the upgrading of science and technology, computer and Internet has been quietly infiltrated into all areas of society, become an indispensable tool in production and life. According to the statistical report of China Internet Network Information Center, we can see that in 2011, the number of Internet users in China had reached 514 million, in 2015, the number increased 300 million (Thome and Espelera 2004). In addition to the growth in the number of Internet users, the education level of Internet users was also rising. In 2011, the number of Internet users who had college degree accounted for 32% of the total number of Internet users, by 2015, the proportion increased to 45%. Statistics tell us that the network has become an important tool for college students to learn, live, communicate. However, the Internet, like everything else, has two sides (Masuda et al, 2010; Vázquez et al., 2016). It not only provides more opportunities and channels for the life and development of college students, but also brings some harm to the mental health education of college students. Thereby, how to guide the college students to draw on advantages and avoid disadvantages in the network environment, cultivate the good psychological quality of college students, is a big problem that the university educators need to focus on exploring (Kitzrow, 2003; Lucas and Souza, 2016).

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2. Survey Methods and Results Analysis

2.1. Survey objects and methods

In this paper, four normal college students were selected as the survey object, sampling surveyed full-time undergraduate college students from each grade, each profession and each academy of four normal colleges. Questionnaires involved with the surfing internet location, surfing internet time, surfing internet motivation and content and so on (Eisenberg et al, 2009). A total of 700 questionnaires were distribute, collected 693 valid questionnaires. The author used Excel and Spss10.0 statistical analysis software for data analysis, the results can basically reflected network behavior and awareness of the normal college students in Zhejiang Province, and the influence of Internet on college students' mental health (Yorgason et al, 2008; Vázquez et al., 2016).

2.2. Survey results and analysis

1. Analysis of the survey on the number and frequency of surfing the Internet showed that 98.36% of students had been to the Internet, the frequency of surfing the Internet is shown in Table 1.

Almost every day	3-6 days a week	1-2 days a week	Less than one day a week
152（23.25%）	178（25.32%）	256（35.21%）	56（8.23%）

Table 1 – Statistical table of surfing internet frequency of college students

2. Surfing internet location analysis

From the surfing internet location, 68.37% of students surfing internet in net bar, students who surfing internet in the school computer room and dormitory only accord for 14.44% and 16.19%. There are three reasons: First, the school computer room is less, with more students, often occur "Demand exceeds supply" situation (Castillo and Schwartz, 2013). Second, the computer in school is normally worse than net bar, Internet speed is slow. Third, students when surfing internet in the net bar, they are more freedom, without restriction on time and content. Therefore, net bar became the first choice of students, indicating that the campus network hardware and software need to be strengthened.

3. Surfing internet time analysis

From the surfing internet time, the average surfing internet time of college students is 7.07 hours a week, the longest continuous surfing internet time is 7.59 hours, the student have experience of overnight surfing internet accounted for 48.12%. When be asked the question "Do you think your surfing internet time is long or short", the answer in Table 2.

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Too long	Slightly long	General	The shorter
154(21.36%)	159(22.36%)	321(15.56%)	59(9.98%)

Table 2 – Inquirer' views of their surfing Internet time

4. The motivation and content of surfing internet analysis

Survey shows that: the main purpose of college students to surfing the internet is to chat and send and receive e-mail, only a small proportion of students is to download software and learn knowledge, specific statistical results is shown in Table 3 to Table 5.

Chat	Find the information	Leisure entertainment	To know the news	Meet personal interests	learning services	External communication	Reading books	Pursuit of fashion
521	541	410	215	256	254	136	152	98

Table 3 – the main purpose of surfing internet

Chat	email	Search engine	Software download	Multimedia entertainment	Electronic bulletin board BBS
593	498	254	265	224	158
Online education	**Short messera service**	**Internet phone**	**others**		
126	105	98	106		

Table 4 – Frequent used network services

Chat	Study	Play games
452(64.25%)	154(21.52%)	95(14.16%)

Table 5 – The content of surfing internet which occupied the longest time

From the above data we can see that the number of college students surfing the internet is large, and the surfing time is very long, and main motivation of college students and the main content of the surfing internet is chat, entertainment and other leisure activities, rather than to learn(Taylor, 2011). Therefore, the network problem is a serious

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problem which the university ideological and political education work can't avoid. From the survey results, we found among the network behavior of college students there are some outstanding problems, and affect the mental health of college students.

3. Negative influence of Network on College Students' Mental Health

3.1. The complexity and diversification of network information easily lead to learning psychological barriers and belief crisis of students.

One of the characteristics of the Internet era is the diversification and abundant of information, and even information overload. Network bring people convenience life and "information enrichment", at the same time, it is easy to lead to the spiritual emptiness (Eisenberg et al, 2011). In the network, people are easily access to information, but it is difficult to analyze the value of information, and effective usage of information. A large number of information is easy to downgrade human brain into the information network itself, when people are in front of the mess information, they will become six gods without a master, attempt and accomplish nothing. Over time, it will lead to loss, confusion and other negative emotions, anxiety, inattention, weak learning will and other learning psychological barriers.

The diversification of network information makes it easy for university students to feel the cultural differences between the East and the West. The western culture represented by the United States is constantly impacting the traditional Chinese cultural concepts accumulated in the minds of college students, and the students' world view, view of life and values become unstable. The clash between cultures and moral concepts making college students easily fall into the confusion of beliefs.

Therefore, ideological and political educators in universities should pay attention to the situation that college students have excess of information and poverty of thought, and guide them in time, only in this way can college students become useful talents with rich knowledge and perfect personality.

3.2. The virtual nature of network transmission easily leads to network personality disorder of college students

In the view of modern psychology, the network personality disorder of college students is a kind of behavioral feature between mental illness and normal personality. Specifically, it can be divided into paranoid personality, narcissistic personality, borderline personality and multiple personality and so on. The root of network personality disorder is the virtual nature of the network.

Network provides an open platform for people to understand information, learning knowledge. But the network is also a barrier, it covers the true face of people. The various activities on the network are carried out by people wearing a virtual identity masks in the virtual environment, it lacks the authenticity and certainty in real life. As the network behavior is mostly anonymous, some students think they don't need to take responsibility for their words and deeds on the Internet, so their words and deeds are very casual, if it last too long, likely to cause offensive personality. The survey shows that 66.23% of

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students have scold rude words online. There are also some students often play the role which is very different with their actual identity and personality characteristics in the online communication, or even diametrically opposed virtual role, also have a number of screen names represent different identity and personality characteristics. (See Table 6)

One	Two	Three	Four	Five or more
52(7.58%)	302(45.32%)	152(22.15%)	130(14.21%)	49(7.01%)

Table 6 – The used identity in online chatting

Yes	Say little	No	nonsense
185(40.25%)	245(41.26%)	84(19.24%)	45(4.25%)

Table 7 – Ever tell your internet friend your true identity

As can be seen from Table 7, when some student are online and offline, as if they were not the same person. With too frequent transform between the multiple roles, will lead to role conflict, and ultimately lead to network personality disorder. Obsessed with the network is the direct consequence of the split personality, interpersonal alienation, alienation of human nature, increased mental disorders. Therefore, it is urgent to create a good spiritual and cultural value system and a healthy network atmosphere.

3.3. The uniqueness of network communication easily leads to interpersonal barriers of students

The network has increased the channel of people's communication, and changed the way people communicate with each other. However, the virtual living environment of the Internet era, continuous decreasing the opportunities for students to participate in collective activities and the actual social life, many people are too lazy to directly communication and interaction. In the relatively closed environment of "man-machine-man", the chance of direct contact with other people and society is reduced, which may easily lead to their self-closing and generate interpersonal obstacles (Locke et al, 2012).

1. Generate communication barriers with the schoolmate, friends

Online communication has its advantages of being open, virtual and free from space and social status restrictions. But in the long run, it will strengthen the satisfaction of students in the virtual world, weaken their communication skills in reality. Survey shows that 78.64% of students think that online dating is easier than that in real world, 49.06% of students think that they are more talkative when they are online. The communication ability of students has big different between online and in the real world, as is shown in Figure 1. On the one hand, they can be active in the online thinking and speaking with fervor and assurance, on the other hand, they are self-locking in reality, and even fear the reality of interpersonal communication. Therefore, these students are difficult to

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locate their role in reality, often put their emotional experience in the virtual world of network (Kirsch et al, 2014).

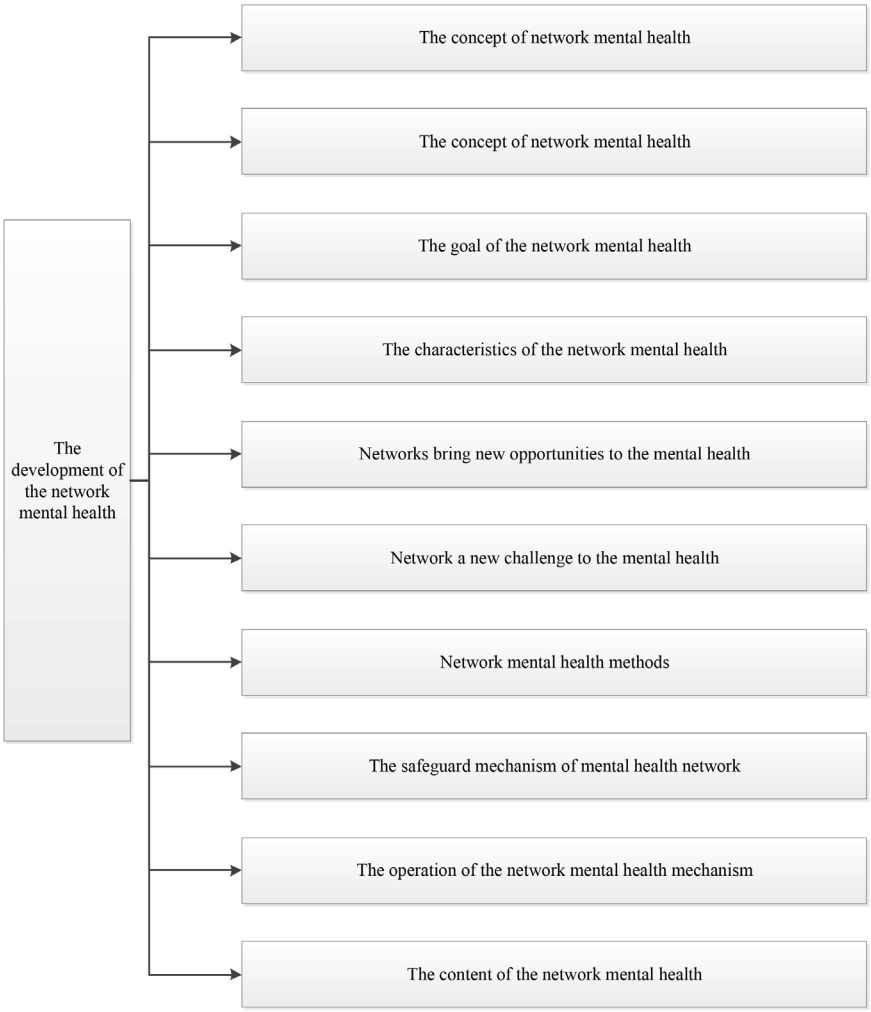

Figure 1 – The development of the network mental health

College life is the important period that interpersonal skills and interpersonal relationships formed, network communication and real communication are very different, it is difficult to form a true, reliable and safe interpersonal relationships (Li et al, 2008). The network communication of college students is in the indirect form and with feature of symbolization, which definitely open a convenient door for the interpersonal communication of students who are weak in conversation and social

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communication (seen in Figure 2). But if when we encounter cold and frustration in the real interpersonal we not actively to adjust and improve, but choose to give up, instead of indulging in network communication, showing no care to the people and things around, indifference, we are will be caught in an isolated and emptiness of mind. From the student's growth point of view, is clearly harmful.

2. Affect the development of college students' correct view of love

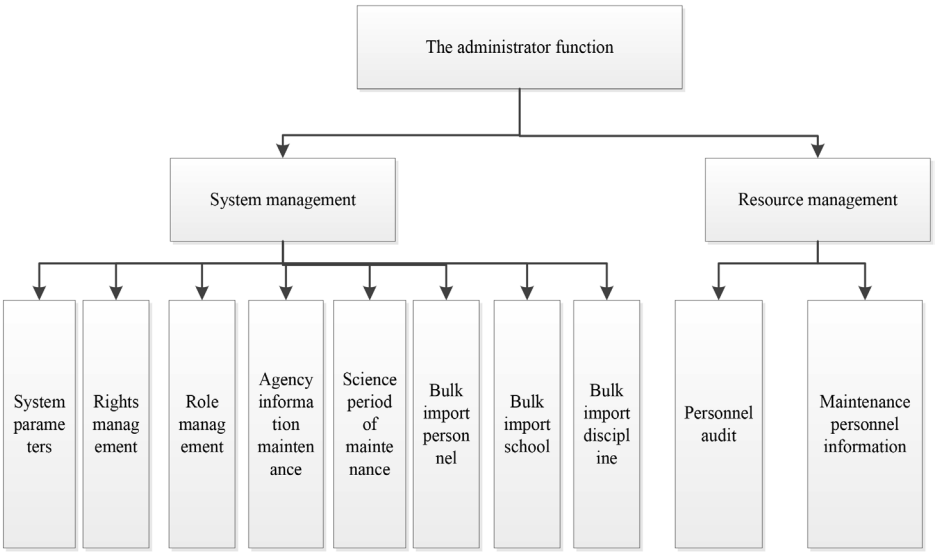

Figure 2 – System administrators to mental health education

Emotional communication is one of the main aspects of college students' online communication. There are two main aspects in emotional needs of college students: First one, to seek the heterosexual friends or objects. The students in the survey have averaged 12.78 regular contact users, of which there are 9.93 heterosexual users, accounting for 77.70%. Second one, for emotional satisfaction and psychological pleasure. 87.01% of the students heard of online dating, 73.30% of students appreciate online dating, 73.45% of students said they would try online dating if have the opportunity (Pedrelli et al, 2015). Because online dating is through the network media, relying on the text, it lacks important basic link which is generation and continuation of love—emotional. Therefore, the success rate of online dating is very low, most of them are easily failed (as is shown in figure 3).

College students are in peak period of the emotional experience, longing for the opposite sex, eager to emotion is normal. But online dating of college students often lack of sincere, irresponsible online flirting may result in harm to the side who sincere treated. Online dating will also lead to game love and breeding of other love psychology, distorted love view.

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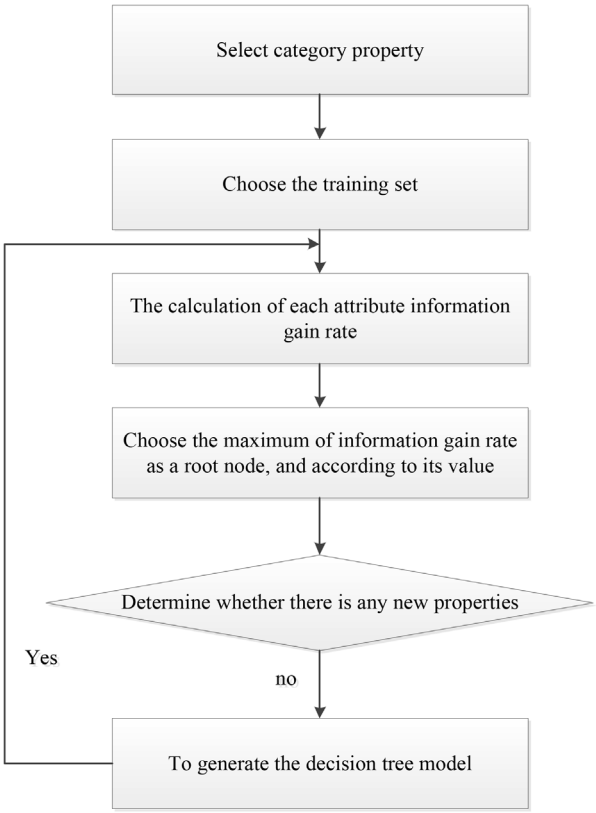

Figure 3 – The working process of the decision tree of mental health computer system

3. The flooding of Internet pornography easily lead to psychosexual disorder of college students

Network is a treasury of information, but also a "garbage dump". A variety of academic, entertainment, economic, and pornographic and violent messages mixed together. Young people with weak self-control tend to be out of curiosity or impulsive psychological deliberately to find some pornographic, violent information. According to statistics, 65.51% of students had intentionally or unintentionally broke into the porn website, 7.07% of students often visit porn websites. When be asked about how to look at porn websites, the students' responses were beyond author's expectation. Only 48.91% of students were disgusted with pornography, while 22.66% thought pornography was harmless.

China's current sexual health education lags behind the reality needs. Sexual knowledge of high school students, college students is the main source from newspapers and books, radio and television and the Internet, while sexual knowledge from teachers and parents is minimal. Unhealthy sexual information and sexual attitudes in the network easily lead to abnormal development of sexual psychology and sexual behavior, resulting in voyeurism, sadism, fetishism and other abnormal behavior, and even lead to sexual crimes.

