Research on Personalized Recommendation System of Learning Resources Based on Computer Big Data Technology

Chenyu Cui, Jian Liu*

School of Mathematical Sciences, University of Jinan, Jinan, China

*ss_liuj@ujn.edu.cn

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Abstract: With the rapid development of information technology, the application of computer big data technology in the field of education is becoming increasingly widespread. The personalized recommendation system of learning resources uses big data technology and combines students' learning behaviors and preferences to provide learners with more personalized and accurate recommendations of learning resources, which helps improve learning efficiency and learning results. This paper conducts an in-depth study on the design framework and application scenarios of personalized recommendation systems, explores the application of computer big data technology in personalized recommendation systems for learning resources, and analyzes the existing problems and challenges. Finally, this paper proposes some suggestions for improvement and development, aiming to provide references for the research and practice of personalized recommendation systems for learning resources.

1. The Raising of Questions

1.1 The promotion of big data to educational reform

With the continuous development of network and information technology, the degree of social information is constantly improving, and the data and information generated and available in society are also increasing. Various fields of society have gradually begun to discover and utilize the value of big data, which has brought great changes to people's study, work and life. For example, in the past few years during the COVID-19 epidemic prevention and control efforts, people have been able to use big data to specifically grasp the action trajectory of infected individuals, accurately locate close contacts, and predict the development trend of the epidemic, thus highlighting the great advantages of big data. The arrival of information technology, has profoundly influenced and promoted educational reform. As a new tool, the introduction of information technology into education has not only changed the physical environment of education and the content of education, but also transformed teachers' teaching methods, students' learning methods, the classroom's deep structure, and the teacher-student relationship. Moreover, it has affected broader school development and education methodologies[1], thus opening up new possibilities for educational development and promoting continuous deepening and improvement of educational reform.

1.2 Big data's contribution to personalization of learning resources

With the development of online education platforms, teachers' teaching methods are no longer limited by traditional textbooks and classroom teaching. Students are no longer confined to classrooms, libraries and teachers' knowledge channels. With the help of the Internet, teachers and students can acquire knowledge anytime and anywhere through search engines, post bars, forums, blogs, videos and other channels. In the future, teaching will require the use of big data analysis technology to process vast amounts of data, effectively classifying and extracting information based on the characteristics of teachers and students.

Under the traditional teaching mode, realizing personalized learning is challenging due to time and cost limitations. In intelligent education, personalized learning evaluation, based on big data analysis, provides direct and reliable decision support. Through the new generation of information

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technology, such as cloud computing and big data, intelligent education can perceive the characteristics of learners and promote the application of personalized learning resources. This transformation facilitates interaction between teachers and students through the learning platform, providing reliable learning resources to meet their growing educational needs.

With the development of social science and technology, online learning resources are increasing, making it often difficult for learners to find the required learning content the vast amount of data available. During the process of searching for learning resources, they may encounter a plethora of irrelevant information, which can lead to a decrease in learning efficiency and interest. The question of how to recommend learning resources that users are interested in has become an important area of research. Therefore, combining personalized recommendation with learning can help learners acquire targeted learning resources more quickly and accurately.

2. Design of Overall Framework of Personalized Recommendation System Based on Big Data Technology

Big data technology plays an important role in personalized learning resource recommendation system. It provides personalized and accurate learning resource recommendation service for users through data collection, user modeling, content analysis, similarity calculation, real-time recommendation and evaluation optimization. Personalized learning resource recommendation system uses big data technology to analyze users' learning behavior, preferences and other related information to provide personalized and accurate learning resource recommendations. This paper designs a personalized recommendation framework for a learning resource system based on an in-depth study of personalized-related theories and technologies. The model is mainly divided into three basic modules: the learner data collection module, the data analysis and processing module, and the learner resource application service module. The specific design structure is shown in Figure 1 below.

