Research on Model of Application-oriented Joint Selective Course Recommendation Algorithm of Universities and Enterprises under Dual - Tutor System

Zhenzhen Fan¹, Huizhen Zhan²

Jiangxi University of Technology, School of Automotive Engineering, Nanchang 330098, China

Abstract

Under the background of dual tutor, colleges and universities are gradually changing their ways of cultivating students to application-orientation. Students not only need to learn professional knowledge, but also to acquire professional skills so as to achieve their teaching goals and promote their own all-round development. Therefore, this paper describes the basic connotation of the recommendation system, illustrates its importance in selective courses in colleges and universities, and then clarifies the necessity of implementing the dual-tutor system in colleges and universities. Based on this, a new method based on the dual-tutor system is proposed to build the model of joint selective course recommendation algorithm of university and enterprise. The paper discusses the application of recommendation algorithm, the refinement of the curriculum structure, the inquiry of students' curriculum information and the construction of the curriculum recommendation system, in order to form the systematic course selection process and optimize students' way of selecting courses, thereby enhancing student learning efficiency.

Keywords: Dual-tutor System, School-enterprise Cooperation, Recommendation Algorithm Model.

1. RESEARCH BACKGROUND

1.1 Research review

With the popularization of information technology, colleges and universities have also entered the information construction period. In the process of university information construction, not only information management mode, but also informationization teaching mode has been formed (Wang, 2017). At the same time, with the continuous development of social economy, the demand orientation of talents in enterprises is also changing. Under this kind of change, the dual-tutor system and the school-enterprise cooperation mode have been application-oriented in the teaching of colleges and universities to form the application-oriented colleges and universities, but this also promotes the transformation of the university curriculum structure. Based on this, the information technology and application-oriented colleges and universities are combined to form a joint school-enterprise recommendation model. Students select courses through the model to complete their learning tasks (Guo, 2017). At the same time, colleges and universities can understand the students' course selection information by means of the selective system model so as to reasonably arrange the course time and the course structure to improve the teaching quality of the teachers. Students choose the course through the course selection model, not only grasping the specific information of the course in time, but also arranging the course according to their own learning situation, and then improving their professional learning effect. At present, the research literature on this aspect mainly focuses on the construction and application of the recommendation algorithmic model of school-enterprise cooperation, which provides research data and research direction for latecomers (Chen and Zhang, 2017).

1.2 Research purposes

This paper takes the basic connotation of recommendation system as the starting point to understand the necessity of school-enterprise cooperation of application-oriented colleges and enterprises in dual-tutor background, and then concludes that the formation of curriculum recommendation is of great importance when using this teaching mode. Students through the recommendation algorithm system choose their own courses,
thereby enhancing learning efficiency and promote their gradual change to application-oriented talents. And the construction of the selective course model has improved the efficiency of curriculum setup in colleges and universities and promoted their teaching level (Hou, 2017).

