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Research on the Design of Computer Course Teaching Resource Recommendation System Based on Collaborative Filtering Algorithm

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ABSTRACT
This paper deeply discusses the design of computer course teaching resource recommendation system based on collaborative filtering algorithm. Firstly, the paper expounds its significance in improving learning efficiency, optimizing resource allocation, helping personalized teaching and promoting education informatization. Secondly, the design path is analyzed in detail, including data acquisition and pre-processing, algorithm optimization, system architecture construction and result evaluation feedback. Finally, by improving user similarity calculation and neighbor selection strategy, accurate resource matching and continuous system optimization are realized, so as to provide efficient and intelligent resource recommendation for computer course teaching.

KEYWORDS
collaborative filtering algorithm; computer courses; teaching resource recommendation; system design

In the teaching of computer courses, the dilemma of matching massive teaching resources with students' individual needs has become increasingly prominent. Traditional recommendation methods are difficult to accurately connect, and the efficiency of teaching resource utilization is limited [1]. The collaborative filtering algorithm causes it hopeful to solve these problems by its unique advantages. This study focuses on computer courses and explores the design of teaching resource recommendation system based on this algorithm, aiming to provide effective schemes for improving the quality of teaching resource recommendation and promoting the development of computer education.

1 Design Significance of Computer Course Teaching Resource Recommendation System Based on Collaborative Filtering Algorithm

1.1 Improve Learning Efficiency and Pertinence

In computer course learning, the number of teaching resources is increasing explosively, which increases the difficulty of students' learning. However, the teaching resource recommendation system based on collaborative filtering algorithm relies on in-depth analysis of students' learning behavior, such as students' browsing history, learning time, homework completion and active participation in discussions on the course platform to provide accurate insight into students' learning preferences and knowledge mastery [2].

Taking programming courses as an example, according to the style characteristics, common error types, and use frequency of specific functions or algorithms in the code writing process, the system can recommend highly suitable auxiliary materials for students such as relevant code sample libraries, algorithm explanation videos, or programming skill blogs. It enables students to quickly obtain learning materials closely related to their own needs without blindly searching in a vast sea of resources, so that students can devote more time and energy to learning, which greatly improves the concentration and efficiency in learning and the pertinence and effect of learning.

1.2 Promote the Optimal Allocation of Teaching Resources

In the teaching of computer courses, the teaching resource recommendation system based on collaborative filtering algorithm can collect and analyze data such as students' browsing time and downloading frequency of various teaching resources in a real-time and comprehensive manner, and generate detailed resource usage reports to accurately feedback the usage popularity and application effects of resources [3]. With the help of these data, teachers can intuitively understand the degree of adaptation of each resource to different course content teaching and different levels of students' ability. And then, for the obscure resources with low use frequency or low-quality resources with poor promotion effect on students' learning, teachers can supplement them or directly replace them with more targeted and high-quality resources. In this way, high-quality teaching resources can be efficiently recommended to the courses and student groups in need, thus avoiding the idle and misallocation of resources, realizing the scientific and reasonable allocation of teaching resources in the entire teaching system, greatly improving the overall utilization efficiency of

resources, and effectively promoting the improvement of teaching quality.

1.3 Help the Implementation of Personalized Teaching

The teaching resource recommendation system based on collaborative filtering algorithm can make use of advanced data tracking technology to comprehensively record all kinds of behavior tracks of students in the learning process, covering key information such as learning time, knowledge point visit frequency, homework completion and test score fluctuation. It also can conduct in-depth analysis of these data through the scientific evaluation model to accurately insight into each student's learning status and shortcomings in knowledge, and generate highly targeted personalized teaching suggestions for teachers. For example, for students with weak foundations, the system will screen and recommend consolidation resources that explain basic concepts in detail and increase difficulty levels gradually to help them lay a solid foundation. For students who have the ability to learn, the system will push innovative content involving cutting-edge technology application and interdisciplinary expansion to stimulate students' exploration potential. According to these suggestions, teachers can better teach students according to their aptitude, design differentiated teaching activities in class, and guide students to carry out personalized learning, so as to fully meet students' personalized learning needs and promote teaching quality to a new height.

1.4 Promote the Informatization Development of Computer Education

In the tide of digital transformation, the computer course teaching resource recommendation system based on collaborative filtering algorithm deeply integrates computer education and big data technology. Through the efficient processing and intelligent analysis of massive teaching data, the system realizes the accurate recommendation of teaching resources, breaks the inherent mode of traditional teaching resource allocation, and provides a very innovative technology demonstration and practical application case for education informatization.

In practical application, the accumulated technical experience and data-driven teaching mode open up a new path for the deep application of educational technology. Schools and educational institutions can optimize teaching strategies, improve curriculum settings, and enhance the overall modern management level of computer education according to the feedback data from the system. At the same time, the accurate resource push can help students acquire knowledge more efficiently and cultivate their ability to use information technology to learn independently, so as to cultivate innovative talents who can adapt to the needs of the digital age, and comprehensively promote the acceleration of computer education on the information track.

2 Design Paths of Computer Course Teaching Resource Recommendation System Based on Collaborative Filtering Algorithm

2.1 Collect Pre-Processing Data to Build a Solid Foundation for Accurate Recommendation

In the design of computer course teaching resource recommendation system based on collaborative filtering algorithm, data collection and pre-processing are the cornerstones of building an accurate recommendation system [4].

First, multi-source data acquisition is crucial. For students' learning behavior data, the system needs to comprehensively record the login time, duration and frequency of browsing course pages, homework completion, test scores and other information, which can directly reflect students' learning interests and knowledge mastery. In terms of course attributes, the difficulty level, the range of knowledge points and the types of courses (theoretical, practical, comprehensive, etc.) are collected in detail to better match the needs of students and course resources. Resource metadata covers resource formats (videos, documents, code examples, etc.), source channels (authoritative textbook websites, platforms of academic institutions, etc.) and subject content, so as to provide a basis for resource classification.