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Online communication has its advantages of being open, virtual and free from space and social status restrictions. But in the long run, it will strengthen the satisfaction of students in the virtual world, weaken their communication skills in reality. Survey shows that students think that online dating is easier than that in real world, students think that they are more talkative when they are online. The communication ability of students has big different between online and in the real world. On the one hand, they can be active in the online thinking and speaking with fervor and assurance, on the other hand, they are self-locking in reality, and even fear the reality of interpersonal communication. Therefore, these students are difficult to locate their role in reality, often put their emotional experience in the virtual world of network.

4. Construct Mental Health Education System for College Students in Network

4.1. Speeding up the construction of campus network facilities, and actively occupying the main line of the college ideological and moral construction in network

Network has opened up a new position for the ideological and political education. The existence of this position depends on the network hardware and software construction.

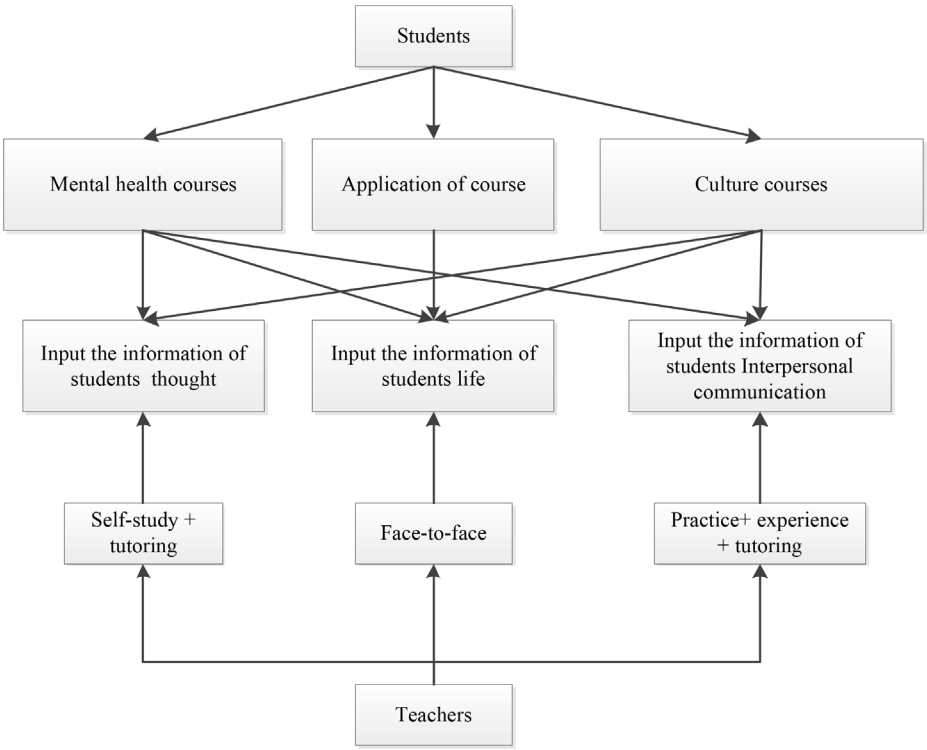

Figure 4 – Computer-aided college student management method

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On the hardware side, the main reasons for the 79% of the students choosing the net bar outside the university are factors that limitation of the number of computer in computer room, limitation the speed of the network, and a lot of restrictions(Kovessmasfety et al, 2016). While lacking of necessary management and supervision in the external of school, easily get out of control. On the Software side, pay close attention to the construction of ideological and political characteristics website of the school, through the ideological and political website construction, make full use of the richness, which is shown in Figure 4. Vivid and interesting features of the network resources, by using graphics, animation, sound and other ways to making the content of ideological and political education become vivid and intuitive and interesting, then to attract the majority of students, so that our moral content is not only rich and diverse than before, but also edutainment, and constantly enhance the persuasiveness and appeal of ideological and political education(Shatkin and Diamond, 2015).

4.2. Perfecting the organizational structure, improving the rules and regulations, to strengthening the supervision, management and guidance of college student's network behavior

The necessary school management mechanism is the basis to ensure the achievement of student online education. Schools should perfect the organizational structure, improve the rules and regulations, strengthen the supervision, management and guidance of college student's network behavior. Firstly, the school shall regulate network operation in the rules and regulations, strengthen management of the local area network and campus network, implementation of real name registration system, and establish a permanent institution for network information management. Students shall set up the corresponding organizations or associations, to achieve "self-education, self-management, self-service" function of student organizations in the network education. Secondly, setting up network behavior guidelines, through the review, monitoring and other patterns to regulate the network behavior of college students, while restricting access to websites with certain harmful information sources, and as far as possible by using of technical means to building a information "Firewall" in the internal network and external network interface, thereby all internal and external connections be mandatory checked the filtered by the information "firewall", furthermore intercept channel where harmful information enter into, realizing purpose of purify the cyberspace.

4.3. Efforts to carrying out online mental health work, safeguarding the mental health of college students

Ideological and political education workers should aware of the problems communication of college students in the network, guide the students to cross the critical line of the virtual world and the real world, abandon the illusion, face their problems in real life, build confidence and enhance social responsibility. To make full use of the network, and actively carry out online mental health work: First is the publicity of the network mental health knowledge, make students aware of the dangers of obsession with the network and addicted to online dating, timely adjustment of psychology. The second is to carry out online psychological tests to help students understand and master their own mental health status in time. The third is to carry out online guidance and online psychological

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counseling, through hiring psychological experts, in the form of E-mail to dealing with psychological barriers faced by the students at various stages.

5. Conclusions

The 21st century is the era of information technology, the rapid development of network technology, the spread and maturity of network culture will be irresistible. It gives us a strong impact on the spiritual, emotional, moral and so on. We should from the perspective of college student's mental health education, to strengthen the guidance of college multi-faceted multi-angle, to improve their judgment of things and self-binding, so that they can improve their own while enjoying the achievements of modern science and technology, can effectively choose information that is useful to their own growth, to guide students to study hard, courage, willing to sacrifice, become the new promising generation in the new century that Chinese science and technology and humanities coordinated development.

In the network, people are easily access to information, but it is difficult to analyze the value of information, and effective usage of information. A large number of information is easy to downgrade human brain into the information network itself, when people are in front of the mess information, they will become six gods without a master, attempt and accomplish nothing. Over time, it will lead to loss, confusion and other negative emotions, anxiety, inattention, weak learning will and other learning psychological barriers. The diversification of network information makes it easy for university students to feel the cultural differences between the East and the West. The western culture represented by the United States is constantly impacting the traditional Chinese cultural concepts accumulated in the minds of college students, and the students' world view, view of life and values become unstable. The clash between cultures and moral concepts making college students easily fall into the confusion of beliefs.

Therefore, ideological and political educators in universities should pay attention to the situation that college students have excess of information and poverty of thought, and guide them in time, only in this way can college students become useful talents with rich knowledge and perfect personality.

Acknowledgments

Stage research results of the Hubei Provincial Department of Education Humanities and social science research Topics on "Study on the relationship between life events and mental health of College Students (13q163)"; Stage research results of the Yunyang Teachers' College science research Topics on "Study on the relationship between life events and mental health of College Students (2012B01)";

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Research on the application of network technique in physical education

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Abstract: Network education is a new teaching mode along with the development of computer network technology, and the domestic sports has also been committed to the research on exploring the integration of network education technology and college physical education. This paper takes Shenzhen University and Hunan University of Science and Technology as an example to use the field investigation, questionnaire survey, comparative analysis and other research methods to describe the application of the network education technology in the universities' physical education, analyze the application mode of the network education technology in universities' physical education, teaching advantages and existing problems, in order to determine the role of the network teaching in the public physical education teaching in colleges and universities.

Keywords: network technique, physical education, network learning

1. Introduction

Current development and application of modern science and technology with computer and network technology as the core has penetrated into every field of the society, especially has a major impact in education field. With the continuous improvement of network technology application level, the concept of "education informatization" has been gradually proposed by people with the advent of information technology highway in the 1990s (Cui, 2014). How physical education meets the challenge of the modern science and technology, especially information technology, how to timely apply computer network technology, improve teaching quality and cultivate high-quality workers, has aroused the attention of the educational circles. The modernization of physical education is the inevitable trend in the development of social informatization (Zhenrui, 2016). The application of network education technology in the physical education teaching is an important symbol of modern physical education teaching, and the sports network or "network sports" will be bright symbol of sports modernization (Zhang, 2014; Quinonez et al., 2016).

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2. Research object and research method

2.1. Research method

During April to July, 2004, the author respectively conducted the field investigation on the teaching mode in Shenzhen university and other colleges and universities, with in-depth understanding (Zhang, 2014). The method includes: (1) observation and experience. Through participating in teaching activities, the author got more real, intuitive observation. (2) Interview. Through the communication with different groups including teachers and students, the author understood the problems existing in the process of network teaching. (3) Data collection (Ying, 2016). The author collected the relevant statistical data and the situation introduced.

2.2. Literature

In the process of thesis writing, the author read the books about network education, including the "network education foundation", "network transmission and contemporary education", "education information technology theory", etc., consulted the research achievements about physical education in college and university and the application of network technology from 1995 to 2004, mastered the domestic several relevant information of several schools carrying out physical network teaching's experiment class, and consulted relevant teaching evaluation, teaching theory, and so on, to grasp the general situation of the development of the current information technology education (Liu, 2012; Vázquez et al., 2016).

2.3. Questionnaire survey

During May to June, 2004, the students enrolled in 2002 from the 6 universities participated in the questionnaire survey. 476 copies were sent out, and 421 were the valid questionnaires (Wang, 2014). The recovery rate was 98.7%, and the effective rate was 89.6%, conforming to the requirements of the statistics. Subjects were involved in ten kinds of sports teaching classes including football, basketball, volleyball, martial arts, tennis, taekwondo, gymnastics, badminton, table tennis, gymnastics (Papastergiou, 2009). For the survey results, SPSS statistical software and Excel statistical software were used for data analysis.

2.4. Comparative analysis

Students from Shenzhen University and Hunan University of Science and Technology were taken as the experimental group, and other university students were as control group, with the relevant survey data analysis, systematical evaluation of the advantages of the application of network education technology in sports teaching, as well as the shortcomings in teaching (Li, 2014).

3. Research result and analysis

3.1. Main problems of traditional physical education mode

Less teaching classes: "Physical Education Curriculum Guiding Outline for Common Institutes of Higher Learning in China" in 2002 regulates public physical education in

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colleges and universities is two years' compulsory subject, with 144 hours, and the total hours have no change, basically once a week (2 hours). Questionnaire survey shows that 14.69% of the students think the current physical education "hours are too less", 55.21% of the students think it is "a little less"; only 29.62% and 0.48% of the students think that it is "proper" and "more" (e.g., table 1). 37.44% of the students think only relying on traditional classroom teaching cannot meet the demand of their own physical education learning. (e.g. table 2)

Content options	The number	The percentage
Class Too little	65	15.2%
Class fewer	231	52.6%
Class Just right	127	26.8%
Class too much	1	0.9%

Table 1 – The students of class attitude questionnaire

Content options	The number	The percentage
Can't agree with	154	37.4%
Basic agree	248	56.8%
Totally agree with	15	4.5%

Table 2 – Students of physical education identity

3.2. Current situation of sports network BBS construction in the domestic universities

BBS is mainly for people to comment on a particular issue, and the electronic bulletin board for discussion. Physical nature is also a very attractive topic. According to the survey, a lot of discussions on BBS focus on the forward and comment of competitive sports news, and also a part is about the students' personal feeling and experience of sports activities, as well as searching help for the encountered problems from other classmates.

The biggest characteristic of BBS is strongly interactive; for questions or comments that a student asks, there often will be many students providing help or participating in the discussion. For the BBS of four universities such as "Peking University Anonymous", the number of all kinds of articles published is shown in table 4-4, which shows that sports topic has become a major topic of discussion for the college campus BBS.

South China normal university is taken as an example, and the campus sports BBS is divided into four discussion areas (As is Table 3 shown), containing a large number of sports articles, (by August, 2004) respectively 3196 articles of sports world; 6025 of green dream; 5134 of basketball park; 845 of sports and health. Visibly, at present, this BBS communication way has also gradually become the most primary interaction way among the various university sports webs.

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Content classification	The article number	The percentage
The perceptual knowledge class	161681	27%
Leisure class	142598	20%
Category of the culture	117854	15%
Social information class	10485	14%
Academic science class	76589	18%
Sports class	65842	12%

Table 3 – BBS content statistics

3.3. Situation of college students surfing online

The survey was conducted for the students of the 6 universities in China, and the situation of Chinese students surfing online is as follows:

	Frequency	Percent	Valid Percent	Cumulative Percent
More than 12 hours	103	23	21	24
9 to 11 hours	51	12.2	12.6	36
6 to 8 hours	26	6.2	5.2	42
3 to 5 hours	142	32.5	32.6	87
Below2 hours	95	21.2	21.8	100
Total	420	99	100	

Table 4 – Students surf the Internet time frequency analysis table

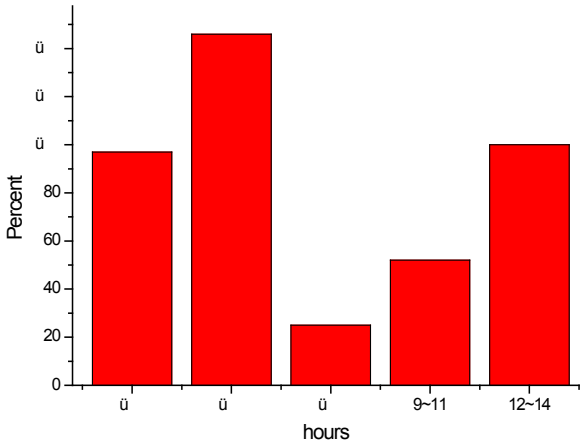

Figure 1 – College students' Internet time statistics

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Table 4 shows: among the 421-people surveyed, the number of people who spend 3 - 5 hours a week surfing online and spend more than 12 hours is 146 and 101 respectively; the two groups of students account for 58.6% of the total students. Students' online surfing time show great differences, with the distribution of the two extremes, as shown in figure 1.

Research shows that the domestic college students basically have a certain condition for surging online, and a relatively stable time for surfing online, and also have higher interest in and higher acceptance for the network information of the sports resources. Development of education function of network sports resources should be feasible.

3.4. Application form of network education technique in physical education

Hunan University of science and technology - "swiping card" fitness gym class. Hunan University of science and technology takes the campus network as technical support to explore a new teaching mode - "network learning and teaching pattern of big physical fitness activities", and to develop the related teaching experiments. They suggest to cancel the traditional public physical education teaching mode, but use a computer network management system of "swiping card" fitness gym class. Process is as shown in figure 2.

Basic function: network curriculum will make the main knowledge carried out in the unit of chapters according to the item, with a full-text searching function: teachers use interactive system to answer questions proposed by students; teachers make teaching content's technical actions as static image and produce a certain animation, and use an animated demo to deepen students' understanding of basic actions and habitual actions, with the acquisition of game clips. Process is as shown in figure 3.

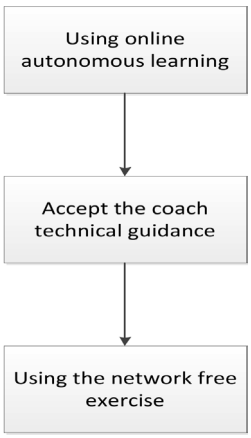

Figure 2 – The teaching process diagram

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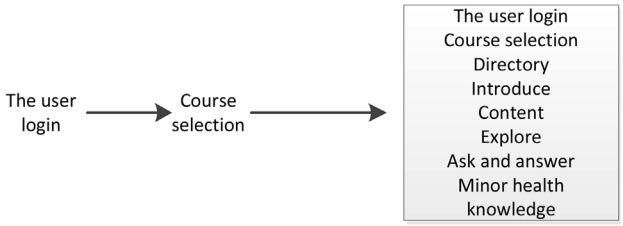

Figure 3 – System structure diagram

3.5. Application of network technique in the teaching affair administration of physical education

The network management system of physical education in Shenzhen University is taken as an example, as shown in table 4. The system software includes:

System management: System management is carried out based on the software design, and it sets different permissions for different visitors and operators, fully considering the security of network information.

Curriculum management: it is to establish a course database, including name, code, class hours, content, teaching management, management of physical education curriculum.

