The Design of an Educational Resource Sharing Platform Based on Collaborative Filtering Algorithm Technology

Pan Xiao

Guangzhou Academy of Fine Arts, Guangzhou, China

xiaogafa@163.com

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Abstract: With the continuous development of educational informatization, more and more educational resources(ER) are digitized and shared online in a digital form. In order to fully utilize these digital ERs and solve the problems of low sharing rate and low quality of ERs, it is necessary to establish a high-quality ER sharing platform. The ER sharing platform based on collaborative collaborative filtering (CF) algorithm can recommend personalized ERs for learners according to their behaviors and preferences, and improve their learning efficiency and satisfaction. According to experimental data, the number of positive reviews on the platform increased from less than 80% to more than 90%, the number of positive reviews decreased from more than 15% to less than 10%, and the number of negative reviews decreased from more than 3% to less than 1%. It can be seen that the design of ER sharing platform based on optimized CF algorithm is highly feasible.

1. Introduction

Therefore, how to realize data resource sharing is an important way to promote the efficient development of scientific research [1-2]. In order to solve this problem, a teaching resource sharing platform based on collaborative filtering has been proposed [3], which is the most commonly used recommendation method at present [4] and can provide users with targeted ERs. In the field of data transmission, the data transmission rate shows a rapid upward trend [5], and the data transmission rate also makes the importance of ER allocation to educational development more and more concerned [6].

It is of great significance to design and develop an educational resource sharing platform based on collaborative filtering algorithm. This platform can provide personalized resource recommendation according to the behaviors and preferences of teachers and students, thus effectively improving learning efficiency and teaching quality. In addition, personalized recommendation can stimulate users' learning motivation and sense of participation, and further promote the rational use of educational resources and the innovation of teaching methods. Yadav A K explored the application of computer education and learning platform based on mobile games [7]. Denny P explored the development of computer education platform in the era of generative artificial intelligence [8]. Zhou N believes that efficient and fair computer-aided teaching depends on teachers' in-depth understanding of justice in computer-aided teaching. Therefore, based on more than two years' teaching experience, he explored middle school teachers' cognition of teaching fairness. Participants have different subjects, and there are also schools with fewer representatives. His research is based on qualitative research, teachers' reflection on writing and semi-structured interviews to explore its teaching effect. On the basis of justice theory, he studied the content of the text [9]. Rankin Y A found that computer-aided education needs to be improved through the cross-study of black women's experiences. He will also provide relevant policy suggestions on the development direction of computer science education and solve the gender difference problem of black girls [10]. Cope B studied the search for new learning methods in the computer education system in the history of e-learning [11]. However, the existing research often ignores the issues of user privacy protection and data security. In practical application, how to ensure the safety and

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privacy of user data while ensuring the effect of recommendation system is an urgent problem in current research[12-13].

The research results of this project will help to promote the sharing of ERs and provide higher quality learning and teaching services for teachers and students. The development and implementation of this system is of great significance to the promotion and development of digital teaching and the promotion of teaching quality[14].

2. Combination of CF Algorithm and ERs

2.1 Advantages of Collaborative Filtering Algorithm in ERs

With the advent of the digital education era, the management and utilization of ERs have become an important topic in educational reform[15]. As a new artificial intelligence technology, collaborative filtering algorithm can improve the utilization and popularity of ERs and achieve the goal of digital education through intelligent data classification and filtering. In education resource management, the CF algorithm has the following advantages:

It improves the utilization of educational resources. The collaborative filtering algorithm can automatically filter educational resources based on students' characteristics such as gender, age, and interests, thereby recommending more suitable educational resources, as shown in Figure 1.