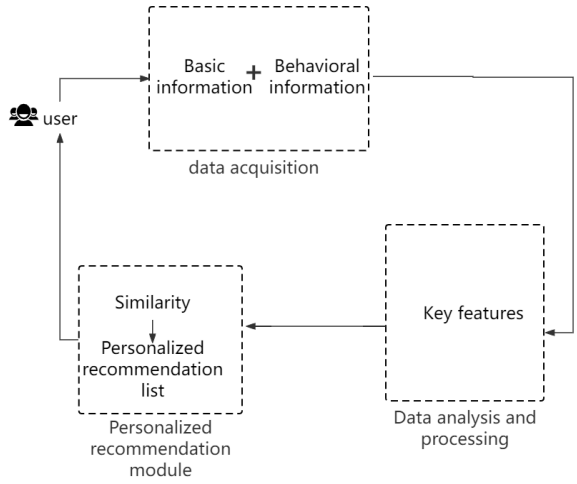

Fig. 1 Personalized recommendation structure diagram of learning resources

2.1 Learner data collection

Learner data collection includes learner's basic information and behavior information [2] . The basic information comprises the user's name, age, and telephone number. When the learner enters the system for the first time, they will register. After registration, the system will collect the learner's basic personal information to build a foundational learner model. The personalized recommendation system understands the user's interests and preferences by constructing a learner model. For the collection of behavior information, it is necessary to gather the user's learning behavior data, including, but not limited to, the user's browsing history, click records, favorite content, search keywords, etc. These data are typically collected through websites, mobile applications or learning platforms. The system collects user behavior data in various ways, preprocesses, and cleans it for subsequent analysis and mining. This process includes data deduplication, outlier processing, data

format unification, and other steps. Through the collected basic information and behavior information, the system employs machine learning algorithms or deep learning models to establish learner model.

2.2 Data analysis and processing

Data analysis is a process of clustering different learners with characteristic data of the same learner or with the same characteristic data, recording learners' learning preferences or learning status [3]. The personalized recommendation system needs to analyze the content of learning resources and extract key features to match the learner model. The system conducts text analysis, image processing, audio and video processing, etc., on learning resources, and extracts information such as keywords, themes and content features. This process helps the system better understand the content and attributes of learning resources.

2.3 Learner resource application service

Personalized recommendation system determines the priority and content of recommendation by calculating the similarity between learning resources and the matching between learning resources and learner model. The system uses big data technology to calculate the similarity between learning resources, and can adopt content-based similarity calculation, collaborative filtering algorithm, recommendation algorithm based on association rules and other methods. Then, according to the similarity between learner model and learning resources, a personalized recommendation list is generated for users. At the same time, the personalized recommendation system can respond to the changes of users' behaviors and preferences in real time and constantly update the recommendation results. The system uses real-time data processing technology to monitor users' real-time behaviors, such as browsing, clicking and collecting, and then updates the user model and recommendation results in real time according to these behaviors to ensure the timeliness and accuracy of recommendation.

3. Application Scenarios of Big Data in Personalized Recommendation System of Learning Resources

3.1 The recommendation of personalized courses by big data

For personalized course recommendation, the system first needs to extract the key features and labels of the course, such as course theme, difficulty level, teaching style, content type, etc. These features can be extracted from course description, title, content summary and other information through natural language processing technology. Use appropriate similarity measurement methods (such as cosine similarity, Jaccard similarity, etc.) to calculate the similarity between the user portraits and course features. According to the results of similarity calculation, the system sorts all courses individually and recommends the most relevant courses to users [4]. Personalized recommendation system usually needs to update user portraits and course information in real time to reflect users' changing interests and the release of new courses.

Personalized recommendation system can recommend the most suitable and diversified learning resources and courses according to users' learning needs, interests and learning level, so as to improve users' learning efficiency and to enrich users' learning experience and help users explore new knowledge fields. Furthermore, by recommending courses related to users' interests, users are more willing to use the learning platform. This enhances their satisfaction and loyalty. Personalized recommendation system can reduce users' time and energy spent finding suitable courses, saving them time and energy. It improves learning efficiency by intelligently recommending courses that meet users' needs.

3.2 The recommendation of personalized exercises by big data

Firstly, the system models the learning resources and exercises, including their topics, difficulty, types, relevance and other information, which usually requires marking or classifying the learning resources so that the system can understand their characteristics. Next, the system will calculate the

similarity between users and different exercises through collaborative filtering and other methods to find exercises that match the user's interest and ability level. The purpose of similarity calculation is to find exercises that match the user's interest and ability level. Based on the calculated similarity, the system will personalize the exercise questions using collaborative filtering and other methods, ranking the most relevant and suitable exercises at the forefront. The recommendation system usually adjusts the recommendation strategy in real time according to the user's feedback and behavior. If the user gives positive feedback to some exercises, the system may adjust the recommendation strategy to recommend similar exercises more frequently.