2. RECOMMENDATION SYSTEM OVERVIEW

With the development of information technology, the popularization of network media terminals and the increasing number of people using the Internet, the Internet has entered a period of rapid development. With the increase of online information resources, the era of information explosion has also come. In the face of massive information, the user are often at a loss to what to do, unable to effectively obtain their most valuable or more valuable information, and at this time the user’s efficiency of the use of information may greatly be reduced, which is now the typical “information overload” problems (Zhao and Song, 2016). In face of information overload problems, this paper proposes two efficient solutions, information retrieval technology and information filtering technology respectively. For example, Baidu, the most commonly used search engine on the Internet, is built by using information retrieval technology (Lu and Li, 2016). It is mainly based on the user's search keywords to give users feedback from the massive information in the valuable search results. When users do not know what information or knowledge they need to obtain, for example, as choosing which movie to watch and information while the retrieval technology at this time still failing to help users, the information filtering technology has emerged. Information filtering technology refers to filtering information according to users' usage information, browsing records and browsing methods. Currently, the most popular recommendation system uses information filtering technology (Zhao, 2015). Recommendation system with the gradual rise of the development of network technology, with its convenient operation and intuitive use, has become the users’ favourite, and the personalized recommendation is the main feature of the recommendation system. It is mainly based on user browsing habits and browsing history to establish a system model for the user to analyze user preferences of needs and interests, carry out personalized calculations, find the user's point of interest, and provide the user with accurate recommendations. Recommendation system not only can provide the user with personalized recommendations, help users choose their own items, but also encourage users to keep using, thus forming a virtuous circle between the promotion system and the user (Luo and Zhou, 2015). In the process of using the recommendation system, because it is mainly composed of information retrieval technology and information filtering technology, attention shall be paid to the difference between the two. First, the information retrieval technology is mainly aimed at users' instantaneous and immediate retrieval request, and information filtering is based on the user's long-term historical behaviour data analysis to form a filter request to respond, which has a certain level of stability. Second, the users of information retrieval technology mainly visit the data that has been stored according to some rules. Since the data is relatively static, the retrieval request is instantaneous. Since he data accessed by users of information filtering technology are mainly the dynamic information flow, the user's filtering request is relatively stable. Third, information retrieval technology mainly uses keywords to describe users' retrieval requests, and information filtering uses the user's long-term historical behaviour data to form a user profile to describe the information needs of users (Liu, 2014).

3. NECESSITY OF COLLEGES AND UNIVERSITIES TO IMPLEMENT DUAL TUTORING AND SCHOOL-ENTERPRISE COOPERATION

With the gradual deepening of social and economic development in our country, the demand for talents in enterprises also gradually changes. When enterprises recruit talents, there is a gradual transition from the former theory-oriented talent to application-oriented talent. Under these circumstances, colleges and universities have also changed the way of cultivation of students, training application-oriented talents as the main training direction. Furthermore, the dual-tutor system and the school-enterprise teaching mode are adopted. The teaching mode is a combination of social needs and the training mode proposed by employers (Liu and Liu, 2014). In the specialized courses, students are provided with two types of tutors: theoretical model in school and practical model out of school. This helps teachers and specialists in the employing unit to take the course teaching together, share the teaching tasks and innovating talents training mode and mechanism so as to enable students to strengthen their professional theory and practice, basic theoretical knowledge and application ability. The use of this teaching mode has greatly changed the course structure and teaching direction of colleges and universities, which is of great significance to college teaching. First, it is conducive to promoting the transition of universities to application-oriented technology-based colleges and universities. The whole transformation process involves many aspects such as the goal of personnel training, curriculum setting and teaching mode reform, among which curriculum setting has gradually become the focus of university restructuring. Second, it is conducive to deepening the reform of personnel training mode and improving the quality of application-oriented personnel training. The application of dual-tutor system and the cooperation of school and
enterprise has changed the mode of traditional personnel training in colleges and universities and promoted the transformation of personnel training mode in colleges and universities to that of application-oriented talents. Emphasis is placed on combining learning with application, learning and creation, learning and production. The cooperative education of production, learning and research has become the main personnel training mode. In this case, the curriculum setting of colleges and universities has also entered a period of transition, the curriculum is more efficient, and students face more courses in their course selection. Third, it is conducive to build a team of professional teachers. The dual tutor system and the joint teaching of school and enterprise have changed the structure of college teachers and prompted teachers to know more about the practical operation process. Under such circumstances, university teachers are gradually changing their orientation toward specialty and pragmatism, providing professional teachers’ team for the all-round development of students. Fourth, it is conducive to improving students’ professional ability and quality. In the learning process, the students’ focus of their learning is not just a professional theoretical knowledge, but more emphasis shall be put on the combination of students’ theory with the operation and practice, thereby enhancing the practical ability of students, encouraging students to learn how to deal with interpersonal relationships and enhancing their social adaptation ability, in which way the employment competitiveness of students is enhanced. Fifth, to promote the transformation of college curriculum. In this context, the structure of university curriculum is not based on professional theoretical knowledge, and when the theoretical knowledge of the course is arranged, the course content is also in line with the actual situation of the profession, prompting students learn to change to the direction of application, and the freedom of students’ course selection is gradually increasing, prompting students to learn better and enhancing their learning efficiency.