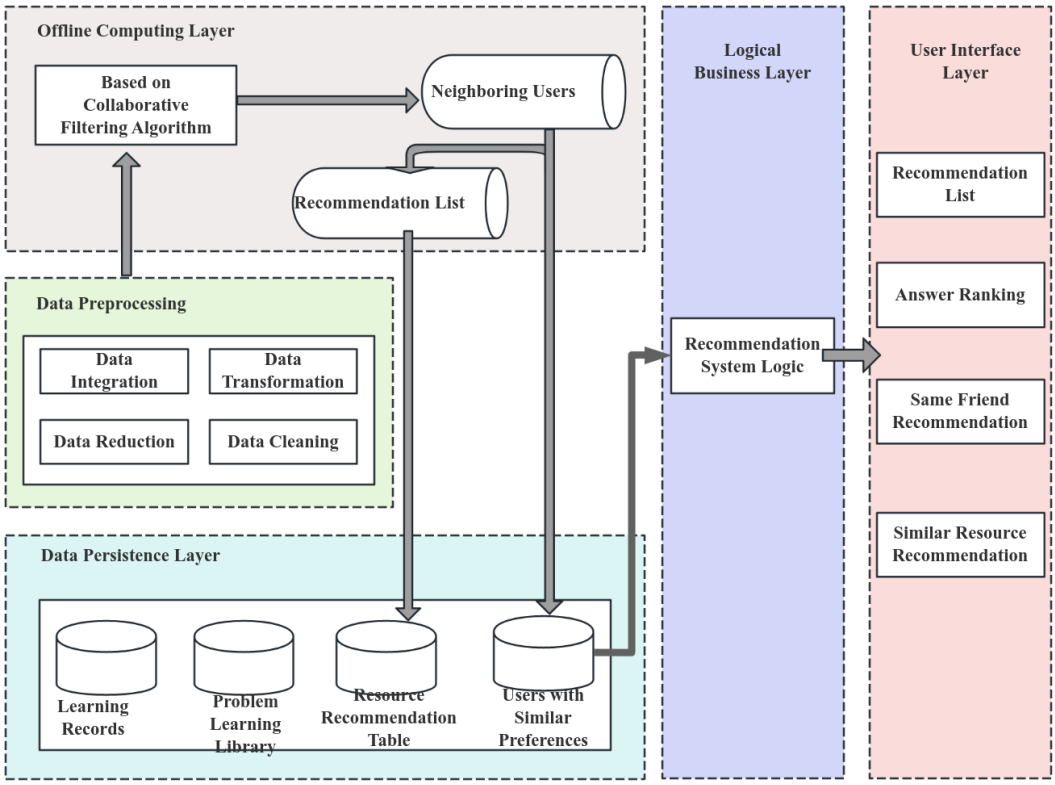

Figure1. Overall System Architecture Based on Collaborative Filtering Algorithm

Enriching the types and contents of educational resources: collaborative filtering algorithm can mine more educational resources according to the characteristics of students' disciplines, grades, learning plans, etc., and filter and classify resources. At the same time, it can gradually improve and enrich the types and contents of resources according to user feedback.

Personalized education: The collaborative filtering algorithm can make intelligent recommendation and personalized customization of educational resources according to students' learning situation and behavior, and provide students with educational resources that are closer to the actual learning situation to achieve personalized education. The process is shown in Figure 2.

Digitization of educational resource management: collaborative filtering algorithm can provide technical support for the digitization of educational resources, and realize intelligent management,

storage, retrieval and distribution of educational resources, thus improving the efficiency and accuracy of educational resource management. Digitalization has been effective in implementation [16].

To sum up, collaborative filtering algorithm has many advantages in ER management, which can help students make better use of ERs and improve learning efficiency and results.

