Hindawi
Mobile Information Systems
Volume 2022, Article ID 6700238, 10 pages
https://doi.org/10.1155/2022/6700238

Research Article

Designing an English Teaching Resource's Information Management System Using Collaborative Recommendation

Yanxia Liu

School of Foreign Languages, Shandong Women's University, Jinan Shandong 250014, China

Correspondence should be addressed to Yanxia Liu; 27046@sdwu.edu.cn

Received 18 April 2022; Revised 13 May 2022; Accepted 24 May 2022; Published 7 June 2022

Academic Editor: Abid Yahya

In the modern world, English education institutions are more concerned about how to recommend the required resources to all types of learners and how to improve the application value of the resources. Therefore, this study introduces and combines the collaborative recommendation algorithm to recommend resources to the learners. The development and design of an English teaching resource information management system based on collaborative recommendation technology are in the best interests of English learners. It establishes an English teaching resource information management system to recommend appropriate teaching resources for different English learners and provide personalized recommendations. English teaching resources are used to improve efficiency and make it easier for English learners to find English teaching resources that meet their specific requirements. Firstly, this study briefly introduces the collaborative algorithm and establishes how the score of similar items or users is calculated by the user-based collaborative filtering algorithm and the item-based collaborative filtering algorithm. Based on similarity, the proposed approach recommends the architectural framework of the English teaching system to other users, describes the functions of each module of the system in detail, and detects the system's application performance through simulation experiments. The result shows that the learning resources are sufficiently accurate. The design system, in comparison with the general information management system, can reduce the time required for users to obtain English teaching resources.

1. Introduction

The number of information resources has increased rapidly in recent years, thanks to the rapid development of Internet and communication network technologies. People are experiencing the fundamental difficulty in locating the information they need among the available data [1]. We can observe the recommendation system's effective involvement in many applications, particularly Web applications, as a result of development and technical innovation. It is easy to see why the recommendation algorithm has become so popular. We can expect the recommendation algorithm to be updated over time and applied to a growing number of scientific fields, which will have an impact on the system's intellectual capabilities and customer experience [2]. The assistance provided will be more efficient. A new approach for teaching assistants is the teaching resource recommendation system. Some systems have been developed and used in a variety of disciplines, including teaching and education, where teaching assistant systems are especially common. Students and teachers will be able to interact more easily using this assistant system, but it may also be simpler to exchange teaching resources [3]. Students can utilize the auxiliary system more precisely and simply seek teaching resources from the instructor, making it possible and more immediate for students to exchange or consult. In the entire teaching-aided system, this is also where the principle of recommended system for integrating teaching resources takes center stage. The use of a recommendation system will greatly improve the usage of teaching resources, particularly if the system can be used to equip with smart educational resources. Students can use the recommendation system to identify resources that interest them to increase their learning interest and performance in studying relevant knowledge, which is particularly advantageous to their learning [4]. As the social Internet grows in popularity, students will have access to more resources, but there are too many concerns. We are constantly bombarded with a massive number of resources, but users have a difficult time finding the ones they need, resulting in the previously mentioned information overload problem. Academics and society have conducted numerous experiments and large-scale research, as well as proposed some solutions, to address this issue [5]. One of the methods by which the recommendation scheme may supply users with accurate resources is the recommendation system. By delivering the resources that users require the most, these resources reduce the earlier overload problem. The recommendation system has been personalized using cutting-edge technology. It can be used to assess users' information needs, and the corresponding resources can be appropriately started to push to the earlier days using user models. This study designs and develops an English teaching resource information management system for English learners using collaborative recommendation technology to mine English teaching resource information and obtain more English teaching resources that English learners are interested in [6].

To recommend items for the sessional recommendation system, the Markov decision processes (MDPs) were proposed. A first-order Markov chain summarizes the simplest MDP. The probability of transfer among items could be used to compute its next recommendations [7]. The behavior of every two neighboring clicks has been simulated in this study, resulting in more precise and reliable sequence predictions. On the other hand, the use of Markov chain models to develop this has the drawback of combining previous components separately. This assumption of independence is too strong, limiting the accuracy of the prediction. The convolutional neural network builds the first-generation graph on this foundation by putting the convolution kernel variable in the frequency domain as that of the number of learning nodes based on the graph network structure's specific convolution points [8]. The frequency-domain configuration of the convolution kernel parameter was optimized in this study. A graph convolutional neural network's computational cost is decreased by fitting the convolution layer effectively with the Chebyshev polynomial [9]. The authors included the gated unit in a graph of a convolutional neural network. On this foundation, this study used the current approach to analyze user activity and got better results. During message transmission, the network executes an iterative action based on its neighboring local nodes, even though the approach based on a convolution graph has great reasonable reasoning capability [10]. It is only relevant to short-length user session sequences. This topic should be modeled around a single user. Because each user's operating characteristics vary, the distance of the user process session to be managed may change, which presents a challenge to the model's capability to analyze a variety of input data [11].