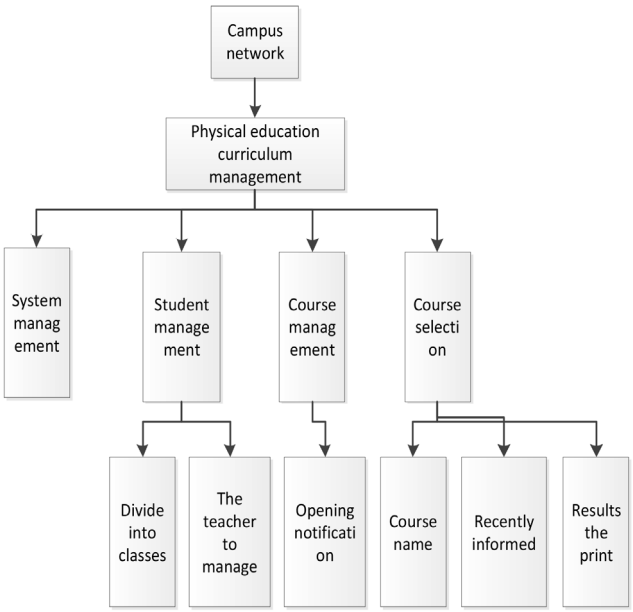

Figure 4 – Campus sports management system software structure

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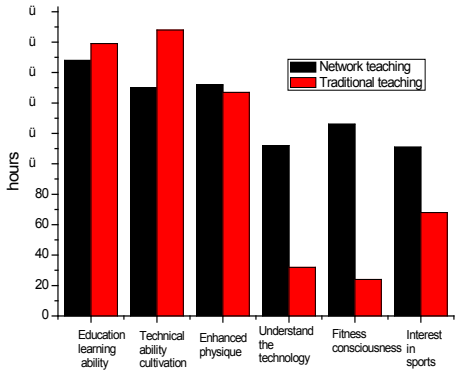

Figure 5 – Teaching effect comparison chart

Student management: it is the implementation of the great management scheme of the students from all majors in the university. Database can read the student information directly from the student management system through campus network. As long as they carry out online registration, students can click on the course; otherwise, they can't register the class.

Course selection management: it includes course selection, and class withdrawal. Students know the course selection information through going online; if it is found that the selected course quota is full, students can take the withdrawal and the second re-election. Teachers can query the situation of course selection, for final arrangement.

3.6. Function and influence of network education technique application on students

The physical education teaching under the network environment is compared with traditional physical education teaching; in the system, it adds the students' autonomous network learning. Use of network resources for independent learning can widen the function of traditional physical education, with the corresponding function and influence on students.

The author used physical education teaching under these two kinds of teaching environment to survey the students' attitude. Research shows: under the network environment, the students' evaluation on curriculum "cultivating students' physical education learning ability", "cultivating lifelong physical education consciousness", "understanding more techniques" is superior to the traditional teaching effect; for the function of "Meet their sports interest" and "learning one or two techniques", it has no significant difference from the traditional teaching; the effectiveness evaluation on "physical exercise, enhancing physique" is lower than the traditional sports teaching. As shown in figure 5, table 5.1 and table 5.2.

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group	N	Physical education learning ability	Technical ability cultivation	Enhanced physique
The network environment	210	M=0.53	M=0.80	M=0.71
Traditional teaching	211	M=0.15	M=0.84	M=0.89
MSE		0.041	0.36	0.31
T		8.9	-1.3	-4.5
P		P<0.01	P>0.05	P<0.01

Table 5.1 – Student evaluation of teaching effect

group	Understand the technology	Fitness consciousness	Interest in sports
The network environment	M=0.60	M=0.53	M=0.53
Traditional teaching	M=0.11	M=0.53	M=0.53
MSE	0.024	0.031	0.48
T	12.5	4.25	0.63
P	P<0.01	P<0.01	P<0.01

Table 5.2 – Student evaluation of teaching effect

3.7. Relevant factors influencing students' network learning

Online learning quality directly affects the physical network teaching development prospect, and reveals the factors that influence the students to carry on the network learning of physical education with the targeted improvements; the further application of the network education technique in physical education teaching has the decisive significance.

Research shows (e.g., table 6), the main factors affecting college students' autonomous learning by using network are, in turn, the level of network material production, lack of network sports material and online condition, the network learning being different from physical education learning and self-learning ability being limited, etc. It contains

Option content	Select The number	digits	The percentage
Low level of production	82	1	63.5%
Lack of access	49	2	30.5%
Different from traditional sports	41	3	31.2%
Lack of freedom to learn	38	4	26.8%
The lack of common sense	33	5	23.8%
Learning result is bad	31	6	15.6%

Table 6 – Factors influencing the student to carry on the network study statistics

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both objective factors, and a lot of subjective factors. There is the limitation of objective material, and the restriction of subjective understanding and ability. These are the revealed factors influencing the students to carry on the network learning.

4. Conclusion

1. Compared with traditional physical education, the network teaching of physical education has certain advantages.

In teaching experiment, the results show that the application of the network education technique in physical education teaching greatly changes the students' sports knowledge source structure and learning approach, and has a obvious role in promoting to cultivate students' physical education learning ability and lifelong learning habit; it is conducive to the deepening of teaching reform.

2. There is a great development space for the application of network education technique in physical education.

Practice has proved that network teaching as an extension of the school sports class has a certain role to assist students' physical education learning. The successful application of the school sports management software promotes some schools to explore its use in school extracurricular sports management and guidance. The asynchronous teaching function of network teaching has the very big development space for the management and guidance of school extracurricular sports.

3. The college students have low recognition on the network teaching class of physical education, and the research based on teaching quality is the essence for the development of network teaching of physical education.

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Expert System of Diabetes Diagnosis Based On C#

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Pages: 372–379

Abstract: It designs and implements an expert system of the diagnosis of diabetes mellitus based on C#. Firstly, it introduces the basic knowledge of artificial intelligence in this paper. Then, the requirements of the user and function and function design are given out. Next, the key technology of the acquisition of expert knowledge, the establishment of knowledge base and diagnostic function are studied. At last it gives the test results of the system. The results show that all functions of this expert system work well.

Keywords*:* Artificial intelligence; expert system; diabetes mellitus.

1. Introduction

Expert System (ES) is produced and developed as a new applied science in the early 1960s, it brings the computer application to a new heights and level, and with the continuous development of computer technology it is becoming more and more perfect and mature (Bo et al., 2008; Anto et al., 2015; Ganji et al., 2011). At present, there are over 400 million diabetic patients worldwide, diabetes has become one of the major diseases threatening human health (Malchoff, 1998). But diabetes knowledge popularization situation is not optimistic, misdiagnosis rate of the young doctor and less experienced doctor is high, so the design and implementation of the diabetes diagnosis Expert System will be helpful to improve the status quo, makes the diagnostic level of the young doctor better (Sigut et al., 2007). There are many studies related to the diabetes diagnosis Expert System, but most of them are only about the theory research, that can be put into actual use of the system is rare, and most of the medical diagnosis expert system structure is complex, cumbersome operation, inconvenient for the actual use (Choubey et al., 2015; Lee et al., 2014; Başçiftçi et al., 2011; Guay-Woodford et al., 2014). In this paper, we propose a diabetes diagnosis expert system that can simulate the diabetes expert diagnosis process, its structure integrity, functional improvement, simple operation, aims to provide guidance for the doctor in the process of diabetes diagnosis, to help doctors complete the diagnosis of diseases and to a certain extent reduce the misdiagnosis rate, especially can give diagnosis ways of less experienced doctors,so that they can accumulate experience

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and improve skills after repeatedly research the past medical records (Fortes et al., 2016; Lino et al., 2016).

2. System analysis and design

2.1. Demand analysis

The main user of the system is a young doctor or a less experienced doctor, targets are the patients. With the improvement of public health awareness, people's demands for prevention and diagnosis of diabetes will gradually increase, diabetes diagnosis expert system will become one of the more frequently used software in doctor's daily life. So, the system must have a concise interface, just a simple operation can be satisfied with the results, can work for a long time and running stability. Therefore, the system needs to meet the requirement of easy to use, easy to operate, stable operation of the user needs.

2.2. Main function design

The main task of diabetes diagnosis expert system is through the symptoms of diabetes patients with suspected to diagnose the disease, its main function is the diagnosis and classification of diabetes, the possibility of illness, refer to the doctor's advice, etc

Diabetes diagnosis. That is, the doctor can get information about whether the patient is sick after entering the relevant information and calculate the possibility of illness.

Classification of diabetes. If the patient has been determined to be sick, then which type of diabetes must clear, because different types of diabetes treatment is different.

Medical order management. Similar to the hospital doctor prescribed to the patient, the system also need to complete the diagnosis of the patient instructions to facilitate the doctor reference.

Case management. After the diagnosis, doctor's advice, the system will record all this record, to facilitate doctors and patients to read the archive. So the case management mainly include storage, modification, view, print and other functions.

2.3. System Process Design

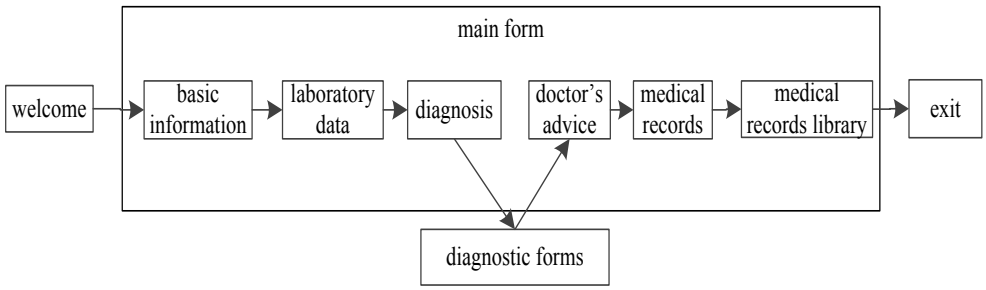

Figure 1 – System Flowchart

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This system has a welcome form, a main form, the main interface contains six pages as basic information, laboratory data, diagnosis, doctor's advice, medical records and medical records library. In addition, there are a number of diagnostic forms. The work flow of the system is also in accordance with this order, and the order of irreversible, so the whole system work flow as shown in Figure 1.

The "basic information page" is to fill in the user's personal information, clinical manifestations and family history, will be complete after the database into the background; the "test data page" is used to fill in the diagnosis of laboratory data required, the first completed and deposited into the background; "Diagnostic page" is used to diagnose the condition, if the "basic information" and "test data" have been filled in, and then click the "Click to start diagnostic button" to enter the diagnostic page;

The diagnostic page is used to simulate the diagnosis process of the physician, the user simply clicks the Yes, No and other radio button according to the page question, and then click the "Display Diagnostic Result" button at the end of the diagnosis to display the diagnostic results for reference. "Doctor's advice page" will automatically generate and diagnosis results related to treatment, while the physician can also be based on the actual combination of patients with their own experience to modify, and finally click Save; "Generate Medical records page" click on "Generate Medical Records" button will generate the patient's medical records for the printing of paper version and store case database. "Medical Records Library page" is used to display the "medical records" stored results and medical records of the query.

3. Key technologies

3.1. Knowledge of diabetes diagnosis

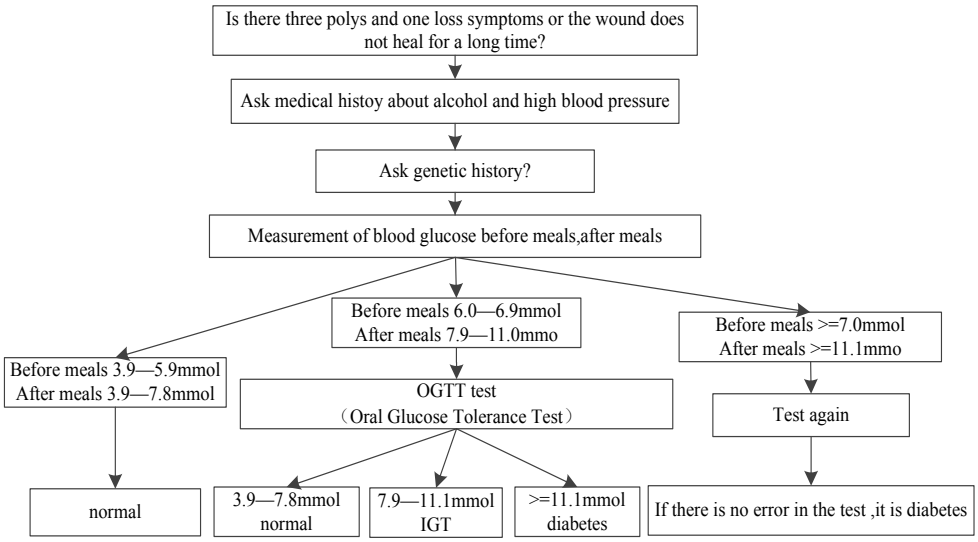

Figure 2 – Knowledge of diabetes diagnosis

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According to the experience of diabetes diagnosis in our country, the diagnosis of patients need to combine clinical diagnosis, blood glucose testing and other chemical tests can be obtained preliminary diagnostic results. First of all, the diagnosis based on clinical manifestations, that is, whether patients have "Three Polys One Loss" symptoms as polydipsia, polyuria, polyphagia and weight loss, the wound is not healing for a long time; Secondly, according to past medical history, genetic history of hypertension, whether alcoholism and other diagnosis; Finally, according to the results of blood glucose testing and OGTT test, combined with the clinical manifestations before the disease can be drawn the initial diagnosis. The specific knowledge chart shown in figure 2.

3.2. Diabetes knowledge of classification

In this paper, we use the internationally accepted classification method, the diabetes is divided into : type 1 diabetes, type 2 diabetes, other special types of diabetes, gestational diabetes. Including type 1 diabetes and type 2 diabetes accounted for more than 95% of the total number of patients; Gestational diabetes is relatively easy to diagnose, the patient is the first time in pregnancy can be basically recognized as gestational diabetes mellitus; Other patients can be basically defined as "other special types of diabetes" except type 1, type 2 and gestational diabetes. Detection of serum insulin C-peptide in patients with diabetes, combined with antibody detection, age and somatotype can be derived classification results. Type 1 and type 2 diabetes on the specific type of knowledge shown in Figure 3.

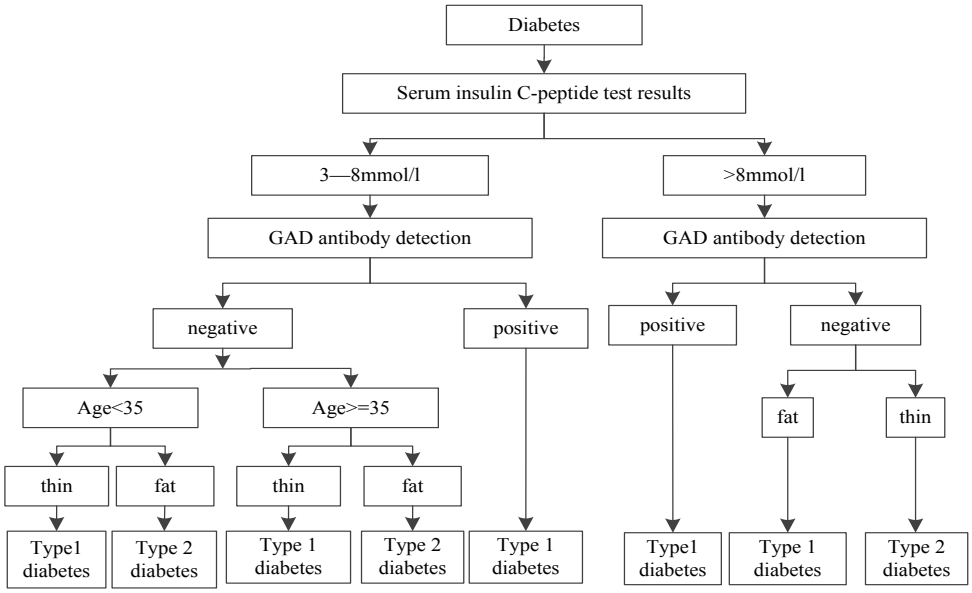

Figure 3 – Diabetes knowledge of classification

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3.3. Design of knowledge base for classification of diabetes

As mentioned above, our diagnosis and classification of diabetes are based on the probability of judgments, so the knowledge base for determining the probability is particularly important, on the one hand, we need to obtain symptoms information from the user, on the other hand, we should add weight to each symptom. Finally, we design the inference engine according to the symptoms and weights, so as to achieve the function of the expert system. According to the expert experience, the following basic information is useful: (1) frequent micturition; (2)frequent thirsty; (3)frequent drinking; (4)weight loss; (5) excessive blood glucose; (6)viral infection; (7)acute onset or slow; (8)age; (9)fat or thin; (10)family history. Through the access to relevant information and expert experience, give a variety of basic information on the weight of diabetes support, get the knowledge base as shown in Figure 4 and Figure 5.