4. TO BUILD APPLICATION-ORIENTED JOINT SCHOOL-ENTERPRISE RECOMMENDATION ALGORITHM MODEL METHOD BASED ON DUAL-TUTOR SYSTEM

4.1 To master recommendation algorithm and refine course structure

![Diagram](https://via.placeholder.com/150)

**Figure 1. Recommendation of Student Course Selection**

When building a joint school-enterprise selective course system, we shall first learn the recommendation algorithm to form the basis of the selective course model, while the collaborative filtering algorithm is the most commonly used algorithm choice in the recommendation system (Guo and Zhou, 2013). Collaborative filtering refers to the filtering of items that are suitable for users' recommendation by analysing the similarity between users or the similarity between items. User-based collaborative filtering is essentially the same as item-based collaborative filtering, except that the former focuses on the user, while the latter focuses on the object (Xu, 2013). User-based collaborative filtering algorithms and object-based collaborative filtering algorithms currently have very mature applications in the course selection system. In the process of students’ course selection,
students also interact with each other and students may recommend each other's own courses. Therefore, the recommendation algorithm based on collaborative filtering has certain feasibility in course selection. The course recommendation system consists of three modules: student modelling module, recommendation course modelling module, and recommendation algorithm module. The recommendation system matches the interests, the course record and the learning status in student modelling module with the feature attributes in the recommendation course model, and uses the appropriate recommendation algorithm to calculate and screen, providing interesting, new and popular course recommendations for the students. As shown in Figure 1 Student Selective Recommendation Map, students choose the course according to the process of the picture, in which schools and enterprises enable students to select through the commonly set course content. Understanding the students' course selection information can adjust the course structure and arrange more subjects for students' course selection to form an efficient teaching mode.

4.2 To set algorithm operation process and establish curriculum evaluation model

In the construction of school-enterprise joint selective course model, it shall set algorithm operation flow based on the algorithm model of recommendation module, as shown in Figure 2 Course Recommendation Algorithm Flow.

First, students' information and students' course selection information are extracted through the college database to construct student selective vector to form a student model (Jiang and Chen, 2012). Combined with the student model and the university information in the course of curriculum information, the course feature vector is established, and the formation of the curriculum model is realized. Second, as college students are constantly updated, the process of the algorithm shall distinguish whether the current user is a new user or an old user, and the user with the course information record is an old user, otherwise is a new user. Among them, new and old users have different choice of course information, and the algorithms used are different. Among them, old users adopt recommendation-based collaborative filtering algorithm based on users' collaborative filtering algorithm (Liu and Gu, 2010). The new user adopts the nearest neighbour recommendation based on the attribute value preference matrix. Finally, in the selective recommendation system, you shall also build two modules, the curriculum ranking list and new course recommendation to help students understand the pros and cons of the course, and then make a reasonable choice. A curriculum consulting platform shall be set up to enable students to master their own course selection according to their own learning situation, so as to select the course in accordance with their own situation and improve learning efficiency, and in the process, students can check the course specific information to understand class time and teachers, and then choose the course in a scientific way. At the same time, the school-enterprise joint selective course recommendation model shall also build a curriculum evaluation system in the construction process. Under the dual-tutor system, when the university
curriculum is carried out, not only the university teachers teach the class for the students, the enterprise teachers may also teach the class for the students. In this case, collecting the curriculum evaluation information of the students is important for enterprise teachers. A student course score matrix is set up:

\[
\begin{array}{ccc}
\text{Student1} & C_{11} & C_{12} & \cdots & C_{1n} \\
\text{Student2} & C_{21} & C_{22} & \cdots & C_{2n} \\
\vdots & & & & \\
\text{StudentM} & C_{m1} & C_{m2} & \cdots & C_{mn}
\end{array}
\]

(1)

It represents M students’ evaluation of the N courses. Evaluation information is integrated to put forward the evaluation requirements.

Figure 3 is Evaluation System of Student Course Selection. The selective system collects the information of the students’ curriculum evaluation through the selective platform of the students, evaluates and analyses the curriculum by using the analysis system, and concludes that the teachers and schools can understand the students’ evaluation through the platform and thus change the course content and structure.