The purpose of the collaborative recommendation algorithm is to find other users who have similar preferences to this user and to recommend relevant content and English teaching resources to them. This research combines collaborative filtering algorithms based on users and collaborative filtering algorithms based on items. Next, it selects the teaching resources that English professors discover most beneficial and then recommends them to other users. The purpose of the hybrid recommendation is to deal with the problems in the collaborative recommendation and content-based recommendation and combine them with other algorithms to complete the recommendation. The purpose of this study was to investigate a collaborative recommendation algorithm to provide technical support for system development. The item-based collaborative filtering algorithm and the user-based collaborative filtering algorithm are both thoroughly detailed to determine the score of long-term users of English teaching resources on a resource and, based on the score, recommend it to other users with a high degree of similarity [12]. A model of the storage mechanism is developed, and then the architectural framework based on collaborative suggestion technology is designed, an English teaching resource information management system has been developed, and the system's functional modules are explained. The collaborative recommendation module is the most important, as it explains the system's process for recommending English teaching information. The hybrid recommendation algorithm is described, and it calculates the similarity of English teaching resources before recommending them to other users [13].

The following are the main contribution of this study:

(i) Firstly, this study proposes English teaching resources using the modern collaborative recommendation algorithm.

(ii) The item-based collaborative filtering algorithm and the user-based collaborative filtering algorithm are both properly described to determine a resource's score among long-term users of English teaching resources.

(iii) The English teaching resource storage module in this study was developed using memory architecture. The English teaching resource information management system based on collaborative recommendation technology allows for real-time sharing of English teaching resources during the design process.

(iv) Finally, the system is split into four functional modules such as resource management, personal space management, communication management, recommendation module, and system management.

The rest of the study is organized in logical order: Section 2 shows related work, Section 3 shows an overview of collaborative filtering recommendation algorithms, Section 4 shows the design of the English teaching resource information management system, and Section 5 shows the system performance analysis. Finally, the research work is concluded in Section 6.

2. Related Work

Currently, recommendation systems are widely used in a variety of fields, but collaborative recommendation technology is used less commonly in English teaching resources. This study investigates the findings of the literature by searching research studies around the globe [14]. Wahyudi et al. integrate a lot of knowledge into the content-based recommendation system and build a content-based recommendation process from a new perspective [15]. The proposed algorithm is used to recognize the subject of the video on the Internet by convolution of the image recommended by the user [16]. The algorithm is used to recognize the subject based on the video. Wang *R* H et al. evaluated the problems with the current recommendation system and developed a hybrid recommendation model based on a Web resource system using information analysis technology and a collaborative recommendation algorithm, which improved the operational efficiency of the system by better facing challenges in the recommendation system [17]. Yu B et al. establish an interest and hobby model and recommend teaching resources using a personalized recommendation algorithm based on the personal interests of English learners [18]. Ge GL et al. proposed a user interest model, which utilizes the personalized information push mode to determine the personalized push service quality directly based on performance level. Implicit and explicit interest calculations are constructed based on a variety of factors, including scenario perception and user behavior, and the relationship between implicit and explicit interests is investigated among users [19]. The author begins by describing the present condition of English education in universities and colleges. However, establishing the overall framework of the system constructs the classification and sharing system for English digital teaching resources allowing for automatic classification and sharing. The effectiveness comparison test improves the system's automatic classification accuracy, and the sharing rate has also been improved to some limited extent [20]. Sang et al. artificial intelligence-based integrated management system for English teaching resources is designed to deal with the sharing of teaching resources among all grades in colleges and universities. Based on the system server and the English teaching resource storage module, the system hardware design is completed [21]. Lei and Liu use a hybrid recommendation algorithm to improve the utilization efficiency of teaching resources based on the characteristics of teaching resources and users [22]. This study is proposed to improve the collaborative filtering recommendation algorithm by incorporating the scoring prediction concept. We utilized the modified conditional probability to determine item similarity and scoring sparsity to investigate similarity measurement and scoring sparsity [23]. Xu et al. investigated the current recommendation systems on the market, most of which are based on collaborative filtering and content recommendation algorithms, which are primarily used to plan recommended courses and learning paths for students, such as learning books [24]. Liu et al. designed and developed a corresponding personalized recommendation system for mathematical exercises using a collaborative filtering algorithm [25].