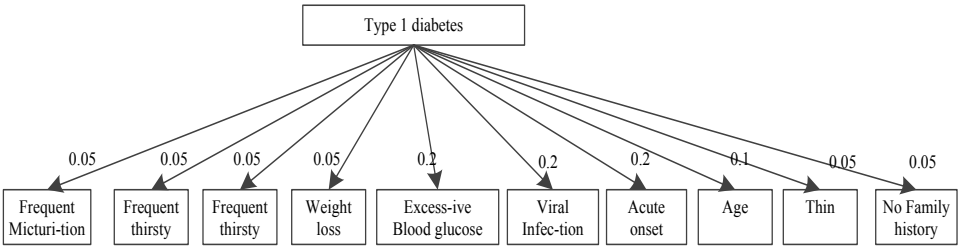

Figure 4 – Type 1 Diabetes Knowledge Base

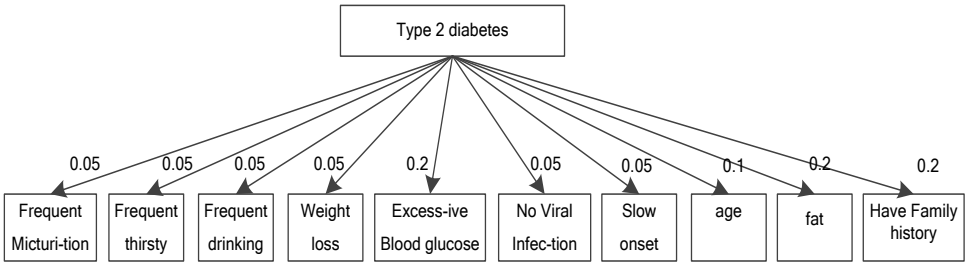

Figure 5 – Type 2 Diabetes Knowledge Base

In addition to weight, there are other knowledge need attention, knowledge 1: All diagnostic conditions are the patient has “three polys and one loss” symptoms, test data meets the requirements; knowledge 2: patients with both “acute onset” and “viral infection” that can determine type 1 diabetes, at this time the other weight effective too; with the knowledge base, the inference engine is easy to design, according to the access to information and the relevant expert system design methods, we use the “rule than” type of inference engine in this system.

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3.4. Diagnostic function design

The core function of diabetes expert system is to achieve the diagnosis of diabetes, the way of diagnosis is greatly related to the type of expert system we choose. In this paper, rule-based knowledge representation is used. First of all, to establish the exact knowledge base data, the method is to collate the experience of diabetes experts and consult diabetes-related data, and make clear mathematical statistics among clinical manifestation, physicochemical examination, probability of occurrence of disease and probability of diabetes , and get the rule of entry , so as to obtain more complete data (knowledge base).

Second, how to express these data is also difficult, many system choices of the program directly to determine by [if-else] statement, but if there are a large number of different conclusion will lead to the inference engine failure occurs, and this way will be written in the process of inference engine, post-maintenance is very difficult, so we choose the knowledge of the items in the knowledge base with *01* code, such as : blood glucose exceeded *1*, not exceeding 0; the incidence of acute *1*, the incidence of slow to 0; homologous disease is *1*, otherwise *0*; viral infection is *1*, otherwise *0*; age is greater than *45* to *1*, otherwise *0*.

Finally, each of the *01* merged into a *01* code, the corresponding database in each string of *01* code represents a rule, at the same time a corresponding conclusion corresponds to it, so that even more rules will not affect the running of the program, and the rules are stored in the database, can facilitate the management of knowledge base. In the foreground program, we only need to access the user information and do a simple treatment, which is converted into *01* form that each symptom, and then the *01* code corresponding to the different information into a 01 code, finally the *01* code sent to the data can be compared to draw the final conclusion.

4. System test

4.1. Running interface

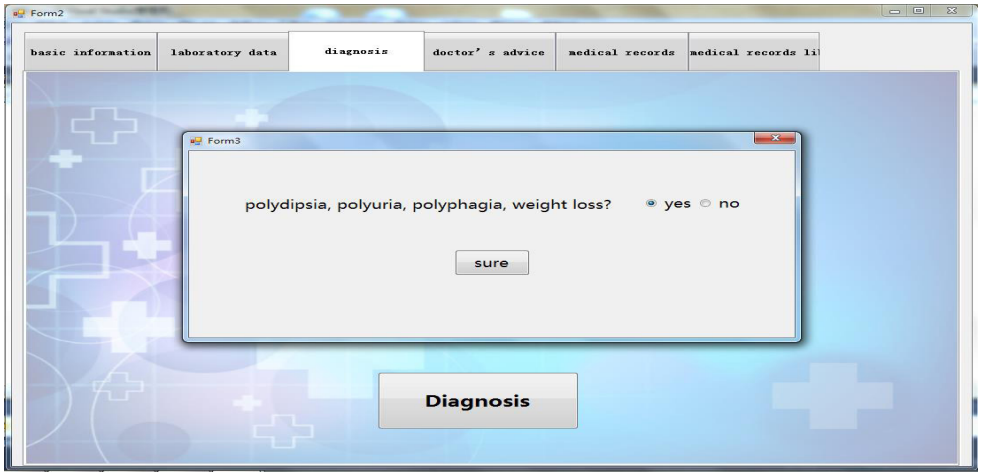

Figure 6 – Running interface

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The expert system consists of six modules: basic information, laboratory data, diagnosis, doctor's advice, medical record and case database. Each module is designed to suit the doctor's practical work and is convenient for doctors to use in their daily work. This system uses Visual Studio 2010 development, the programming language is C#, the data base is SQL Server 2008, in the Windows platform operating interface as shown in Figure 6.

4.2. Disease diagnosis test results

We use the actual cases in "Disease diagnosis test" to test the system, from different cases of different disease manifestations of the corresponding disease type, the possibility of illness and the corresponding doctor's advice, which can be drawn system test results. Here we take three different medical records as an example, and the results are shown in table 1.

Number	Symptoms	Diagnosis	Probability
1	Female,27 years old, glu 12.0 mmol/l, fpg 6.9 mmol /l, 2hpg13.0 mmol/l, no allergies and three polys one loss symptoms, in pregnancy, first onset, acute onset, no homologous disease, have viral infection	Gestational diabetes	Unable to determine the prevalence of gestational diabetes in the current level
2	Male,33, glu 13.0 mmol/l, fpg 12.9 mmol /l, 2hpg11.9mmol/l, have viral infection, have three polys one loss symptoms, fat, onset slow, have homologous disease	Other special types	>50%
3	Male, 64, glu13.3mmol/l fpg8.9mmol/l,2hpg11.8mmol/l, have viral infection, three polys one loss symptom, thin, acute onset, have homologous disease	Type 1 diabetes	>70%

Table 1 – Test Results

Case 1 and other cases of the biggest difference is that "*women*" and "*the incidence of pregnancy*", from this special performance and other symptoms, combined with relevant knowledge can be identified as gestational diabetes.

Case 2 and case 3 were male, the main difference is that age, size and onset of acute or slow, combined with figure 3, figure 4 and figure 5 can be obtained diagnostic results.

5. Conclusiones

In this paper, we based on actual demands as the starting point, designs and implements the diabetes diagnosis expert system used C#, using about the knowledge of expert system and through the "basic information", "diagnosis", "records management" three parts to complete the function of concrete. System interface is simple and easy to operate, stable running, it can meet users basic demands, and also has certain promotion value. The next step of work mainly focused on the following three aspects:

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1. the expansion of the knowledge base. Only the reliable knowledge base can improve expert system , to make the diagnosis results are closer to the real expert level.
2. the optimal diagnosis algorithm, improve the diagnostic accuracy.
3. the system security research, especially about the patient privacy information.

Acknowledgements

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Application Research on Music Feature Recognition Based on Computer Markov Model Algorithm

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Pages: 380–391

Abstract: Music is a kind of important audio data. Traditional music retrieval is the key word retrieval, which is restricted in practical application. With the rapid development of Internet technology and the popularity of digital equipment, content-based music retrieval research has been extensive concerned. This paper carries out In-depth studies on the key technologies of content-based music retrieval: the representing method and recognition algorithm of music chord features are proposed, and then the music chord recognition system is constructed. By using of Viterbi algorithm, the input signal in accordance with the maximum likelihood method to find the best path, further to obtain the best chord sequence. This paper applies the music features to the recognition system and analyzes the recognition results. The research conclusion is of great practical significance for the music feature recognition based on computer algorithms.

Keywords: music chord, music features, recognition system, computer algorithms.

1. Introduction

As shown in Figure 1, automatic music chord recognition consists of two moments: feature extraction and chord recognition (Cuddy & Duffin, 2005). The appropriate feature representation must first be extracted from the audio data, the extracted features must satisfy the following requirements: Firstly, the features must be low-dimensional (Wang, 2006), especially when it is the real-time recognition and lacking of training data (Gosselin, 2007). Secondly, the features should have robustness, for example, some crash and irregular sound will appear in the music, they do not constitute chord (Camurri, 2000). Thirdly, the feature must be a constant, because the rhythm, melody changes, etc. will cause some acoustics differences, thus the extracted features need to maintain the state of the constant so as to ensure the correct music theory expression (Gosselin, 2005).

Once the appropriate eigenvectors are extracted from the original audio data, it becomes an input of the recognition system (Peretz, 2009), and each eigenvector represents a chord to be recognized. We adopt the CMM model to classify chords, because the model represents a probabilistic framework that not only provides the distribution and

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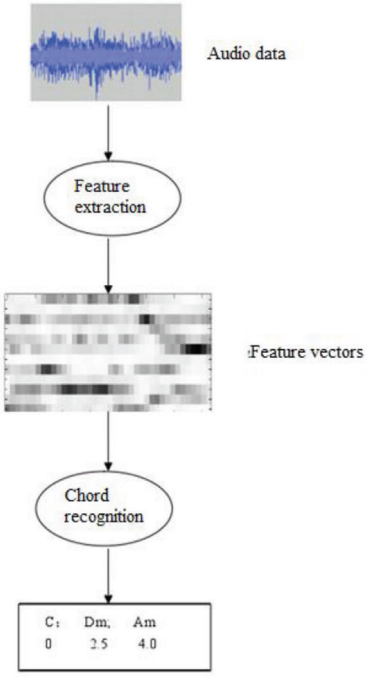

Figure 1 – The tow moments of chord recognition

observation vector for the input chord, but also expresses the chord progression through the Markov chain (Clausen & Kurth, 2004).

This paper focuses on the chord features and chord recognition model and makes a detailed exposition(Sourina, Liu & Nguyen,2011), introduces the chord features—Pitch Class Profiles (PCP), puts forward the feature—Mel Pitch Class Profiles (MPCP); deduces the basic algorithm of CMM; establishes chord recognition system based on MPCP features and CMM, by comparing the recognition results of the three different chord features, through analysis of the experimental results, ultimately determines the chord feature and recognition model (Drapeau et al.,2009; Fortes et al., 2016).

2. Chord features

2.1. Pitch Class Profiles (PCP)

The perceptual process of sound is closely related to the spectral analysis function of the human auditory system (Khalfa, 2005). Therefore, conducting spectral analysis on the music signals, is one of the effective means to recognizing the music signals and the processing audio signals (Stock et al., 2009). Fourier analysis is a powerful method for analyzing the linear systems and the steady-state characteristics of stationary signals. Based on the assumption of short-time stationary, the short-time Fourier analysis is a method for dealing with non-stationary signals by steady-state analysis method, it also can be called as time-dependent Fourier transform. Chord is the combination of three

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or more sound (Omar et al., 2011), this form is called as chord. The appearance of the chords enhances the performance of the melody.

The Pitch Class profile (PCP) feature is used by Fujishima as a musical chord feature for musical chord recognition and extraction of musical pitch. Musical pitch increases with the increasement of frequency (Mendez, 2001). They do not change with a one-dimensional straight line, but change in a spiral. The perception of musical pitch consists of two distinct properties: height and chroma. The height describes how the music pitch increases as the frequency increases, while the chroma cycles in an octave period. Thereby the chromas which with the integer octaves differ belong to the same chromas. More intuitive schematic diagram is shown in Figure 2.

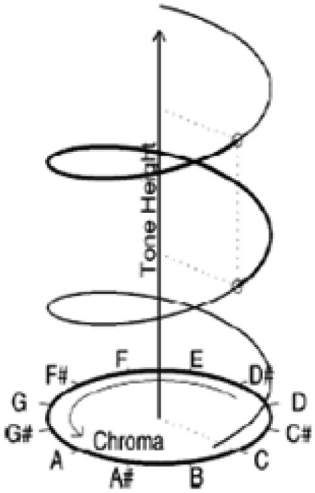

Figure 2 – Schematic diagram f pitch and chroma

PCP as a chord features, although it express the theory of music, but it did not fully take into account the listener factors or identifier factors , therefore there are the following shortcomings: 1: The characteristics is fuzzy at low frequency, make it can't normally express chord; It adopt chroma feature of tempo synchronization, although to avoid the restriction of frequency resolution, but since the computation amount is large which will affecting the recognition efficiency; 3: It is prone to confusion at the peak; From the above analysis, for chord recognition, we can combine the auditory characteristics and music theory together as a feature to recognize, it will be the development direction of chord recognition. Therefore, this paper proposes a new recognition feature based on human auditory characteristics and music theory: MPCP (Mel PCP) (Bellini et al., 2007).

2.2. Propose of MPCP feature

PCP feature first transforms the music signal from the time domain to the frequency domain, and then maps the signals to 12 frequency bands by spectrum mapping and

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according to the music theorem; finally the PCP feature is obtained by summation. PCP feature can be seen as the energy compression of music signal in accordance with twelve-tone equal temperament. While the MFCC parameter constructs the human auditory model by combining the auditory perception characteristics of the human ear with the mechanism of voice production, and the musical information through the model can be transform to acoustic characteristics (Punkanen et al., 2011). Therefore, the combination of above two further to form a new chord feature, it will not only overcome their mutual deficiencies, but also complement each other and give full play to their strengths, and further to express the music features of the chord.

MPCP feature first changes the signals to frequency domain; determine MFCC, and then through the music theorem to mapping the MFCC signal to the frequency band; finally to obtain MPCP by the formula. Figure 3 shows the computing process of MFCC.

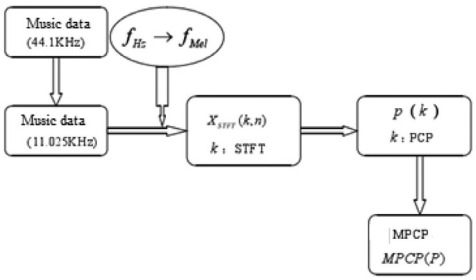

Figure 3 – The computing process of MFCC

2.3. Experimental analysis of feature comparison

Figure 4 is a comparison diagram of two features:

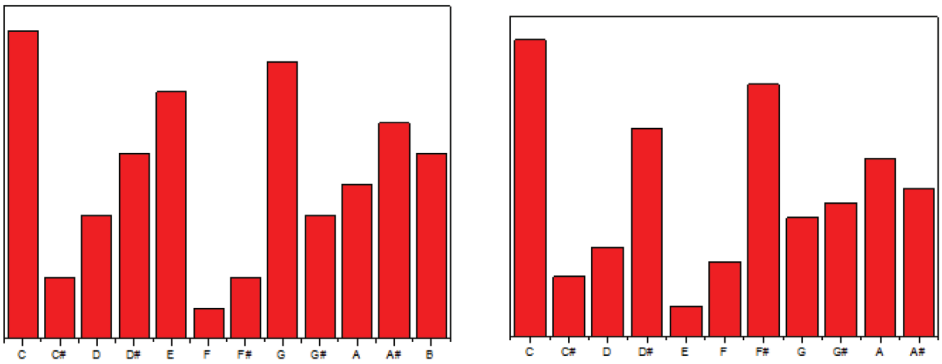

Figure 4 – C chord class

C chord consists of three single-tone C, E, G, from the comparison of the above figure can be seen: whether it is PCP feature or MPCP feature, both well reflect the composition

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of the chords. Under the same conditions, the MPCP feature effectively overcomes the shortcomings of the PCP feature: information fuzzy at low frequency. At the same time on the basis of contacting with the music theory, with the fully consideration of the human auditory characteristics, and to a certain extent improve the anti-noise ability. Therefore, MPCP feature more highlight the three single-tone information, and with better expression of the chord features.