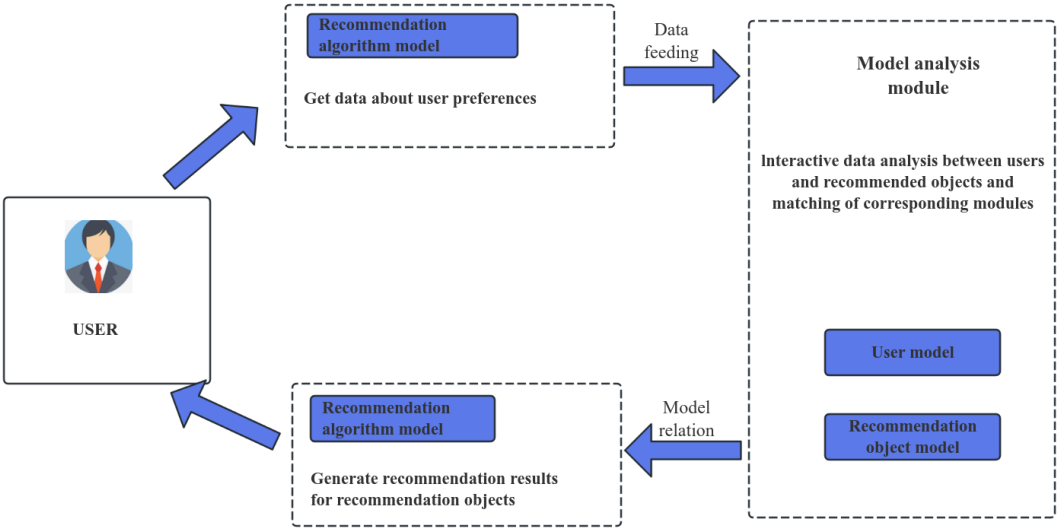

Figure 2. Personalized Education Resource Operation Process

2.2 Process Assumption

Education data resource management is one of the essential contents in students' learning process, and how to select and recommend suitable education resources based on students' personalized needs and learning situations is one of the important issues in the current education field [17-18]. Using collaborative filtering algorithm to manage ERs can better realize personalized screening and recommendation, and improve students' learning effect and interest. The process design of collaborative filtering algorithm combined with ERs aims to help teachers and students to meet students' learning needs and interests by analyzing students' personal information, learning conditions and interests, and making personalized intelligent screening and recommendation of ERs, as shown in Figure 3.

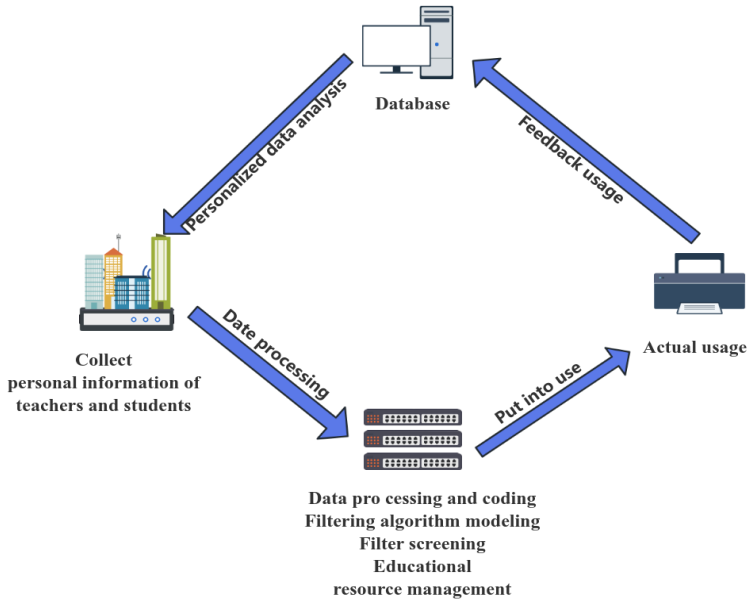

Figure 3. Collaborative Filtering Algorithm Education Resource Data Processing Flow

The CF algorithm combines the process design of ERs, and through the CF algorithm based on the characteristics of students' personal information and ERs, it realizes to find resources suitable for students in a large number of ERs, and supports online learning and downloading. By constantly optimizing and improving the data and feedback generated when students use ERs, the recommendation efficiency and accuracy of CF algorithm can be improved, and students can obtain better learning results and satisfaction.

3. Design of Collaborative Filtering Algorithm Design of Educational Resource Sharing Platform

3.1 Platform Role

Resource sharing platforms have become an important component of the digital and intelligent era. Through the platform design of collaborative filtering algorithm combined with educational resources, this way can provide better personalized learning experience for students, and provide more extensive educational resources for educators and students. The ER sharing platform based on collaborative filtering algorithm can provide ERs that are closer to students' needs and interests.