3. Overview of Collaborative Filtering Recommendation Algorithms

3.1. Collaborative Recommendation Algorithms. Until now, many personalized recommendation algorithms have used the most successful and effective uncooperative recommendation algorithm. These algorithms have been widely used and can intelligently recommend content to users [26]. There are many ways to choose how vector similarity is computed by comparing behaviors. The most typical algorithm is cosine similarity and Pearson's correlation.

3.1.1. Pearson's Correlation

$$S(i, j) = \frac{\sum_{s \in T_{ij}} \left(r_{i,s} - \overline{r}_i\right)\left(r_{j,s} - \overline{r}_j\right)}{\sqrt{\sum_{s \in T_{ij}} \left(r_{i,s} - \overline{r}_i\right)^2 \sum_{s \in T_{ij}} \left(r_{j,s} - \overline{r}_j\right)^2}}. \quad (1)$$

In the above formula, $\overline{r}_i$ is the average score value of user i, $\overline{r}_j$ is the user average score value j, and the item set jointly scored by I and j is represented by T_{ij}.

3.1.2. Cosine Similarity

$$S(i, j) = \cos(i, j) = \frac{R_i \cdot R_j}{\left|R_i\right| \times \left|R_j\right|} = \frac{\sum_{s \in T_{ij}} r_{i,s} r_{j,s}}{\sqrt{\sum_{s \in T_{ij}} r_{i,s}{}^2 \sum_{s \in T_{ij}} r_{j,s}{}^2}}. \quad (2)$$

In the above formula, the user scoring vector i is represented by R_i, the user scoring vector j is represented by R_j, and the item set scored by i and j is represented by T_{ij}

3.1.3. Modified Cosine Similarity. The scoring scales used by each user when evaluating the same item are very different. The average value of the item score can be removed using the cosine similarity correction to improve its disadvantages. There is less common scoring data between two different users based on the premise of sparse data. For example, (1, 2) is the score of users evaluating two common items, and (4, 5) is the score result of user B evaluating two items. The similarity between the two results is 0.98. This result is unreasonable, and the problem can be solved by correcting the cosine similarity.

$$S(i, j) = \frac{\sum_{s \in T_{ij}} \left(v_{i,s} - \overline{v}_i\right)\left(v_{j,s} - \overline{v}_j\right)}{\sqrt{\sum_{s \in T_{ij}} \left(v_{i,s} - \overline{v}_i\right)^2 \sum_{s \in T_{ij}} \left(v_{j,s} - \overline{v}_i\right)^2}}. \quad (3)$$

3.2. User-Based Collaborative Filtering Algorithm. The nearest neighbor algorithm is among the most widely utilized collaborative recommendation algorithms. The algorithm produces a group of nearest neighbors for the user based on similarities of the user's scoring system and then uses the equal weights of the nearest neighbor's score on the project to estimate the user's score for the project. The core idea is to estimate a user's project score using a weighted average of the user's project score. The next three processes complete the user-based collaborative recommendation algorithm [27].

Firstly, each user's and the user's similarities are calculated. Because users trust some people with similar hobbies, they should first obtain the similarity between their own users and other users. The measure of correlation is computed among users using Table 1 of user-item scoring matrix.

Secondly, the user neighbors are defined based on the user items and their similarity with other users.

Thirdly, the weighted score of this neighbor is selected as the score of active users.

The main problem during the practical application of this method is sparsity; that is, the sparse user-item scoring matrix is the result of a large number of items and a small number of user scores during the system's procedure. Therefore, this evaluation cannot be used to determine the user's similarity based on the user collaborative recommendation algorithm.

3.3. Based on Items, a Collaborative Filtering Algorithm. The collaborative recommendation algorithm based on an article differentiates significantly from the collaborative recommendation algorithm based on users. Instead of calculating the similarity with both users, the similarity respectively articles are calculated using the following two methods [28].

Items are identified that are related to this item and items that are similar around. Many similarity calculation methods used in this process include Pearson's correlation, ordinary cosine similarity, and modified cosine similarity.