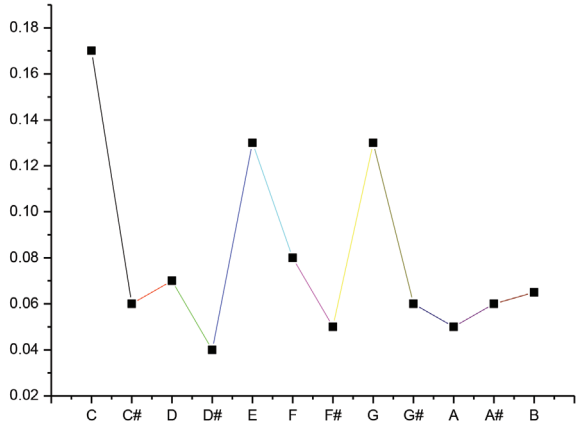

Figure 5 – PCP Vector

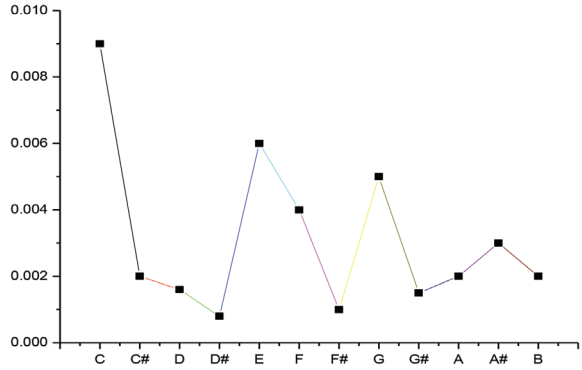

Figure 6 – MPCP Vector

Figure 5, Figure 6, reflects the observation and distribution parameters of C major chord of the two features (PCP, MPCP), respectively. By observing the mean vector and covariance vectors of the two features in the figures, it can be seen that the PCP and MPCP features all reflect the height autocorrelation of the pure tones of chord. The

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experiment is designed for the C chords, so the corresponding pure tones C, E, and G are correlated, while the other single-tones are with low correlation.

3. Computer Markov Model (CMM) and the establishment of the system

3.1. The basic concept of CMM

Markov process (or Markov chain) describes a class of important stochastic processes, which is proposed by the Russian mathematician A. Markov in 1907. It is intuitively explained that the "future" is independent of the "past", under the condition that given the current state of the system (now). CMM algorithm is:

First, define a forward variable $\alpha_t(i)$:

$$\alpha_t(i) = P(O_1, O_2, \dots, O_t, q_t = S_i|\lambda) \tag{1}$$

That is, under the condition that model λ is given, generate the probability that a part of the observed symbol sequence before t $(O_1, O_2, \dots, O_t)$ (inclusiveO_t) and at the moment of t is in the state of S_i. Here are the steps of the forward variables perform iterative computations:

1. Initialization

$$\alpha_1(i) = (\pi_i b_i(O_1), 1 \le i \le N \tag{2}$$

2. Iterative computation

$$\alpha_{t+1}(j) = \left[\sum_{i=1}^{N} \alpha_t(i)\, a_{ij}\right] b_j(O_{t+1}),\ \ 1 \le t \le T-1;\ 1 \le j \le N \tag{3}$$

3. Final calculation

$$p(O|\lambda) = \sum_{i=1}^{N} \alpha_T(i) \tag{4}$$

In the above formula, a_{ij} is the elements of the State transition matrix, $b_j(O_t)$ is the elements of the observations symbol matrix.

3.2. The establishment of chord recognition system based on MPCP feature

In this paper, CMM with 36 states is adopted to recognize chords, each state representing a class of chord. The probability distribution of the observation vector is fitted by a 12-dimensional Gaussian function with multivariate. We can directly estimate the parameters of CMM, when the training get the following model parameters: initial state probability, state transition probability, mean vector and covariance matrix of each state, then apply Viterbi algorithm to this model, use maximum likelihood to estimate

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the given input signal (the chord frame signal) and search for the best path, namely the best chord sequence. The recognition system is shown in Figure 7.

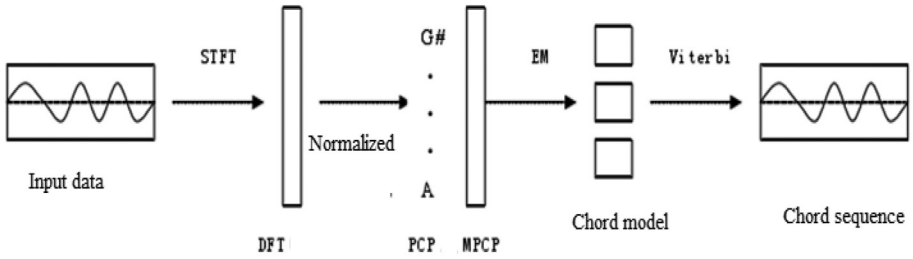

Figure 7 – The chord Recognition system

4. Experimental results and analysis

We apply PCP feature, MFCC feature and MPCP feature to chord recognition system respectively, and compare the applicability and recognition effect of the features through different test songs.

Training data is 48 songs in the three albums of Beatles, the test data is also three songs of Beatles.

Training data	The test data	Characteristics	Recognition rate
Please Please Me	Help	PCP	70%
		MPCP	82%
		MFCC	52%
Help	I Need You	PCP	63%
		MPCP	65%
		MFCC	40%
Abbey Road	Yesterday	PCP	69%
		MPCP	70%
		MFCC	56%

Table 1 – The recognition results (MPCP1)

As it can be seen from the above table 1: the MPCP feature is better than PCP features in recognizing of songs. The recognition rate based on PCP feature is low, the reasons are as following: Since the analysis window is fixed, when the rhythm speed up will skip some empty chords and then cause confusion; due to seven and three chords are of the same tone, and seven chord is based on the three chord, superpose a seven tone on radical, besides some part of the seven and three chords contain the same pure tone, so

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it is prone to errors in the recognition process. For example: in the song "Help" appeared about 20 root and pure tones, PCP feature recognition error is mainly in this. Similarly, the recognition error of the other two songs also appears in the above situation. Because the MPCP feature considers the auditory characteristics of the human ear and has better recognition ability in the changing frequency domain, thus the recognition rate of the MPCP feature is significantly higher than the PCP feature, which overcomes the problem of chord confusion to a certain extent, and basically solve the problem that mistaken recognition of empty chord. While the recognition rate of MFCC feature is far lower than the above two features, indicating that the feature is not suitable for chord recognition.

Comparing the recognition rates of songs 1, 2 and 3, it was found that the recognition rate of the latter two songs was lower than that of song 1 in both the PCP feature and the MPCP feature. By comparing tag files and songs, recognition errors are almost focused on a kind of chord—suspended chord: A chord which increases three tone of three chord by half or full, so that it is four degrees from the root tone. Since this chord changes part of the interval, such as hanging two chords, it replaced the original third degree sound with second degree sound, so there is an unstable tone itself. While song 2 and 3 totally contain 28 suspended chords, there are 26 suspended chords in songs 2, there is no case of suspended chord in song 1, therefore the phenomenon is occurred that recognition rate the song 1 is higher than the last two songs, and the recognition rate of the song 2 is only 60%.

Chord	Number	Characteristics	Results	Mistake
B(min)	4	PCP	4	0
		MPCP	4	0
G	10	PCP	8	2
		MPCP	9	1
E	4	PCP	3	1
		MPCP	3	1
A	20	PCP	12	7
		MPCP	14	5
C#min	6	PCP	3	2
		MPCP	4	1
F#min	7	PCP	5	2
		MPCP	6	1

Table 2 – The recognition results of "help" (MPCP1)

Table 2 lists the detailed recognition results of the song "Help" recognition: the entire song includes 6 kind of chords, a total of 51 chords. The PCP feature recognizes 37 chords correctly, while the MPCP recognizes 42 chords correctly. The main recognition error concentrate in the A chord, which PCP features correctly recognizes 13, while the MPCP feature slightly better, reached 15. The reason is that A chord of the song is between the

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C and G chords, and A chord is composed of single tone A, C and C chord is composed of single tone C, E and G, Therefore, in recognition process the composition of single-tone which is easy to confuse and cause recognition errors; from the above table, the recognition result of the C chord is also can be seen, PCP feature of the 4 correct, 2 errors, and MPCP feature of the 5 correct, 1 error; the reasons of misrecognition is the same with A chord, the recognition result of the G chord is also the same.

Chord	Number	Characteristics	Results	Mistake
A	38	PCP	25	14
		MPCP	26	12
Asus2	13	PCP	2	11
		MPCP	2	11
A sus4	13	PCP	3	11
		MPCP	3	10
D	13	PCP	12	2
		MPCP	13	0
F#min	9	PCP	9	0
		MPCP	9	0
C#min	4	PCP	4	0
		MPCP	4	0
Bmin	4	PCP	4	0
		MPCP	4	0
E	6	PCP	3	3
		MPCP	3	3
B	5	PCP	2	0
		MPCP	2	0

Table 3 – The recognition results of “I need you” (MPCP1)7

Table 3 gives the specific recognition result for the song “I need you”, which includes 9 kinds of chords and a total of 102 chords. The PCP feature recognizes 61 chords correctly, and the MPCP feature recognizes 66 chords correctly. The recognition errors mainly concentrate in the first 3 chords. Since Asus2 and Asus4 are suspended chords, are hanging two chords and hanging four chords respectively, they are obtained on the basis of changing the interval of A, the chord has unstable sound. In this song, the above-mentioned three chords are continuous appear in the order of A, Asus2 and Asus4, the appearance of suspended chords can produce some unique artistic charm, for the song “I need you” it forms a Kind of feeling with nostalgia. It is precisely because of the existence of such chords, making the case of misrecognition happened in recognition process. It can be seen from the table, for Asus2 and Asus4, PCP or MPCP features recognition rate is very low, 26 suspended chords, PCP features recognizes only 4 correctly, MPCP

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features recc f two chords,
recognition ecognizes 24
correctly, M ecognition is
more than 1

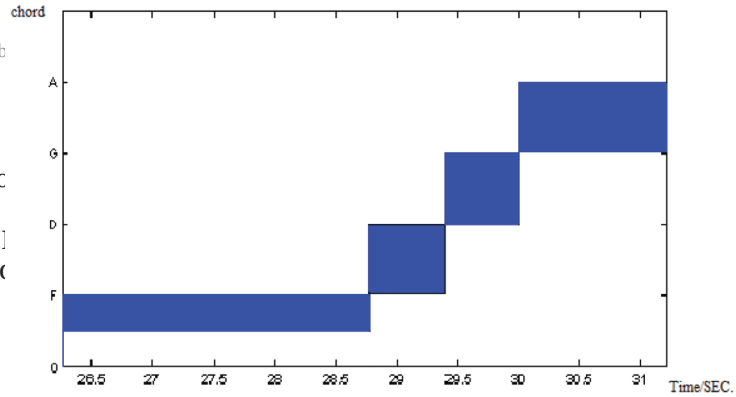

Figure 8 – The segment of "help"(MPCP1)

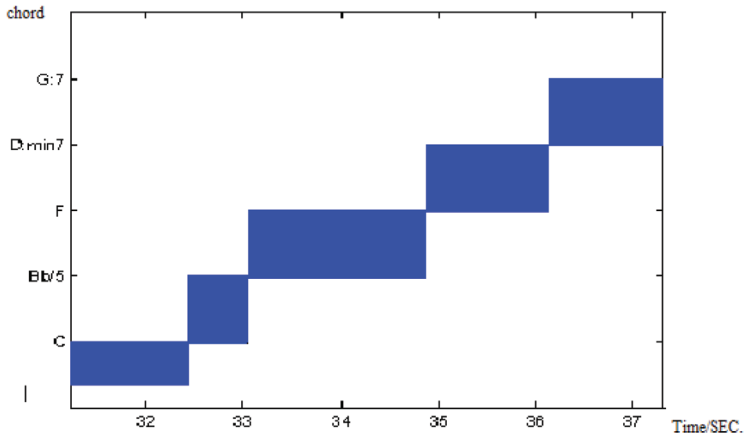

Figure 9 – The segment of "yesterday"(MPCP1)

Figure 8 lists the recognition results for the song "help": The figure shows the recognition result from 26.3 seconds to 31.2 seconds, during which four different chords appear, in order: F#min (26.3- 28.8), D (28.8-29.4), G (29.4-29.9), A (29.9-31.2). As can be seen from Figure 8, both PCP features and MPCP features are accurately reflect the chord name and change. Similarly, Figure 9 also shows a segment of the song "yesterday", with 5 different chords in the range of 31.2-37.3 seconds: C (31.2-32.4), B (32.4-33.0), F (33.0- 34.9), Dmin7 (34.9-36.1), G7 (36.1-37.3), we can see that the above five kinds of chords did not exist suspended chord, thereby the recognition of the music is accurate, and reflecting chord changes of the original song.

5. Conclusions

In this paper, the chord recognition system based on CMM is introduced, and the new chord feature—MPCP proposed by the author is applied to the chord recognition system, which improves the recognition rate to a certain extent. The advantages

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and disadvantages of the PCP feature are analyzed, and then a new chord feature is proposed: MPCP, which combines the advantages of PCP feature and MFCC feature, as well as integrates the music theory and human auditory theory, and more fully expresses the chord feature. Respectively, PCP, MPCP and MFCC features are applied to the chord recognition of the song, through the analysis and discussion of the recognition experiment, it can be seen that the first two features can correctly express the chord and recognize the song effectively, while MFCC feature is not suitable for chord recognition. The new feature proposed in this paper effectively avoids the defects of PCP feature, increases the anti-noise ability of recognition, thus improve the recognition rate of the whole system.

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A Study on Directly Obtaining Particle Size Based on Angle Light Scattering

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Abstract: This paper attempts to explore a method to directly acquire particle size using light scattering. In this paper, we take single spheres made of the same material but of different sizes, i.e. polytetrafluoroethylene (PTFE) balls with a size of 1um and 4um respectively, as experiment subjects. Through test, we obtain their angle intensity scattering signals. After analyzing the angle intensity scattering signals from the particles with two different sizes, we divide the scattering signals into 6 angle bands within the angle domain and calculate the sum of energy in each angle band. Through comparison, we find that the angle bands of the angle scattering signals from particles with different sizes have different energy values. Therefore, we can distinguish the particles made of the same material but of different sizes based on the energy value of the angle bands of angle scattering signals. At last, we use the generalized regression neural network to sort out the 1um- and 4um-size single spherical particles.

Keywords: light scattering; angle band; neural network - particle size

1. Introduction

Due to the unique advantages of light scattering in measurement of particulate matters (PM), this PM measurement method has been widely used in various applications. By signal, this method can be divided into: small angle forward scattering, angle scattering, light extinction, dynamic light scattering and polarized light methods (Sun et al., 2007); by the measured PM, it can be divided into: overall light scattering for simultaneous measurement of multiple particles and light scattering for measurement of a single particle at a time. The multi-particle measurement result has low spatial resolution and can only provide the overall size statistics of all particles in the measurement area. If we want to obtain a more accurate result, we have to use the single particle measurement method – the angle scattering method, i.e. the classic Mie scattering. At the beginning of this century, Lorenz, Mie and Debye put forward some classic solutions. One feasible method is to calculate the relation between the diameter D, the refractive index n, the incident wavelength and the scattering intensity I and the scattering angle and

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obtain the angular scattering distribution; in other words, the so-called phase function $I(\theta, \lambda)$has a measurement graph, and through inverse operation, the particle size can be obtained and the particle concentration obtained accordingly (Rosskamp et al., 2007; Ray et al., 1991; Liang et al., 2004). In current applications, many choose the 90-degree scattered light intensity to determine the particle size and then deduce the concentration. However, there are two problems: 1. at 90 degrees, to those strongly absorbent PMs like sand, the scattered light intensity is very weak; 2. To measure a single particle, the scattered light signal is very weak and when the particle size is small, it will be disturbed by the background noise of the electronic parts, reducing the precision. Besides, as the method adopts reverse operation, standard particulate matters need to be used to calibrate instruments. This paper attempts to explore a method to directly obtain particle size of signle particle– performing multi-angle detection, dividing angle energy bands and using the neural network to obtain the particle size (Renard et al., 2010; Fortes et al., 2016).

2. Simulation study

2.1. Selection of angle band feature vectors

We select two kinds of PTFE particles with a size of 1um and 4um respectively. Based on the incident wavelength of 650nm, we use the classic Mie scattering algorithm for calculation. And the calculated angle scattering distribution is shown in Figure 1 and Figure 2. With an angular resolution of 0.1 degree, 1,800 data can be obtained. We can see from the charts that the scattering intensity of large particles is greater than that of the small ones. Compared with the waveform for small particles, the waveform amplitude for large particles is significantly increased, which can be seen from the energy value. Generally speaking, the simplest and quickest particle size calculation method is to count the number of waveforms observed. Once the relation between the number of waveforms and the size is established, we can convert the number into size (Min and Gomez, 1996; Wright et al., 2002). However, this method has some shortcomings: 1. There are limits to the size and number of waveforms. For example, when the size difference is fairly small, the wave counts for the spherical particles with different sizes will be the same. 2. Wave count is a low-dimension index. It is effective for the identification of spherical particle size one by one, but it does not employ tools like neural network to do automatic batch identification. Therefore, we propose using frequency-band energy as the feature vector of particles. Frequency-band energy is defined in Formula (1) below:

$$E_n = \int_{\alpha}^{\beta} |A|^2 \, d\theta \tag{1}$$

Where, E_n stands for the energy of the n-th angle domain band; A stands for the amplitude of the waveform corresponding to each angle in the angle domain band; α and β refer to the starting and ending angle of the angle frequency band, which are constants; the angle frequency band is divided into a number of equal portions, and $d\theta$ is one portion, as the independent variable of the integral.