Personalized recommendation system can provide personalized exercises for each student according to factors such as students' academic level, learning history and ability level, so as to ensure that the difficulty and complexity of exercises adapt to students' current learning status. By recommending personalized exercises, it can help students concentrate on their relatively weak knowledge points, strengthen their learning and improve their understanding and mastery of specific concepts or skills. At the same time, personalized practice recommendation can promote students' autonomous learning, enable them to choose appropriate difficulty and types of exercises according to their personal learning goals, and enhance students' learning motivation and sense of responsibility.

3.3 The planning of personalized learning path by big data

The system interacts with users or obtains users' learning goals by other means, which can be specific skills, knowledge fields, or broader career goals or interest directions. Based on the user's learning objectives, the system can use planning algorithm or heuristic method to formulate an initial learning path, which may include basic concepts, advanced knowledge, practical projects and so on. According to the user's learning progress, feedback and other contextual information, the learning path is constantly adjusted and personalized.

Personalized path planning can tailor the appropriate learning path for each student according to the students' learning goals, existing knowledge level and learning progress, making the learning process more efficient. In addition, personalized path planning can adjust the learning path in real time according to students' learning performance and needs, and ensure that the learning process always conforms to students' learning state and learning goals.

3.4 The recommendation of personalized learning groups by big data

For learning group recommendations, the system can use clustering algorithms and other methods to divide the group into different subgroups or clusters, and analyze the similarities and differences between individuals in the group. Based on the characteristics and commonalities of different subgroups, personalized learning resources are recommended. For example, suitable learning content can be recommended according to the common interests, subject preferences, and learning objectives of the group. Additionally, the system utilizes behavioral data from individuals in the group, such as learning history, evaluations, feedback, etc., and adopts a collaborative filtering algorithm to recommend learning resources. In short, the system comprehensively considers the characteristics of individuals and groups, providing learning resources that align more closely with their needs and interests for learning groups through personalized and group recommendation strategies.

Personalized learning groups can be formed based on learners' learning interests and goals, promoting cooperation and communication among learners. They can discuss learning problems together, enhancing the learning experience and improving learning effects.

4. Issues and Challenges of Personalized Recommendation System under Big Data Technology

4.1 Data privacy and security issues

Big data technology involves the collection, storage and processing of a large amount of user data, which may raise concerns about data privacy and security. Personalized recommendation

system needs to collect and analyze extensive user data, including learning history, hobbies, social relationships, etc., which also encompass sensitive information such as user's identity information and learning records, thus posing the risk of privacy breaches. If this sensitive information is obtained by an unauthorized third party, it could potentially harm users. Additionally, the collected user data might be utilized for other purposes, such as advertising, market research, etc., and the misuse of data could jeopardize users' interests and privacy[5].

Therefore, it is essential to implement effective data encryption and access control measures to prevent unauthorized access to or tampering with data.

4.2 Lack of diversity

Personalized recommendation algorithm tends to recommend resources similar to the content users have liked in the past and filters out irrelevant information based on users' historical behavior and interest preferences, which leads users to only touch the content that is consistent with their preferences. This leads users to interact only with content that aligns with their preferences, thereby limiting their exposure to a variety of information. Consequently, users may find it challenging to encounter views and content that differ from their own, resulting in the formation of an information cocoon effect and reducing users' opportunities to access diverse information. Moreover, tags and filters used in the system may exhibit biases, making it easier to recommend certain types or sources of content while overlooking others, thus diminishing the diversity of recommended results.

Therefore, diversity evaluation index and feedback mechanism can be introduced to avoid over-personalization.

5. Conclusions and reflections

Today, with the rapid development of information technology, the widespread application of computer big data technology in the field of education indicates that the education model is evolving in a more personalized and accurate direction. Personalized recommendation system for learning resources, as one of the important applications of big data technology in education, can enhance learners' learning content, consolidate learning weaknesses, improve learning effect and promote cooperation and exchange by combining students' learning behaviors and preferences.

This paper systematically discusses the application of computer big data technology in personalized recommendation system for learning resources by deeply studying the design framework and application scenarios of personalized recommendation system.

However, compared with its extensive application and remarkable effect, its data privacy and security problems and lack of diversity still need to be solved, which requires us to make more efforts in system design and algorithm optimization and make full use of various information sources and means to solve these problems.

Overall, the application of big data technology in personalized recommendation system for learning resources is an important direction in the development of education. Through overcoming challenges and continuous improvement, we can expect this technology to play a more far-reaching role in enhancing students' learning experience and promoting educational intelligence.

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