3.2 Platform Design

Resource sharing platforms have received increasing attention [19], and the operating interface of ER sharing platforms requires a clear and easy-to-use interface. At the top of the interface, there is a search bar and classification filtering function to help users quickly find the resources they are interested in, as shown in Figure 4. The platform mainly includes the following parts:

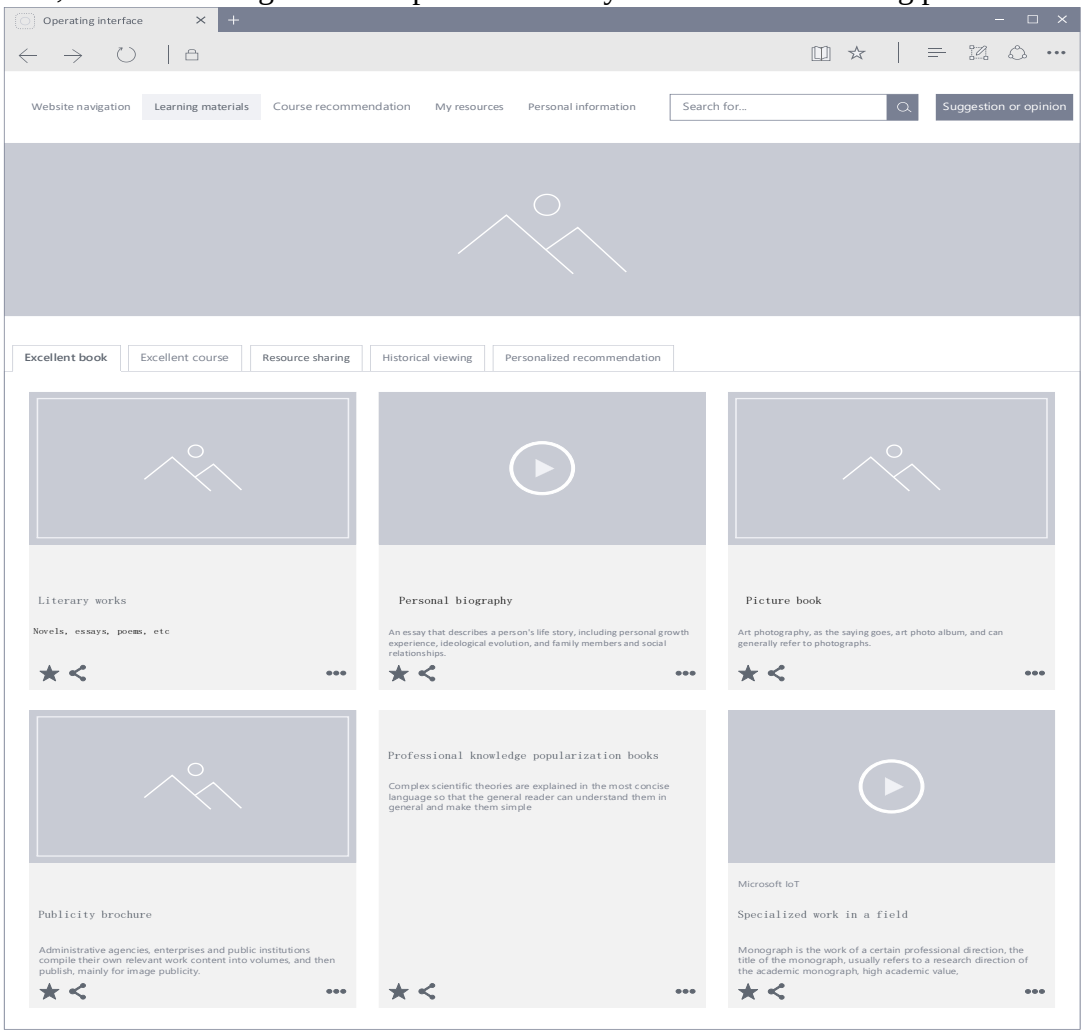

Figure 4. Operation Interface of Design Education Resource Sharing Platform of Collaborative Filtering Algorithm

Homepage: The homepage of the website is the "portal" of the system [20], showcasing high-quality courses and recommended resources on the platform, allowing students to quickly start their learning journey through recommended resources.

Course library: Developing and utilizing course resources and applying them to teaching practice is an inevitable trend [21]. The system course library should cover courses of all grades and educational stages, and students can choose according to their own interests and needs.