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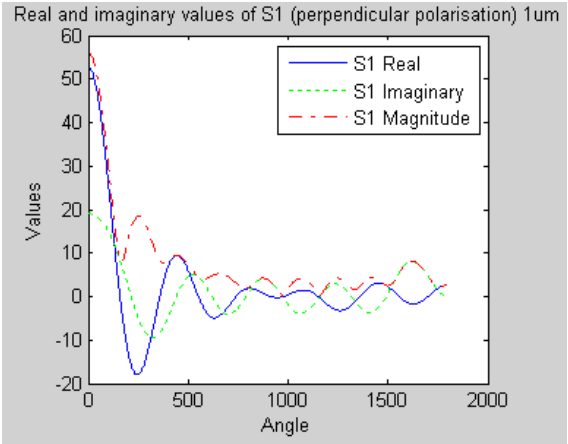

Figure 1 – Angle Scattering Waveform Chart for 1um-size PTFE Particles Based on Mie Scattering Algorithm

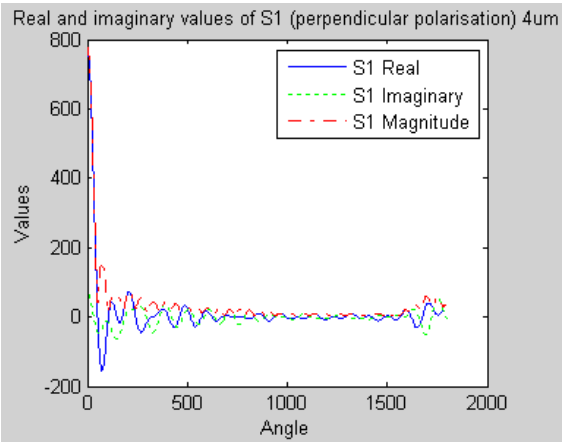

Figure 2 – Angle Scattering Waveform Chart for 4um-size PTFE Particles Based on Mie Scattering Algorithm

We select 6 angle bands from the angle scattering waveform curves (red waveform curves) of PTFE particles with different sizes within the angle domain in Figure 1 and 2 (0-15 degrees; 30-45 degrees; 60-75 degrees; 90-105 degrees; 120-135 degrees; 150-165 degrees); we calculate the energy value of each frequency band using the integral principle and then obtain the distribution of frequency band energy corresponding to the angle scattering waveform curve of PTFE particles of two sizes, as shown in Figure 3 and 4.

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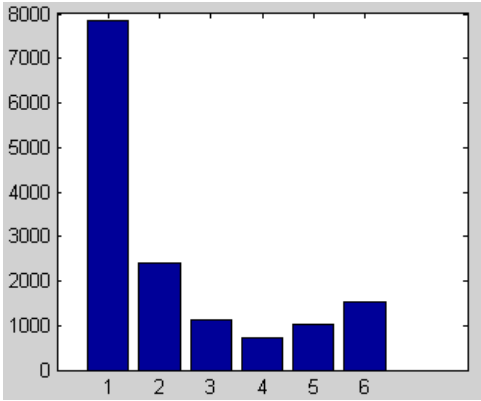

Figure 3 – Frequency-Band Energy Distribution Chart for Angle Scattering Curve of 1um-size PTFE Particles

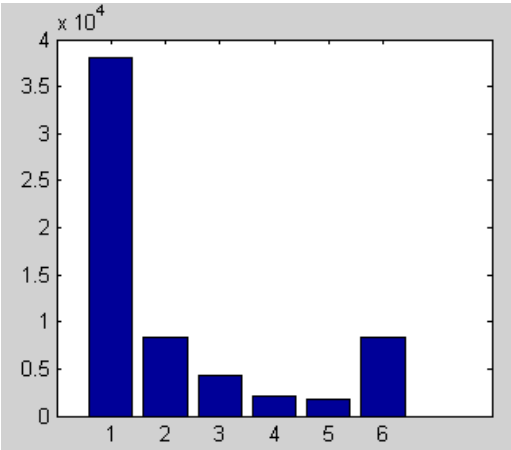

Figure 4 – Frequency-Band Energy Distribution Chart for Angle Scattering Curve of 4um-size PTFE Particles

From Figure 3 and 4, it can be seen that the energy value of each angle frequency band for 1um-size PTFE particles is smaller than that for 4um-size ones. The general angle frequency-band energy distribution pattern is from large to small and at last from small to large. The pattern for 1um-size PTFE particles is that the energy gradually decreases from Frequency Band 1-4 and increases from Band 5. The pattern for 4um-size PTFE particles is that the energy gradually decreases from Band 1-5 and sees a sudden increase in the last Band 6. Therefore, the characteristics of frequency-band energy distribution corresponding to the angle scattering curve can be input into the generalized neural network as a high-dimension feature vector to identify different sizes of spherical PTFE particles.

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2.2. GRNN-based Particle Size Identification Method

This paper uses the neural network to sort out different sizes of PTFE particles. The merit of the generalized regression neural network is that the network finally converges to the optimized regression plane where samples are concentrated. As the generalized regression can complete learning quickly and the sort result involves little human interference, this paper chooses the generalized regression network to sort out different sizes of spherical particles. Below is a brief introduction to the basic principles of the generalized neural network.

In 1991, Specht proposed the Generalized Regression Neural Network (GRNN)[]. GRNN does not need to determine the equation form. It uses the probability density function (PDF) to replace the inherent equation form. Nodes of the hidden layer consist of radial action functions like Gaussian function, while nodes of the output layer usually consist of simple linear functions. Figure 5 shows the topologic structure of GRNN **(Haykin)**.

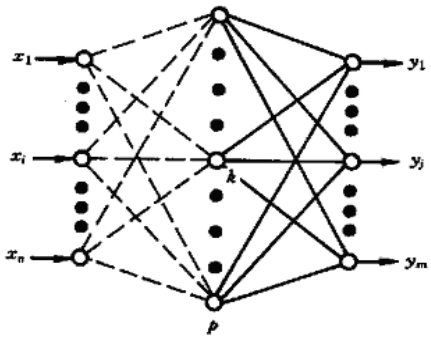

Figure 5 – Topologic Structure of the Generalized Regression Neural Network

The basic mathematical principle of GRNN is nonlinear kernel regression analysis. Let y be non-independent variable and x be independent variable. The regression analysis of y with respective to x is essentially to calculate the y with the maximum probability.

Let $f(x,y)$ be the joint probability density function of random variables x,y. Let X be the observed value of x. So the regression value of y with respect to X, i.e. the conditional mean, is calculated according to the following formula:

$$\hat{Y} = E\left[y/X\right] = \frac{\int_{-\infty}^{+\infty} yf(X,y)dy}{\int_{-\infty}^{+\infty} f(X,y)dy} \tag{2}$$

Regarding the function $f(x,y)$ with unknown probability density, we use Formula 4.2 and the sample observation values of x and y to obtain its non-parametric estimation as follows:

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$$f(X,Y)=\frac{1}{(2\pi)^{(m+1)/2}\sigma^{m+1}n}\times\sum_{i=1}^{n}\exp\left[-\frac{(X-X_i)^T(X-X_i)}{2\sigma^2}\right]\exp\left[\frac{(Y-Y_i)^2}{2\sigma^2}\right] \quad (3)$$

Where, X_i and Y_i are the sample observations of random variables of x and y; σ stands for the smoothing parameter (kernel variance); the sample size is n; the dimension of the random variable is m.

We substitute $\hat{f}(X<Y)$ for $f(x,y)$ in Formula (3), and exchange the sum order of integrals to obtain:

$$\hat{Y}(X)=\frac{\sum_{i=1}^{n}\exp\left[-\frac{(X-X_i)^T(X-X_i)}{2\sigma^2}\right]\int_{-\infty}^{+\infty}y\exp\left[-\frac{(y-Y_i)}{2\sigma^2}\right]dy}{\sum_{i=1}^{n}\exp\left[-\frac{(X-X_i)^T(X-X_i)}{2\sigma^2}\right]\int_{-\infty}^{+\infty}\exp\left[-\frac{(y-Y_i)^2}{2\sigma^2}\right]dy} \quad (4)$$

For the integral part in Formula (4), we reduce the formula with the equation $\int_{-\infty}^{+\infty}x\exp(-x^2)=0$ to obtain a simplified result.

$$\hat{Y}(X)=\frac{\sum_{i=1}^{n}Y_i\exp\left[-\frac{(X-X_i)^T(X-X_i)}{2\sigma^2}\right]}{\sum_{i=1}^{n}\exp\left[-\frac{(X-X_i)^T(X-X_i)}{2\sigma^2}\right]} \quad (5)$$

In Formula (5), the estimation $\hat{Y}(X)$ is the weighted mean value of all sample observation values Y_i, and the weight of each observation value Y_i is the exponent of the squared Euclid distance between the corresponding sample X_i and X.

The generalized regression network is a regularized radial basis function network. The radial basis function theory is a multi-dimensional spatial nonlinear interpolation algorithm, whose accuracy depends largely on the choice of radial basis function center []. However, in the generalized regression network, the Green function center, the number of hidden layer units, the weighted norm matrix and the connection coefficient are determined through learning. For the Green function, it usually takes learning to make the solution close to the normalized exact solution, and in the hidden layer, there is only one closed value; as a result, all network learning has to rely on data samples. This feature makes this network able to minimize the impacts of people's subjective assumptions on the forecast results.

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The basic topological structure of the generalized neural network built from Formula (5) is shown in Figure 5. The basic structure of the generalized neural network consists of an input layer, a model layer, a summation layer and an output layer. In the network input layer, the input sample is $X=\left[x_1,x_2,x_m\right]^T$, and the corresponding output layer is $Y=\left[y_1,y_2,\cdots,y_k\right]^T$.

Step1: For the operation in the input layer, first input the samples of angle band energy of different sizes of PTFE particles as training samples to the GRNN input layer. The number of neurons in the input layer needs to be consistent with the number of dimensions of the angle band energy sample vectors of PTFE particles input in the learning samples.

Step2: For the operation in the model layer, the number of neurons in the model layer needs to be consistent with the size n of learning samples at the same level with the angle band energy samples of PTFE particles. Each neuron corresponds to a sample. The transfer function of neuron i is:

$$p_i=\exp\left[-\frac{\left(X-X_i\right)^T\left(X-X_i\right)}{2\sigma^2}\right],\ i=1,2,\cdots,n \tag{6}$$

In other words, the output data of neuron i is the exponential form of the squared Euclidean distance between the input variable X and the corresponding sample X_i $D_i=\left(X-X_i\right)^T\left(X-X_i\right)$, where X is the network input variable; X_i is learning sample corresponding to the i-th neuron.

Step3: The operation in the summation layer mainly involves the use of neurons for summation. There are two types of neurons.

One formula is $\sum_{i=1}^{n}\exp\left[-\frac{\left(X-X_i\right)^T\left(X-X_i\right)}{2\sigma^2}\right]$, i.e. the denominator in Formula (5). It is mainly used to sum up all output values of neurons in the model layer. The connection weight of each neuron is 1. The transfer function is as follows:

$$s_D=\sum_{i=1}^{n}p_i \tag{7}$$

An alternative formula is $\sum_{i=1}^{n}Y_i\exp\left[-\frac{\left(X-X_i\right)^T\left(X-X_i\right)}{2\sigma^2}\right]$, i.e. the numerator in Formula (5). It is mainly used to calculate the weighted sum of all output values of neurons in the model layer. The connection weight of the i-th neuron in the model layer with the j-th elemental summation neuron is the j-th element y_{ij} of the i-th output sample Y_i. Its transfer function is as follows:

$$s_{Nj}=\sum_{i=1}^{n}y_{ij}p_i \tag{8}$$

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Step4: the number of neurons in the output layer is equal to the number of dimensions of output vectors in the learning samples. Divide the output of (7) by the output of (8) in the summation layer to obtain the result shown in Formula (5). The output of neuron j corresponds to the j-th element in the estimation result $\hat{Y}(X)$, as shown below:

$$y_j = \frac{s_{Nj}}{s_D} \tag{9}$$

Step5: Take 80 PTFE particle samples with known sizes as the training set for GRNN. Train the GRNN to make it able to identify the sizes of spherical PTFE particles.

Step6: Take 20 PTFE particle samples with known sizes as the validation set for GRNN. Validate the effectiveness of the GRNN-based particle size identification method with the output identification results.

3. Experiment System

In order to validate the feasibility of the method to identify particle size based on the frequency band energy of angle scattering waveform proposed in this paper, we have built an experiment system for one particle, whose structure is shown in Figure 6. A vertical He-Ne laser with a wavelength of 650nm is used as the incident light source, 6 lens (f=50mm) are set, and behind is a photodiode array (N=512, L=0.6cm) (Min and Gomez, 1996; Wright, 2000; Dick et al., 2007).

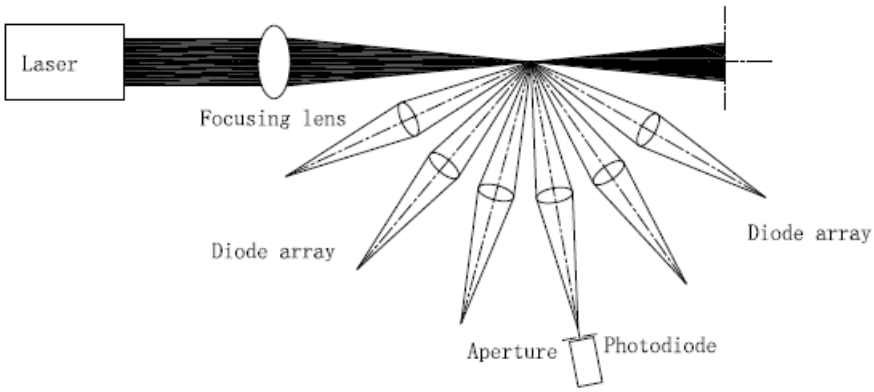

Figure 6 - Structure Diagram of the Experiment System

For validation purposes, we take PTFE particles with a size of 1um, 4um and 10um respectively as standard matters. Figure 7 shows the angle scattering distribution obtained through measurement.

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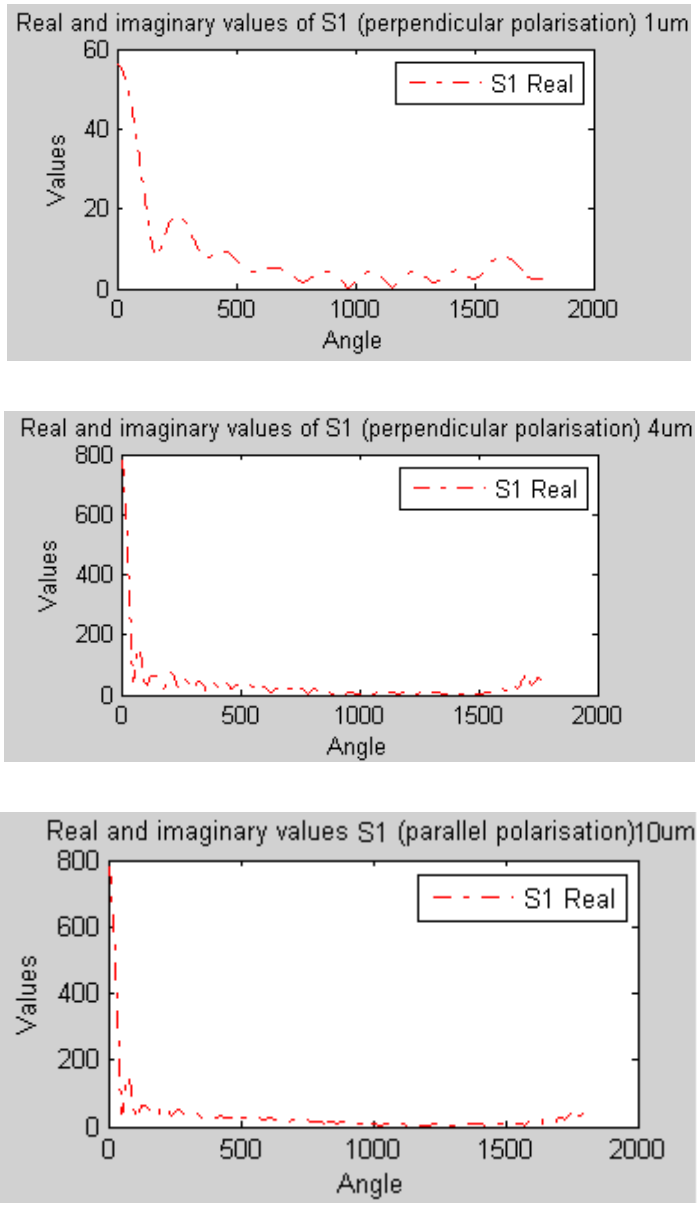

Figure 7 - Angle Scattering Waveform Charts for PTFE Particles with Different Sizes

The frequency-band energy waveform charts corresponding to the above angle scattering waveform charts for three sizes of PTFE particles are shown in Figure 8:

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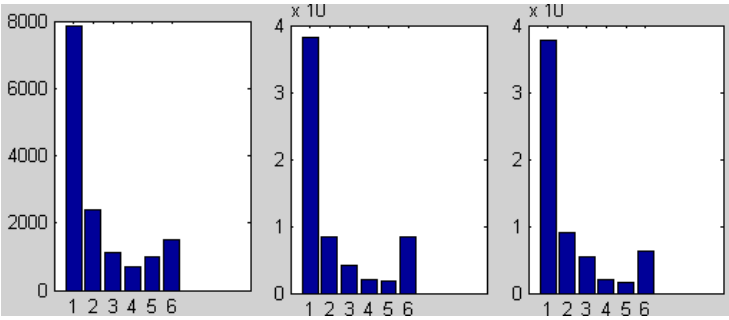

Figure 8 – Frequency-band Energy Distribution of Angle Scattering Waveforms of PTFE Particles with Different Sizes

From Figure8, we can see that there are differences between the frequency-band energy distribution of PTFE particles with three different sizes. We can input the frequency-band energy values of the samples with known sizes as feature vectors into the generalized neural network for training, and then input the samples to be sorted out into the trained neural network for sorting. We use the generalized regression network to sort out the PTFE particles with different sizes. The first 80 samples are used as training samples and the last 20 as test samples. The sorting results are listed in Table 1.

