Research on College Students' Course Selection Recommendation Model Based on Big Data and Cloud Computing

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Abstract. When students choose courses online, they need to compare and analyze the difficulty of courses, professional relevance and interest, so as to make choices. Therefore, the decision-making process of course selection is the decisive link of online course selection. In the educational administration management system, the course selection system directly faces students and serves them. According to the past management experience, this system involves many links, including majors, teachers, courses, credits, teaching places, students and so on. By means of modern information technology, it is an important measure in the reform of higher education and teaching to integrate the course selection under the credit system with the information network, and to develop an online course selection system for students that adapts to the credit system management mode, which is also the key to ensure the smooth implementation of the credit system teaching reform. In order to improve the optimal allocation performance of students' course selection and improve the utilization efficiency of course resources, a design method of students' optimal course selection scheme model based on big data analysis and cloud computing technology is proposed.

Keywords: Course selection; big data; cloud computing

1. Introduction
With the rapid development of China's higher education, especially since the beginning of the new century, the enrollment scale of colleges and universities has expanded year by year, the scale of running schools has doubled, and higher education has achieved an unprecedented historic leap [1]. With the deepening reform and development of higher education, in order to give full play to the advantages of teaching resources in Colleges and universities, combined with the differences of students' courses and majors, the course selection system is adopted for course collocation design [2]. The credit system in Colleges and universities is a kind of teaching management system based on the course selection system, with credits as the unit of measurement, and with the minimum graduation credits as the necessary prerequisite for graduation and degree [3]. Whether a student can graduate is not based on the number of hours or years of study, but on whether he can complete the total number of credits specified in the professional training program, which is also one of the most significant differences between the credit system and the academic year system in teaching management [4]. At
present, the elective course system is widespread in Chinese universities. However, according to the facts, the development of public elective courses in Chinese universities is far from enough compared with that in developed countries [5]. In terms of personalized service of online course selection for college students, data mining and cloud computing technology have a very wide application prospect, which can effectively avoid students' blindness and conformity in course selection, and guide students to conduct scientific and reasonable course selection [6].

Since the expansion of university enrollment, the number of students in Colleges and universities has increased geometrically. Now an ordinary university contains many branches, and the geographical distribution is different [7]. How to integrate and reorganize teaching resources in order to serve students and teachers in a timely and efficient manner and successfully complete teaching tasks has become a new topic [8]. Course selection in open education is an important content of its talent training mode, which is based on the professional characteristics and training objectives, combined with learners' time, space, interest and knowledge to ensure learners' autonomous learning and personalized development. With the full coverage of the Internet on campus, mobile Internet and social networks are more and more close to students' daily learning and life, and students are more willing to show themselves through these applications and share their campus life and learning with others [10]. What follows is that a large amount of data is constantly being recorded and accumulated. The speed and volume are unprecedented. The course selection system is not only the foundation of the credit system, but also the core of the credit system. Whether the course selection results can reflect the requirements of fairness, real-time and rationality will directly affect the implementation effect of the course selection system, and will also affect the success or failure of the credit system teaching reform [11].

2. Analysis and design of course selection system

In the process of research and development of course selection system, in terms of software design, course selection should be the core of system construction, based on business logic, and on the basis of satisfying the information management of each part, the extensibility, maintainability, system stability and product universality of software design should be improved as much as possible. In order to realize the optimal design of the student's best course selection scheme model under the big data processing environment, the overall structure model of the software system is analyzed first. The student's best course selection scheme model based on big data analysis is based on the information fusion and optimal access design of the student's course selection resource database, and the model design of the student's best course selection scheme is carried out by combining the data information processing model. The credit system based on the elective system adheres to a personalized educational philosophy, respecting students' individual differences and emphasizing students' individual development. Under the credit system, the teaching plan is flexible. By offering a large number of elective courses on the basis of compulsory courses, the people-oriented idea of running a school can be truly realized, with all eyes on the development of students. In the past, the traditional management mode of academic year system can not adapt to the changes in the system, content, methods and management means of education and teaching.