Resource upload: Educators and academic institutions can upload their high-quality ERs to the platform for more people to share and use.

My Resources: Students and educators can bookmark their uploaded resources in 'My Resources' for easy search and management.

Personal information: Users can improve their personal information, including name, grade, subject, and other information, in order to obtain more personalized recommendation resources. In terms of information security and privacy, continuous work is needed to ensure that the technological infrastructure provides an environment for secure and effective care [22].

The design education resource sharing platform of CF algorithm can automatically match the most suitable resources for students, so as to provide better personalized learning experience. Online courses include video lectures and live streaming courses, where students can choose to study based on their own learning progress and interests. The courseware mainly includes videos, audio, PPTs, and PDFs, providing students with richer learning resources. The test questions cover various types of questions, and students can choose different types of test questions to practice according to their learning needs.

3.3 Design of CF Algorithm Education Resource Sharing Platform

The main purpose of the experiment is to investigate the satisfaction of students and teachers of the ER sharing platform based on the collaborative CF algorithm in the school through questionnaires, as well as their views on the experience of using the platform and the accuracy of recommended resources [23]. By asking participants' opinions and feedback, as well as data statistics and analysis, guidance and suggestions are provided for the improvement and optimization of the platform, thereby improving its satisfaction and usability. At the same time, implementing such experiments to strengthen the collaborative cooperation and resource sharing awareness between students and teachers can promote better learning and educational experiences.

3.4 Optimization of Education Resource Sharing Platform

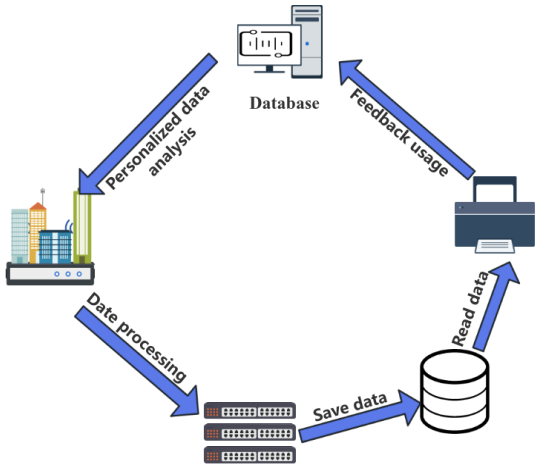

Figure 5. Optimization of Education Resource Sharing Platform

Network optimization is a very important component in the construction process of mobile communication networks [24]. Based on the survey data of the education resource sharing platform questionnaire mentioned above, it can be seen that there are still some problems in the use of the current education resource sharing platform, such as slow data transmission speed, which affects the usability and user experience of the platform for users. In order to improve the data transmission

speed, the data access speed can be accelerated by adding caching technology to the CF algorithm education resource data processing flow in Figure 3 to set a cache on the server side of the platform to cache some commonly used data. The security of data transmission process is of great significance [25]. After adding a buffer, data security can be guaranteed to a certain extent. After optimization, the system is shown in Figure 5.

Based on this, this paper proposes a CF-based teaching resource sharing system, which can effectively analyze students' learning needs and preferences, thus providing students with more personalized teaching resources. Such optimization can not only improve the user experience, but also improve the utilization rate of teaching resources and improve the teaching effect.

First of all, the working principle of CF algorithm is to obtain teaching resources from users' evaluation and feedback. For example, if more than one teacher has a high score on an online course, the system will determine that the quality of the course is higher and recommend it to teachers with similar teaching needs. This paper puts forward a recommendation method based on user group behavior, which solves the traditional hot recommendation method and realizes the diversification and personalization of resource recommendation.

Secondly, the basic CF algorithm can dig out the potential demand for educational resources. For example, if a teacher frequently browses the information on a certain topic, then the system will recommend him new resources that he is interested in but has not yet been discovered according to this behavior law. The early warning function of the system can help teachers to dig more actively and deeply into educational resources, help educators to make rational use of platform resources and improve the quality of education.