	Sorting result of 1um-size samples			**Sorting result of 4um-size samples**			**Sorting result of 10um-size samples**		
Sample No.	**1um**	**4um**	**10um**	**1um**	**4um**	**6um**	**1um**	**4um**	**10um**
1	0.99	0	0.01	0	1	0	0.02	0	0.98
2	0.96	0	0.04	0	1	0	0.06	0	0.94
3	0.97	0	0.03	0	1	0	0.08	0	0.92
4	1.00	0	0.00	0	1	0	0.04	0	0.96
5	0.97	0	0.03	0	1	0	0.03	0	0.97
6	0.96	0	0.04	0	1	0	0.10	0	0.90
7	0.97	0	0.03	0	1	0	0.03	0	0.97
8	0.98	0	0.02	0	1	0	0.03	0	0.97
9	0.97	0	0.03	0	1	0	0.03	0	0.97
10	0.97	0	0.03	0	1	0	0.03	0	0.97
11	0.96	0	0.04	0	1	0	0.09	0	0.91
12	1.00	0	0.00	0	1	0	0.01	0	0.99
13	0.97	0	0.03	0	1	0	0.03	0	0.97
14	0.97	0	0.03	0	1	0	0.03	0	0.97
15	0.98	0	0.02	0	1	0	0.02	0	0.98
16	0.97	0	0.03	0	1	0	0.01	0	0.99
17	0.98	0	0.02	0	1	0	0.01	0	0.99
18	0.96	0	0.04	0	1	0	0.14	0	0.86
19	0.96	0	0.04	0	1	0	0.11	0	0.89
20	0.97	0	0.03	0	1	0	0.03	0	0.97

Table 1 – GRNN Sorting Results of PTFE Particle Samples with Three Sizes

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From this table, we can see that the feature information extracted from the angle scattering waveforms of PTFE particles with different sizes after being processed by the energy method are successfully applied in the sorting of particle sizes. 20 particle samples with 3 different sizes are correctly grouped. The method is most effective to PTFE particles with a size of 4um, and the accuracy for 1um-size and 4um-size particles is respectively over 95% and 90%. Experiment results show that using frequency-band energy of angle scattering waveforms as feature vectors is very effective in the identification of particle sizes.

4. Conclusions

This paper studies the application of the method combining frequency-band energy of angle scattering waveforms and the neural network in the identification of particle sizes. It proposes an identification method using frequency-band energy in the angle domain to help identify particle sizes in engineering fields. Through application in the identification of PTFE particles with three different sizes, it is proved that the feature information - the frequency-band energy based on angle scattering waveforms can well identify different particle sizes; and that this method is effective in the identification of particle sizes. Through the above experiment, it is found that the method proposed in this paper has the following merits in terms of particle size identification:

1. The frequency-band energy of angle scattering waveforms is used as the new feature information, which results in differences in the angle scattering signals of particles with different sizes, thus it can be used as basis to identify different sizes of particles.
2. The frequency-band energy of angle scattering waveforms as feature information is very different for particles with different sizes, so the number of feature vectors needed in particle size identification can be greatly reduced, which shortens the training time needed by the neural network and improves its sorting accuracy.
3. The successful application of the method using frequency-band energy of angle scattering waveform in the identification of particle sizes provides a new idea for achieving the automatic machine identification of particle sizes.

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Research on the Recommendation Algorithm of Operating Vehicles' Optimum Passenger-chosen plots based on ST-DBSCAN and AHP

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Abstract: The pedestrians have difficulties in taking a taxi while on the contrary the aimless operating vehicles cannot quickly and timely find the passengers which leads to the high empty-loading ratio. In order to ease the contraction between the pedestrians and the operating vehicles, the paper brings forward the research on the recommendation algorithm of operating vehicles' optimum passenger-chosen plots based on ST-DBSCAN and AHP. The recommendation algorithm firstly mines the historical passenger-chosen hot plots sequences with time characteristics through the cluster analysis to the historical GPS trajectory data of the operating vehicles using spatial-temporal clustering algorithm ST-DBSCAN. Secondly the algorithm will carry through the quantitative analysis to all of the factors in the context that can affect the operating vehicles' decision. Finally, through the results of the quantitative analysis, the algorithm can provide the optimum selection scheme of the passenger-chosen plots to the operating vehicles. Experiment indicates that the recommendation algorithm can efficiently mine the temporal and spatial characteristics of the passenger-chosen plots, reduce the empty-loading ratio the scheduling success ratio and at the same time raise the income of the operating vehicles.

Keywords: empty-loading ratio of the operating vehicles; recommendation algorithm of the passenger-chosen plots; ST-DBSCAN; AHP

1. Introduction

The urban operating vehicles have become an important part of urban transportation system because of its flexibility and convenience. But because of the lack of efficient and reasonable monitoring and dispatching to the operating vehicles, the drivers of the operating vehicles are used to relying on the experience for searching the cruise route (YUAN et al., 2013). At the same time, the randomness, dynamics and complexity of the pedestrians when they go out. All the factors above often lead to high empty-loading problem. The high empty-loading ratio not only reduces the driver's income and simultaneously increases environmental pollution as well as the energy consumption, but also easily leads to the traffic congestion problem (Kimura, 2008). Therefore, in

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order to help the drivers to quickly find the passengers on the cruise service process and change the inefficiently operating mode that when the operating vehicles are waiting for the pedestrians, the pedestrians are also waiting for the operating vehicles and reduce the empty-loading ratio of the operating vehicles, the paper put forwards the research on the recommendation algorithm of operating vehicles' optimum passenger-chosen plots based on ST-DBSCAN and AHP.

Because the GPS and the communication devices loaded in the operating vehicles will transfer informations such as real-time longitude and latitude, operating status, travelling direction, speed and others at a certain frequency to the urban passenger transportation management center, the management center can accumulate a large number of vehicles' travel path data. So we can use these data to realize the spatial-temporal clustering analysis using ST-DBSCAN algorithm to mine the spatial distribution characteristics in different time period and then recommend the passenger-chosen plot sequences for the operating vehicles according to the context such as the different region and the time that the operating vehicles are in. Next, the research uses AHP algorithm to implement the for the recommended passenger-chosen plot sequences and finally, the optimum passenger-chosen plot will be find according to the results of the quantitative analysis.

2. Model Design of the Passenger-chosen Plots' Recommendation System

The environment model of passenger-chosen areas' recommendation system consists of four parts, the passenger-chosen plot model, operating vehicle model, recommendation model and constraint model. The model can be described as follows.

$$PPRSM = (PPM,\ OVM,\ RM,\ CM) \tag{1}$$

In the formula, PPM represents the passenger-chosen plots model. OVM represents the operating vehicle model. RM represents the recommendation model and CM represents the constraint model.

2.1. Model of Passenger-chosen plots

There are twelve administrative regions in the city of Yulin. Every region can be subdivided into different streets. In order to facilitate the simulation, the paper selects Yuyang district whose geographical coordinates ranges from east longitude 108°58′-110°24′ to north latitude 37°49′-38°58′ as the research area. The research firstly divides the Yuyang district's passenger-chosen areas into eight streets. Every street are made up of five attributes which can be described as name of the passenger-chosen areas (name), region area (ra), GPS longitude range (rlgi), GPS latitude range (rlati), population (pn). The partition table is shown in table 1. Every partition is composed of numbers of passenger-chosen plots. The partitions can be represented with directed acyclic graph (DAG) which is described with two tuple (P, E). The P in the two tuple indicates the different streets passenger-chosen divisions, P={p1, p2,... pi, pj,... Pn} is a collection of passenger-chosen plot sequences. Each node represents a passenger-chosen plot and pi represents the list passenger-chosen plot, n represents the number of the passenger-

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chosen plot sequences. E={e12, e13,... eij,... } is a collection of directed edges among the passenger-chosen plot sequences. Each side represents the distance relations among the passenger-chosen plot sequences. The model of the passenger-chosen plots is established as shown in figure 1.

Areas' name	Region area (km2)	GPS longitude range	GPS latitude range	Population
New Minglou street	3.8	109.665998-109.789405	38.29421-38.488715	21319
Drum-tower street	6.85	109.733248-109.756099	38.294277-38.340347	37878
Qingshan road street	6.5	109.676718-109.748037	38.280509-38.29899	44673
Shangjun road street	13.5	109.74187-109.81229	38.217068-38.310727	59671
Hangyu road street	29.2	109.726859-109.768459	38.254998-38.28957	46073
Congwen road street	9	109.676718-109.74691	38.285258-38.306564	50661
Tuofeng road street	14.5	109.749693-109.789405	38.298926-38.319128	49864
Changcheng road street	148.8	109.711339-109.82859	38.147846-38.354766	24337

Table 1 – Partition table of passenger-chosen areas in Yuyang district

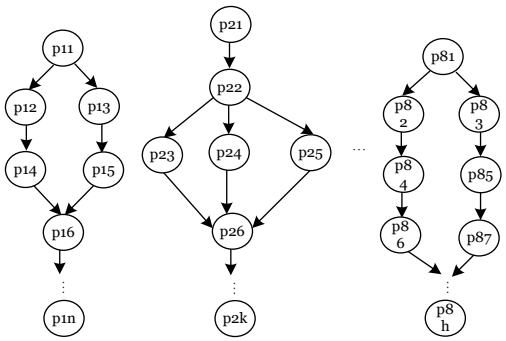

Figure 1 – Passengers-chosen Plots' DAG Diagram

Because of the rule of time for human routine and social activities, the regional distribution characteristic of the passenger-chosen areas in different time period may be different. In the research, one day can be divided into 24 day period and one hour is regarded as one time slot (GE et al., 2010). By this way, the distribution characteristic of the passenger-chosen plots' in each time slot for the operating vehicles can be obtained. In this paper,

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the historical passenger-chosen data can be obtained through the spatial and temporal clustering analysis to the historical GPS trajectory information by ST-DBSCAN. Each passenger-chosen plot pi is made up of five attributes which can be described as the identification of the passenger-chosen plot p (vi), name of the passenger-chosen plot name (vi), GPS latitude and longitude of the passenger-chosen plot (vi), the current time (vi), and the street division that belongs to sd (vi). The specific values are shown in Table 2. Because the number of the passenger-chosen plots in Yuyang district is numerous, only a part of information is listed in the table.

plot's ID	plot's name	GPS latitude and longitude	current time	street division that belongs to
p1	Northern Hospital	(109.76107,38.292411)	7:40	New Minglou street
p2	Kaixin Mansion	(109.757695,38.288573)	10:50	Changcheng road street
p3	Discipline Inspection Commission	(109.724695,38.292258)	12:10	Qingshan road street
p4	Grand Hotel	(109.73605,38.295313)	13:50	Congwen road street
p5	Guan Yu Temple	(109.714457,38.304537)	16:50	Tuofeng road street
p6	Guangji Mansion	(109.753211,38.300741)	18:00	Changcheng road street
p7	Yulin Theatre	(109.759648,38.295195)	23:20	New Minglou street
p8	Experimental Primary School	(109.738514,38.289677)	6:50	Qingshan road street
p9	Tenth middle school	(109.76223,38.298677)	9:30	Tuofeng road street
p10	Yuan Yang lake	(38.308128,109.753456)	12:00	Drum-tower street
p11	Ninth primary school	(38.269812,109.752545)	13:50	Hangyu road street
p12	Third kindergarten	(38.306834,109.783495)	16:50	Tuofeng road street
p13	Yulin university	(38.298873,109.729996)	18:00	Congwen road street
p14	Sunshine Hospital	(38.287057,109.767122)	19:47	Shangjun road street
p15	Dragon Garden	(109.75361,38.305376)	20:32	Drum-tower street
p16	Xisha hospital	(109.743412,38.291922)	22:09	Qingshan road street
p17	Yongle District	(109.758861,38.285887)	23:54	Changcheng road street

Table 2 – Attributes of passengers-chosen plot

2.2. Model of Operating Vehicles

The model of the operating vehicles in the Yuyang area can be represented by an undirected graph, which is described by two tuple (V, D), where V represents the operating vehicles, V={v1, v2,... vi, vj,... vn} is a collection of operating vehicles. Each node represents an operating vehicle. vi represents the ist operating vehicle. The symbol n represents the number of users. D={d12, d13,... dij,...} is a collection of edges between

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the operating vehicles, each of which represents the distance relationship between the operating vehicles. Each operating vehicle is made up of seven attributes which can be described as the license plate number (lnum), the driver's name (name), current location (cloc), current time (ct), operating state (osta), driving direction (ddir), and driving speed (dspe). The model of the operating vehicles is shown in figure 2.

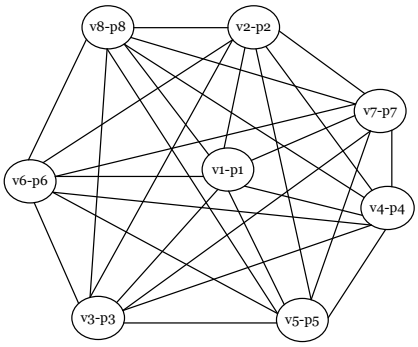

Figure 2 – Model of Operating Vehicle

These attributes' specific values: the license plate number lnum (vi), the driver's name name (vi), current location cloc (vi), current time ct (vi), operating state osta (vi), driving direction ddir (vi), and driving speed (dspe) are shown in table 3.

lnum	name	cloc(GPS coordinates)	ct	osta	ddir (GPS direction)	dspe (km/h)
T0342	vn1	Bell tower (109.761842,38.296229)	6:00	0	26	17
T0349	vn2	Second hospital (109.742083,38.283562)	8:22	1	88	0
T3986	vn3	Post office district (109.744532,38.284884)	12:10	1	306	54
T3182	vn4	Immeasurable Temple (109.764601,38.306364)	13:50	1	178	38
T3971	vn5	Agricultural Bank of China (109.763456,38.289132)	18:10	0	78	21
T3027	vn6	Municipal government (109.741224,38.290915) (109.74123,38.290912))	19:04	1	212	41
T0024	vn7	Culture Road Primary School (109.735554,38.292258)	21:45	0	180	86
T2559	vn8	Sunshine Home (109.743603,38.298769)	22:30	1	39	12

Table 3 – Attributes of Operating Vehicle

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In table 3, the value of the operating state ranges from 0 to 3. 0 represents the empty-loading state. The number 1 stands for the state of carrying passengers. The number 2 stands for the state of parking. The number 3 stands for the stated of outage. The value of the GPS direction ranges from 000 to 360. The direction's unit is degree which stands for the angle to the Arctic direction. In other words, the GPS direction value stands for the driving direction of the operating vehicles.

2.3. Recommendation Model

There may be a mass of operating vehicles that make request for recommendation service at the same time. So the recommendation system of the optimum passenger-chosen plots belongs to the real-time concurrent system whose goal is the high recommendation success rate, low empty-loading ratio, high throughput, short average turnaround time, fast response time, good fault tolerance and expansion (LI et al., 2011). In order to make all the concurrent users get the responses in the relatively ideal time and obtain a higher recommendation success rate as well as improve the concurrent processing ability, the research divides the recommendation algorithm into three stages. The first stage uses the ST-DBSCAN algorithm to realize the clustering analysis to the operating vehicles' historical GPS trajectory data which can make the operating vehicles that request the services obtain the historical passenger-chosen hot sequences based on the time characteristics. The second stage uses analytic hierarchy process to realize the quantitative analysis for all of the factors that the operating vehicles' are in. This stage can recommend one to three optimum passenger-chosen plots for the operating vehicles. In the third stage, the drivers of the operating vehicle can choose one plot to go from the recommended plots in the stage two. The recommendation model is shown in figure 3.