4.3 To search student course information and build course recommendation system

Under the background of dual tutors, we shall combine the actual situation of application-oriented colleges and universities and information technology in the construction of the course recommendation system to form the three systems of student system, teacher system and management system. Based on the students’ course
selection data, a model is built to form a student table, a curriculum record table and a teacher information table in the system database, so that the user can better understand the selective information and improve the efficiency of the selection (Wang 2010). At the same time, the information technology is used to build course recommendation system for students to build selective modules to help students better understand the selective content, which are personalized recommendations, list courses recommendations, and new course recommendation modules, among which the different recommendation modules use different algorithms. The personalized recommendation algorithm adopted by the personalized recommendation module is implemented according to the recommendation algorithm flow described above, which uses the basic idea of nearest neighbour recommended based on the preference of attribute value. Firstly, according to the selective courses and evaluation records of target users and the initial users obtained through dimensionality reduction, the target users' selective courses and their records are collected to map the attribute values of each item to generate the attribute value preference matrix of the user. Secondly, the similarity calculation is performed on the user preference attribute matrix to obtain the nearest neighbour set of the target users, and the curriculum recommendation is realized according to the selection records of the nearest neighbours. The algorithm is as follows: After the nearest neighbour students $L_e$ who have got the recommendation courses are collected, the prediction formula is used

$$P = g + \sum_{cr} \frac{\text{sim}(u, u_w) \cdot (g_e - g_t)}{\sum_{cy} \text{sim}(u, u_w)}$$

(2)

g means the average score for the course

$u$ means students

g_e means the score of the course is not zero, the value of $P$ is calculated by the formula. By arranging $P$ in size order, the result of recommendation courses is obtained.

The new course recommendation module refers to recommending the newly set courses to suitable learners, letting students choose their own courses and promote students' development. The main idea of the algorithm is to generate students' preference matrix of attributes, and then according to the new curriculum, timely obtain the attribute value of the course, match the attribute value of the new course with the attribute value preference matrix of all learners, and find out the students with the highest similarity. When the course is selected by the student, the course record is deleted from the curriculum. In order not to affect the real-time performance of the recommendation system, the algorithm is done offline. The specific algorithm is:

The rating information is a $m$ dimension vector

Student $e$, where the $a$ element of the vector is the student's $a$ selective course score

To put it into the formula

$$o_a = \frac{\sum_{aw} w_a w_t}{\sqrt{\sum_{aw} w_a^2} \sqrt{\sum_{aw} w_t^2}}$$

(3)

$$s_a = \frac{\sum_{bw} r_{bw} r_{bi}}{\sqrt{\sum_{bw} r_{bw}^2} \sqrt{\sum_{bw} r_{bi}^2}}$$

(4)

$s_a$ is the similarity of selective course $r_i$ and $w_a$, $r_{bi}$ is the score of student $w_i$ for the selective course $r_i$, and $w_{at}$ is the score set of selective courses $r_i$ and $r_b$. 

170
Ranking courses recommendation module in the course of operation mainly make recommendations based on the number of students’ selection times of a course, and students in the course of selection can select the appropriate course according to the course ranking and enhance learning efficiency.

5. CONCLUSION

Under the background of double-teacher system, during the course of constructing the joint selective course model of university and enterprise, based on the recommendation algorithm and information technology, the selective course recommendation system is formed to enhance the efficiency and quality of course selection for students to conduct scientific course selection and further promote students' comprehensiveness development.

ACKNOWLEDGMENTS

This paper is the name of the project of teaching reform in higher education institutions of Jiangxi province:Research on "dual tutorial system" in application oriented university based on school enterprise synergy innovation -- an example of automotive service engineering major in Jiangxi Institute of Technology(item No. JXJG-16-24-10).

REFERENCES


Guo X.L. (2017). Research on the training mechanism of practical teaching ability of applied undergraduate colleges and universities based on the environment of school enterprise cooperation, China Hi tech Development Zone, (18), 75.