At the same time, the algorithm can also optimize the overall structure of the teaching resource platform. By analyzing the user's feedback and the use of resources, we can classify, display and search the resources, and help users find the learning resources they need quickly. For example, when the data shows that the user's preference for teaching content is greater than that of text description, the platform can appropriately increase the proportion of video resources according to the needs of users.

Finally, the CF algorithm is applied to the teaching platform to evaluate the teaching resources. This paper intends to compare and analyze the learning behavior of similar users in the learning process, so as to evaluate the real learning effect of various learning resources, thus providing data support for subsequent learning and optimization.

The application of this technology can not only improve the intelligence of teaching platform, but also effectively use teaching resources and improve teaching quality.

4. Experimental Testing after Optimizing the ER Sharing Platform

4.1 Formulas

The use effect of ER sharing platform based on collaborative CF algorithm can be evaluated by the following formulas:

Root mean square error (RMSE):

RMSE is the most commonly used error evaluation index in collaborative CF algorithms. It can be represented by the following formula:

$$RMSE = \sqrt{\frac{\sum(A-P)^2}{n}} \tag{1}$$

In Formula (1), n is the number of users and items in the test set, A is the actual score of users, and P is the score predicted based on the collaborative CF algorithm.

P and R are two important indicators for evaluating the performance of recommendation systems, which are used to evaluate the accuracy and completeness of system predictions. After simplification, it can be represented by the following formulas:

$$P = \frac{TP}{TP+FP} \tag{2}$$

$$R = \frac{TP}{TP+FN} \quad (3)$$

In formulas (2) and (3), TP represents the number of samples with a positive actual score and a positive predicted score, FP represents the number of samples with a negative actual score but a positive predicted score, and FN represents the number of samples with a positive actual score but a negative predicted score.

4.2 Optimized Experimental Testing

The optimized experimental test results are shown in Table 1. We can see a comparison between the user's actual rating and the system's predicted rating. The smaller the difference between the actual score (A) and the predicted score (P), the higher the accuracy of the system's predictions. Through the root mean square error (RMSE) contribution column, we can intuitively see the contribution of each user item to the overall error. For example, user 001's actual rating for project 101 is 4.0, predicted rating is 3.8, and error contribution is 0.04, which is relatively small. This indicates that the system's predictions in this regard are more accurate. In addition, we also evaluate the performance of the recommendation system by the number of TP, FP, and FN. The table shows that in most cases, the system is able to correctly predict items with a positive rating, which is reflected in a high precision and recall rate of 0.75, respectively. This means that when the system recommends resources, most of the recommendations are what users like and can find the resources that most users like. Overall, the data in this table indicates that the optimized education resource sharing platform performs well in predicting ratings and resource recommendations, providing accurate rating predictions while effectively meeting user needs.

Table 1. Optimized experimental test results

User ID	Item ID	Actual Rating (A)	Predicted Rating (P)	RMSE Contribution	TP	FP	FN
1	101	4	3.8	0.04	1	0	0
2	102	3	2.5	0.25	0	0	1
3	103	5	4.5	0.25	1	0	0
4	104	2	2.2	0.04	0	1	0
5	105	1	1.2	0.04	0	0	0
6	106	4	3.9	0.01	1	0	0
7	107	5	4.8	0.04	1	0	0
8	108	3	2.8	0.04	0	0	1
9	109	4	4.2	0.04	1	0	0
10	110	2	2.1	0.01	0	1	0

5. Conclusions

Aiming at the problems of information overload and poor recommendation effect in the field of ER sharing, this paper designed an ER sharing platform design and development scheme combined with the collaborative CF algorithm. The user interface was designed through the personalized process design and data transportation process design of the collaborative CF algorithm, which increased the practicability of the ER sharing platform for the design of the CF algorithm. At present, there are still many problems in the research of this platform, such as the cold start of new users and new resources, which may adversely affect the recommendation results. In addition, in order to ensure the user's privacy, it is also necessary to ensure that the user's privacy will not be violated in the future. This project will further study how to integrate various data and introduce machine learning methods to improve the recommendation efficiency. At the same time, more effective means such as anonymity and password are adopted to ensure the information security of users. Through the above research, an intelligent and safe teaching resource sharing platform is provided for the majority of users.

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