Faced with the wide range, short time, large quantity and high intensity of elective tasks, our teaching means and methods should be more flexible, flexible and efficient, and also put forward higher requirements for the reform of teaching management system. The overall B/S architecture of the course selection system software is shown in Figure 1.
Colleges and universities are expanding their enrollment year by year, and teaching resources are becoming more and more scarce. Colleges and universities urgently need to coordinate and resolve the contradictions. Course selection is particularly important as the beginning of teaching work. For freshmen, face the profession. During the construction of the course selection system, a unified comprehensive application platform will be built, and on this basis, the business application system of unified technical architecture, unified database, unified identity verification and single sign-on will be further expanded, and existing application systems will be integrated to achieve a unified network course selection Portal. The purpose of association analysis is to see the connections between courses. Since it is difficult to see the connection between the courses directly from the table, we first use the "network" graphical analysis model to make a preliminary and intuitive observation of the data. For college students, professional skills courses are only conducive to improving and strengthening their professional qualities and laying a solid foundation for future work. Public elective courses, as an important part of the college student education system, are also an indispensable link, which can not only improve students The cultivation of comprehensive quality can play a pivotal role in expanding students' horizons and improving their knowledge structure. The teacher management module mainly realizes the function of modifying and viewing teachers' own information, as well as viewing the course selection information [12]. In order to understand the basic information of teachers, improve teaching quality, and ensure the operation of teaching work in universities. Among them, the basic information of teachers is used to manage basic information of faculty and staff, such as names, academic backgrounds, majors, and graduation schools.

First get all the items scored by users i and j, and then calculate the similarity between them through different similarity measurement methods, denoted as \( sim(i, j) \). This article uses a modified cosine similarity calculation method:

\[
sim(i, j) = \frac{E_{c \in L_{i,j}} \left( R_{i,c} - \bar{R}_c \right) \left( R_{j,c} - \bar{R}_c \right)}{\sqrt{\sum_{c \in L_{i,j}} \left( R_{i,c} - \bar{R}_c \right)^2 \times \sum_{c \in L_{i,j}} \left( R_{j,c} - \bar{R}_c \right)^2}}
\]

\( R_{i,c} \) is the rating of user i on item c, and \( \bar{R}_c \) is the average rating of item c. After calculating the similarity between users, for a user u, a set of "neighbors" arranged according to the similarity is generated, \( N = \{ U_1, U_2, \ldots, U_t \} \), \( 0 \leq t \leq m \), u does not belong to N, from \( U_1 \) to \( U_t \), \( sim(u, U_i) \)(\( 1 \leq i \leq t \)) from Arrange from large to small.

At present, although the teaching effect of elective courses in colleges and universities has been recognized, due to various factors, there are many disadvantages in elective courses, such as arbitrariness and strong utilitarianism in the teaching process. How to improve the teaching quality and teaching efficiency of elective courses has become a hot issue for many college educators.
Personalized recommendation has been very mature in commercial application and made great achievements. By applying the system recommendation of big data technology, the system can understand students' needs more directly and accurately. After building the corresponding recommendation model for analysis, students can know what courses other students are choosing, and get reasonable suggestions when choosing courses, so that students are no longer confused when choosing courses. One of the most important parts of the application of big data in college education is to create the possibility for students to carry out personalized education, teach students in accordance with their aptitude, and recommend some interesting courses to college students according to local conditions, which are more helpful to their future studies and employment, so as to enhance and improve the teaching environment and quality. Under this background, the idea of college elective recommendation system came into being. The ultimate goal of college elective system is how to better meet students' independent elective needs and effectively recommend individualized elective courses to students.

3. The overall framework of students' optimal course design

Recommender system is an application based on Internet big data. Through the user's behavior data, the data model is imported for analysis and mining, and then the user is automatically recommended to meet their needs and interests. It is not easy to guarantee the systematicness and integrity of the teaching plan, and the quality of students' learning. Because what class to attend and which semester to attend are all arranged by students themselves, there will be great randomness, and it is difficult to guarantee the integrity and systematicness of the teaching plan. The credit system is based on the course selection system. The most basic feature of the credit system is that students can choose courses freely to the greatest extent. Only when the course selection system is fully implemented, can it meet the requirements of the credit system reform in Colleges and universities, and further mobilize the enthusiasm of students and reflect the dominant position of students in learning. The architecture of the recommendation system is shown in Figure 2.