The second is the data cleaning link. The outlier data caused by network fluctuations and operation error is removed by denoising algorithm, and the missing data is completed by data filling technology to ensure data integrity. Then the standardization process is carried out to unify the data format, such as standardizing the time data into a specific format, and quantifying the difficulty of the course.

Finally, according to the established rules, the processed data is classified and stored in the database to provide a stable and accurate data basis for the efficient operation of the subsequent collaborative filtering algorithm, so as to build a solid foundation for accurate recommendation and realize the accurate push of teaching resources.

2.2 Optimize the Collaborative Filtering Algorithm to Improve the Accuracy of Resource Matching

Traditional similarity calculation methods have many limitations, which often rely only on simple user behavior data,

such as views and scores, but ignore the depth information of students in the learning process [5]. The improved algorithm introduces the learning path and the weight of knowledge acquisition progress. The node correlation degree in the student knowledge graph reflects the internal relationships among knowledge points. When calculating user similarity, the weights can be dynamically adjusted according to these correlation degrees to ensure that the recommended resources are highly correlated with the learning situation of users.

In terms of neighbor selection strategy, although the fixation of neighbor number is easy to operate, it cannot adapt to the diverse needs of different course stages and students. The dynamic neighbor selection is flexible, but is unstable. Therefore, the adaptive neighbor selection strategy combining resource popularity and user activity comes into being. In the basic course stage, in the area with high resource popularity and strong user activity, the neighbors can be appropriately expanded to allow more students with similar basic learning experience to participate in the recommendation. In advanced courses, the neighbors can be accurately narrowed down according to the specific needs and learning progress of students, and focus on users who have in-depth learning and positive feedback in the field. Through the optimization, the accuracy of the collaborative filtering algorithm in resource matching can be significantly improved, which can effectively promote the improvement of the teaching resource recommendation system.

2.3 Carefully Structure the system to Ensure the Stable and Efficient Operation of the Recommendation

The data layer is mainly responsible for storing all kinds of data collected and pre-processed, including student learning behavior, course attributes and resource metadata and other information. The use of high-performance database management systems, such as MySQL or PostgreSQL, ensures efficient data storage and fast retrieval, and provide stable data support for upper algorithms.

The algorithm layer integrates the collaborative filtering core algorithm and its optimization module. Here, advanced programming languages such as Python or Java are used to implement an improved algorithm for user similarity calculation based on learning path and knowledge mastery progress, as well as an adaptive neighbor selection strategy combining resource popularity and user activity. Through well-designed algorithm architecture, efficient data processing and accurate recommendation models can be achieved.

The recommendation layer generates the recommendation list based on the calculation results of the algorithm layer. It selects the teaching resources that meet the needs of users best through complex logical operation and data filter, and sorts them according to a certain priority and relevance to provide ordered data for the presentation layer.

The presentation layer focuses on user interface design, which uses simple and intuitive HTML, CSS, and JavaScript technologies to present recommendations to users in a clear and understandable form. At the same time, it pays attention to user interaction design to facilitate user feedback and further operation.

The layers interact with each other through standardized interfaces and data transfer protocols. For example, SQL is used to query statements or data access interfaces are used to transfer data between the data layer and the algorithm layer, the calculation results are passed between the algorithm layer and the recommendation layer through function calls, and the communication between the recommendation layer and the representation layer is based on data in JSON or XML format. This layered architecture design ensures the stability, efficiency and augmentability of the system, and can adapt to the growing amount of data and diversified user needs, which provides reliable technical support for the recommendation of computer course teaching resources.

2.4 Evaluate Feedback Results to Promote Continuous Improvement of Recommendation Quality

It is very important to establish a comprehensive and scientific evaluation system with multiple indexes. The click-through rate can directly reflect the initial attention of users to the recommended resources. A higher click-through rate means that the resources attract users' attention during the initial display. The stay time further reveals the user's deep participation in the resource page, and the long stay indicates that the resource content has a certain attraction and value. The resource download rate reflects the user's actual demand for resources and is a key index to measure the availability of resources. The improvement of academic performance is an indicator that considers the impact of recommended resources on students' learning effect from the outcome level. If students' performance improves after obtaining recommended resources, it proves the effectiveness of recommendation.

Designing a variety of user feedback channels is essential. In this regard, a special feedback button or questionnaire pop-up can be set up in the system interface to facilitate users to express their satisfaction with the recommendation results at any time. In addition, online forums or community sections can be opened up to encourage users to share their experience on use and suggestions for improvement, and promote communication and interaction among users.

After obtaining feedback data, data analysis technology can be used to dig deeper into the information. For the resources with low click-through rate and short stay time, the reasons are analyzed, and the algorithm parameters are adjusted or the resource tags are optimized accordingly. For the improvement suggestions put forward by users, the

system can be updated in time by adding specific resources or improving the recommendation sorting method. Through this continuous cycle of evaluation and feedback mechanism, the algorithm and system can be continuously improved and the recommendation quality achieves a spiral rise, so that a more intelligent and efficient teaching resource recommendation system can be created.

3 Conclusion

To sum up, it is of great significance to build a teaching resource recommendation system based on collaborative filtering algorithm, which can effectively improve the accuracy of resource recommendations and the system performance. In the future, it is necessary to continue to deepen the integration of algorithms and expand the dimension of data to continue to help computer teaching, provide better services for teachers and students, promote the continuous innovation and progress of computer education in the information tide, and achieve the steady improvement of teaching quality.

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