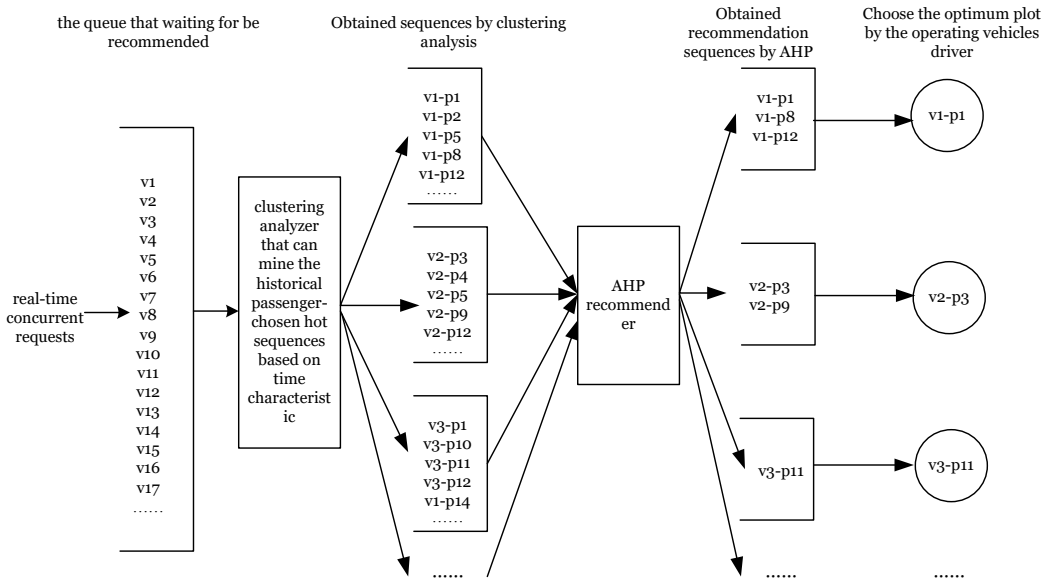

Figure 3 – Recommendation Model Diagram

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2.4. Constraint Model

In order to make the model more close to the real environment, some constraints are defined.

1. Each request from the operating vehicle is a real-time task which means that in must be accomplished within the stipulated time as far as possible.
2. Because of the time law of human routine and social activities, the recommended plots in different time period for the operating vehicles that located in the same place location will not exactly be the same (DING et al., 2013).
3. Because the different context that the operating vehicles are in, the recommended plots for the same operating vehicles that located at the same place and the same time will not exactly the same.
4. One operating vehicle can have a number of recommended passenger-chosen plots. A recommended passenger-chosen plot can also be assigned to a limited number of different operating vehicles.

3. Conclusions Design of the Optimum Passenger-chosen Plots Recommendation Algorithm for the Operating Vehicles

The design of the optimum passenger-chosen plots recommendation algorithm for the operating vehicles is divided into two stages. In the first stage, the ST-DBSCAN algorithm is utilized to the mining of the historical passenger-chosen plots sequences. In the second stage, the AHP algorithm is used to recommendation of the optimum passenger-chosen plots. The basic steps of the algorithm can be described as follows.

1. Make use of the ST-DBSCAN to carry out data mining to the historical passenger-chosen plots which can obtain the historical hot passenger-chosen plot sequences.
2. Make use of the AHP to carry out the quantitative analysis to the mined passenger-chosen plot sequences according to the context that the operating vehicles are located in. In this stage, one to three passenger-chosen plots which have the highest quantized value can be obtained. Assign the 1 to 3 recommended passenger-chosen plots to the operating vehicles that request the service. Then the drivers can select a preference from them and head to. After that, delete the operating vehicle that has been recommended from the list of recommended services requests which should be repeated until the request list of the recommendation service is empty. The two stages will be detailed described in 3.1 and 3.2.

3.1. Spatial-temporal Clustering Analysis using ST-DBSCAN Algorithm

The randomness, dynamic nature and complexity of pedestrian travel often lead to the high empty-loading ratio when the operating vehicles choose the cruise service way. The high empty-loading ratio not only reduces the driver's income and increases environmental pollution as well as the energy consumption, but also easily leads to traffic congestion problems (Yuan et al., 2011). With the continuous accumulation of

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operating vehicles' GPS historical trajectory data, all kinds of clustering algorithms can be used to carry through the clustering analysis for the historical trajectory data. The clustering analysis can mine the temporal and spatial distribution rules and trends of the passenger-chosen plots which can effectively solve the high empty-loading ratio when the operating vehicles drivers search the cruise route only depending on their experiences. The clustering analysis can also provide a scientific basis for the drivers which can be used to help drivers quickly finding passengers in the process of cruise service and improve the income as well as reduce the energy consumption and traffic congestion to a certain extent.

The human routine and social activities demonstrate obvious time rules. For example, the distribution of the passenger-chosen plots in rush hour and off peak hour will not be exactly the same. Based on this, The GPS historical trajectory data can be classified according to time characteristic, and then carry out the spatial-temporal clustering which can fully mine the spatial density distribution in different time period and provide the operating vehicles more reasonable passenger-chosen plots' spatial-temporal distribution data, and effectively improve the success ratio in the cruise process (Yuan et al.,2011). Based on this, the paper introduced ST-DBBSCAN algorithm which requires 4 input parameters: the historical trajectory data object D, the spatial radius ε, time radius ΔT, and the density threshold MinPts. The output parameter is cluster C. The specific steps of the algorithm are described as follows.

ST-DBSCAN(D, ε, ΔT, MinPts)

{Set a given value to the density threshold MinPts and determine the spatial radius ε as well as the time radius ΔT according to the K-DIST diagrams that drawn by the historical GPS trajectory data;

```
initialize C to zero;
for( if exists the object that has not been accessed in D such as p)
{  flag p as the object that has been accessed;
N(ε,△T)(p)=getNeighbourhoods(p, ε, ΔT);
if(sizeof(N(ε,△T)(p))<MinPts)
      flag p as spatial-temporal Noise point;
else
{  create a new cluster C;
add p to the cluster C;
for(if exists the object that has not been accessed in N(ε,△T)(p) such as q)
{  flag q as the object that has been accessed;
N(ε,△T)(q)=getNeighbourhoods(q,ε,ΔT);
if(sizeof(N(ε,△T)(q))>=MinPts)
N(ε,△T)(p)=N(ε,△T)(p)+N(ε,△T)(q);
if(q does not belong to any cluster)
join q to the cluster C; //  }       }     }  }
```

The value of Mints and ε will exert a tremendous influence on the clustering results of the ST-DBSCAN algorithm and may even cause serious deviation to the clustering results which eventually leads to poor clustering effect. In order to effectively solve the

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problem of parameter selection and obtain the better clustering results, the paper refers to the k-dist diagram. Construct the k-dist diagram by the way of solving the K nearest neighbor radius k-dist of the data object which can finally acquire the appropriate parameters Mints and ε. After obtained the value of Mints and ε, the clustering using ST-DBSCAN for the data sets can be carried out. The process of clustering using ST-DBSCAN algorithm should refer to the areas of Yuyang district, the population, the total number of the operating vehicles in this district and k-dist diagram (Pei et al., 2010). Before the clustering, firstly, the data sets in the file "simudata.xlsx" should be imported using the matlab codes described as follows.

```
data = importdata('simudata.xlsx');
data0 = data;
[x,y] = find(isnan(data0));
x0 = unique(x);
data0(x0,:) = [];
data = data0(:,5:6);
x1 = data(:,1);
min_x = min(x1);
max_x = max(x1);
y1 = data(:,2);
min_y = min(y1);
max_y = max(y1);
......
delt_x = abs((xr-xl)/(Nx-1));
delt_y = abs((yr-yl)/(Ny-1));
x00 = xl:delt_x:xr;
y00 = yl:delt_y:yr;
figure;imagesc(x00,y00,img);colormap(gray);
......
```

The chosen data sets in the simulation experiment are the GPS trajectory data of Congwen Road Street. Nine spatial-temporal clusters C1-C9 are found in the clustering results. The clustering results are shown in figure 4.

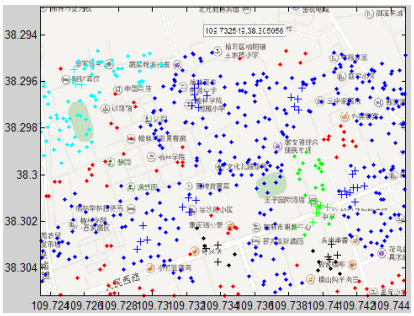

Figure 4 – Clustering Result

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3.2. Quantitative Analysis to the Recommended Passenger-chosen Plot Sequences using AHP

Analytic Hierarchy Process which can be abbreviated as AHP a simple and effective method of multi-objective decision making proposed by the famous American professor Sarti in mid twentieth Century. This method can deal with qualitative and quantitative factors at the same time. In this stage, the AHP algorithm is used to carry out the quantitative analysis to the passenger-chosen plot sequences that obtained by the ST-DBSCAN clustering algorithm. After acquired the assessed values, compare the results and pick up the 1-3 plots that owned the highest values to the drivers. The process of AHP, in general, can be carried out in the three steps described as follows.

1. Establishment of hierarchical structure model

   When we use the AHP to analyze decision problems, the first step is constructing a hierarchical structure model. The elements of the upper level serve as the guidelines for the relevant elements of next level]. The hierarchical model of the recommendation of the passenger-chosen plot sequences is shown in figure 5.

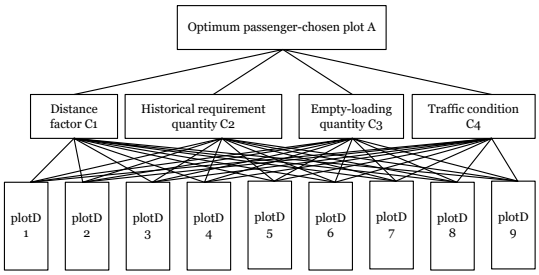

Figure 5 – Hierarchical Structure Model

2. Judgment matrix's construction, hierarchical single sort and consistency check

   - Judgment matrix's construction

A-C	C1	C2	C3	C4
C1	1	2	5	1/2
C2	1/2	1	5	1/3
C3	1/5	1/5	1	1/5
C4	2	3	5	1

Table 4 – Judgment Matrix of Second Layer relative to the First Layer

The eigenvectors and eigenvalues of the judgment matrix are calculated respectively as follows.

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$W=(1.495,0.955,0.299,2.340)^T, \lambda max=4.142$

Carry through the consistency test to the judgment matrix. In other words, calculate the value of C.I. and C.R..

C.I. =0.0473 C.R.=0.053<0.1

The results show that the consistency of the judgment matrix is acceptable.

- Judgment matrix of the third layer relative to the second layer

C1-D	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1	2	3	4	5	6	7	8	9
D2	1/2	1	2	3	4	5	6	7	8
D3	1/3	1/2	1	2	3	4	5	6	7
D4	1/4	1/3	1/2	1	2	3	5	6	8
D5	1/5	1/4	1/3	1/2	1	2	4	5	6
D6	1/6	1/5	1/4	1/3	1/2	1	2	4	7
D7	1/7	1/6	1/5	1/5	1/4	1/2	1	3	5
D8	1/8	1/7	1/6	1/6	1/5	1/5	1/3	1	3
D9	1/9	1/8	1/7	1/8	1/6	1/7	1/5	1/3	1

Table 5 – Judgment Matrix of C1-D

The eigenvectors and eigenvalues of the judgment matrix are calculated respectively as follows.

$W=(4.147,3.008,2.113,1.576,1.080,0.753,0.495,0.300,0.194)^T, \lambda max=10.379$

Carry through the consistency test to the judgment matrix. In other words, calculate the value of C.I. and C.R..

C.I. =0.089079 C.R.=0.061<0.1

The results show that the consistency of the judgment matrix is acceptable.

Construct the C2-D judgment matrix in the same way. The result is shown in table 6.

C2-D	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1	1/2	1/5	2	6	1/2	1/4	3	2
D2	2	1	1/5	3	7	1/2	1/3	7	2
D3	5	5	1	7	9	2	2	8	6
D4	1/2	1/3	1/7	1	2	1/4	1/6	2	1/2
D5	1/5	1/7	1/9	1/2	1	1/7	1/9	1/2	1/4
D6	2	2	1/2	4	7	1	1/2	7	4
D7	4	3	1/2	6	9	2	1	8	5
D8	1/3	1/7	1/8	1/2	2	1/7	1/8	1	1/2
D9	1/2	1/2	1/6	2	4	1/4	1/5	2	1

Table 6 – Judgment Matrix of C2-D

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The eigenvectors and eigenvalues of the judgment matrix are calculated respectively as follows.

$W=(1.277,1.392,4.064,0.501,0.243,2.097,3.093,0.335,0.685)^T, \lambda max=9.4043$

Carry through the consistency test to the judgment matrix. In other words, calculate the value of C.I. and C.R..

C.I. =0.0505 C.R.=0.035<0.1

The results show that the consistency of the judgment matrix is acceptable.

Construct the C3-D judgment matrix which is shown in table 7.

C3-D	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1	5	7	2	6	1/2	8	4	3
D2	1/5	1	3	1/4	2	1/6	4	1/2	1/3
D3	1/7	1/3	1	1/6	1/2	1/8	2	1/4	1/5
D4	1/2	4	6	1	5	1/3	7	3	1/2
D5	1/6	1/2	2	1/5	1	1/7	3	1/3	4
D6	2	6	8	3	7	1	9	5	4
D7	1/8	1/4	1/2	1/7	1/3	1/9	1	1/5	1/6
D8	1/4	2	4	1/3	3	1/5	5	1	1/2
D9	1/3	3	5	1/2	1/4	1/4	6	2	1

Table 7 – Judgment Matrix of C3-D

The eigenvectors and eigenvalues of the judgment matrix are calculated respectively as follows.

$W=(3.008,0.685,0.332,2.113,0.644,4.147,0.241,1.000,1.072)^T, \lambda max=10.0452$

Carry through the consistency test.

C.I. =0.1307 C.R.=0.089<0.1

The results show that the consistency of the judgment matrix is acceptable.

Construct the C4-D judgment matrix which is shown in table 8.

C4-D	D1	D2	D3	D4	D5	D6	D7	D8	D9
D1	1	1/2	1/3	2	1/4	3	1/5	4	1/6
D2	2	1	1/2	3	1/3	4	1/4	1/2	1/5
D3	3	2	1	4	1/2	5	1/3	6	1/4
D4	1/2	1/3	1/4	1	1/5	2	1/6	3	1/7
D5	4	3	2	5	1	6	1/2	7	1/3
D6	1/3	1/4	1/5	1/2	1/6	1	1/7	2	1/8
D7	5	4	3	6	2	7	1	8	1/2
D8	1/4	2	1/6	1/3	1/7	1/2	1/8	1	1/9
D9	6	5	4	7	3	8	2	9	1

Table 8 – Judgment Matrix of C4-D

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The eigenvectors and eigenvalues of the judgment matrix are calculated respectively as follows.

$W=(0.685,0.774,1.459,0.473,2.113,0.332,3.008,0.311,4.147)^T, \lambda max=9.8345$

Carry through the consistency test.

C.I. =0.1043 C.R.=0.071<0.1

The results show that the consistency of the judgment matrix is acceptable.

3. Hierarchical total sort and consistency check

Scheme	C1	C2	C3	C4	weight
	1.495	0.955	0.299	2.340	
D1	4.147	1.277	3.008	0.685	9.922
D2	3.008	1.392	0.685	0.774	7.842
D3	2.113	4.064	0.332	1.459	10.553
D4	1.576	0.501	2.113	0.473	4.573
D5	1.080	0.243	0.644	2.113	6.984
D6	0.753	2.097	4.147	0.332	5.145
D7	0.495	3.093	0.241	3.008	10.805
D8	0.300	0.335	1.000	0.311	1.795
D9	0.194	0.685	1.072	4.147	10.969

Table 9 – Total Weight

Finally, the eigenvector is obtained by calculation.

$W=(9.922,7.842,10.553,4.573,6.984,5.145,10.805,1.795,10.969)^T$

The calculation shows that the weight of each passenger-chosen plot can be sorted as D9>D7>D3>D1>D2>D5>D6>D4>D8. Therefore in this context, the optimum passenger-chosen plot is D9, the second is D7, and the third is D3.

3.3. Selection by the drivers of the operating vehicles

Send the recommended results to the drivers of the operating vehicles. After that the drivers can select a preference from the recommended ones and head to the destination.

Conclusions

This algorithm uses ST-DBSCAN to mine the historical hot passenger-chosen plot sequences and AHP to associate the historical laws with the current status of traffic condition, vehicles to realize the optimum recommendation of the passenger-chosen plots which can effectively solve the problem such as high empty-loading ratio, waste of resources, environmental pollution and so on. The simulation results show that the

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algorithm can efficiently mine the spatial-temporal characteristics of passenger-chosen plots and can reasonably combine qualitative decision and quantitative decision together in order to facilitate the decision-making by the way of layering and quantifying the decision-making process according to the law of thinking and psychology.

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