![Figure 2 E-commerce recommendation system architecture](image)

The full implementation of the elective system is also more conducive to enhancing teachers' sense of competition and mobilizing their initiative and enthusiasm in teaching lung, and it is also more conducive to teachers teaching students in accordance with their aptitude in order to cultivate more truly high-quality talents. Big data makes recommendation more accurate, and its core lies in the application of standardized methodology. The modeling process of big data mining is a process of solving business, which originates from business requirements and is finally applied to business. Although big data mining modeling solves different problems, the whole process is planned, normative and standard [13]. Most of the current elective systems are developed based on public elective courses. The credit system allows students to choose courses across the limitations of classes, and sometimes across the limitations of departments and even schools. Students can also choose the class time, class place and even teachers according to their actual situation [14]. However, due to the
limitations of various practical conditions, most schools may not be able to fully realize this unconditional and completely free course selection. Therefore, according to the actual situation, it is necessary to set some preconditions to choose courses with limited conditions.

Recommendation is mainly used to predict the interest of target users in items that have not been rated in the nearest neighbor information. The prediction of user interest can be calculated as follows:

$$P_{u,j} = \bar{R}_u + \sum_{m=1}^{n} \left( \frac{R_{m,i} - \bar{R}_m \times \text{sim}(u,m)}{\sum_{m=1}^{n} \text{sim}(u,m)} \right)$$

(2)

Where $\bar{R}_u$ is the average score of user $u$ on the resource, $R_{m,i}$ is the score of user $m$ on item $i$, $\bar{R}_m$ is the average score of user $m$ on the resource, and $\text{sim}(u,m)$ is the similarity between users $u$ and $m$.

In the field of education and teaching, personalized recommendation is also a very good technology, which can use existing teaching resources and a large number of students' learning history data to dig out better and more useful data, and it is an important technical support for teaching management, teaching quality improvement and students' comprehensive quality improvement in schools. The prediction of user interest can be obtained by the following calculation:

$$P_{u,j} = \bar{R}_u + \sum_{m=1}^{n} \left( \frac{R_{m,i} - \bar{R}_m \times \text{sim}(u,m)}{\sum_{m=1}^{n} \text{sim}(u,m)} \right)$$

(3)

Where $\bar{R}_u$ is the average score of user $u$ on the resource, $R_{m,i}$ is the score of user $m$ on item $i$, $\bar{R}_m$ is the average score of user $m$ on the resource, and $\text{sim}(u,m)$ is the similarity between users $u$ and $m$.

As the learning process of elective courses depends entirely on students' self-consciousness, students who are not aware of their studies may not be able to guarantee the quality of their studies. Moreover, it is easy to take refuge in course selection, resulting in the phenomenon of "collecting credits". Students often choose some relatively easy-to-learn courses in order to get credits, instead of paying attention to the systematic problems of their professional training programs. From the above analysis, although the specialty priority algorithm is fair and reasonable in principle, it also solves the problem that the queue algorithm may cause sudden peak traffic. However, because the complexity of the algorithm will multiply with the increase of the number of courses and majors, the algorithm is not suitable for public optional courses in the whole school.

4. Conclusions

Today, with the rapid development of the network, it has become an indispensable management means for colleges and universities to use the network for educational administration. In order to improve the rational design of college students' course selection, this paper proposes a design method of students' optimal course selection scheme model based on big data and cloud computing. The intelligent course selection recommendation system based on this model can effectively help students to guide and help in course selection, which is suitable for individualized development. The query efficiency and recommendation accuracy of the system meet the needs of students. Because people's interests are not static, they will change with time and external factors, especially students' interest in learning. Therefore, after creating a good interest model, it provides a basis for better reflecting students' interests and high-quality recommendation. The recommendation application model can more scientifically and accurately establish the association of these attribute information and calculate their similarity, so as to complete the recommendation. A collaborative filtering recommendation algorithm based on students' interest is proposed for the course selection of knowledge recommendation service,
which effectively solves the problem that students change from the traditional scattered, random and utilitarian course selection mode to the targeted, guiding and normative course selection mode, which is conducive to promoting the reform of personalized education and promoting the individualized development of students, and truly achieves the purpose of offering elective courses in schools.

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