3.3.1. Common Cosine Similarity

$$\operatorname{sim}(i,j)=\frac{\sum\limits_{u\in U} R_{ui}\cdot R_{uj}}{\sqrt{\sum_{u\in U} R_{ui}{}^{2}}\sqrt{\sum_{u\in U} R_{uj}{}^{2}}}. \tag{4}$$

The above formula u represents users, and U is the set covering all users.

3.3.2. Pearson's Correlation

$$\operatorname{sim}(i,j)=\frac{\sum\limits_{u\in U}\left(R_{ui}-\overline{R}_i\right)\left(R_{uj}-\overline{R}_j\right)}{\sqrt{\sum_{u\in U}\left(R_{ui}-\overline{R}_i\right)^2}\sqrt{\sum_{u\in U}\left(R_{uj}-\overline{R}_j\right)^2}}. \tag{5}$$

In the above formula, the average score of articles i is expressed by $\overline{R_i}$ and the average score of articles j is expressed by $\overline{R_j}$.

3.3.3. Cosine Correction of Similarity

$$\operatorname{sim}(i,j)=\frac{\sum\limits_{u\in U}\left(R_{ui}-\overline{R}_u\right)\left(R_{uj}-\overline{R}_u\right)}{\sqrt{\sum_{u\in U}\left(R_{ui}-\overline{R}_u\right)^2}\sqrt{\sum_{u\in U}\left(R_{uj}-\overline{R}_u\right)^2}}. \tag{6}$$

Table 1: Matrix of user and item scoring.

User	Item_1	Item_2	......	Item_n
U_1	v_{11}	v_{12}	......	v_{1n}
U_2			......	v_{2n}
......	......	......	......	......
U_m	v_{m1}	v_{m2}	......	v_mn

The average value of users' u rating of goods is represented by $\overline{R}_u$.

The user's predicted score on the item based on the user-item neighborhood and historical scoring data is calculated, and then, a recommendation list is listed.

In this study, the item-based collaborative filtering algorithm is used to predict P_{ui}. In the process of recommending item i, the recommending scores mainly depend on the impacts of item i to surrounding things.

$$P_{ui}=\overline{R}_i+\frac{\sum\limits_{j\in S(i,k)\cap N(u)}\operatorname{sim}(i,j)\left(R_{vi}-\overline{R}_v\right)}{\sum_{j\in S(i,k)\cap N(u)}\left|\operatorname{sim}(i,j)\right|}. \tag{7}$$

The above formula $N(u)$ is the collection of all items purchased by the user u, and $S(i,k)$ is the collection of k items with the highest similarity with item i. After calculating the user's predicted score for this item, the top-N method is used to select n items with the highest score to recommend to the target user.

4. The Design of a Management System for English Teachers' Resources

The English teaching resource storage module in this study is built using memory architecture. Real-time sharing of English teaching resources was realized when designing an English teaching resource information management system based on collaborative suggestion technology [29]. Figure 1 shows the memory mechanism model.

In this model, memory's key role is to store important information from English teaching resources. The common data materials include documents, teaching courseware, and exercises. Figure 2 shows the information storage map of English teaching resources.

This study builds a folder by merging different types of media assets, creates a system teaching resource storage module based on this, and saves English teaching resource information and description resource information in the associated folder. The construction of the English teaching resource information storage module is shown in Figure 3.

4.1. Overall System Architecture. The B/S architecture is used in this research to build an English teaching resource information management system. Its system design consists of three layers: logic, application, and data. Figure 4 depicts the system's overall structure.

(1) Application Layer

The purpose of designing the application layer in the system is to provide each user with a unified

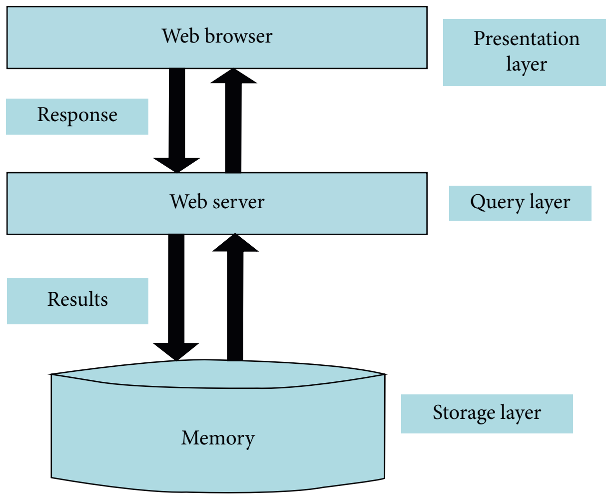

Figure 1: Reservoir mechanism model.

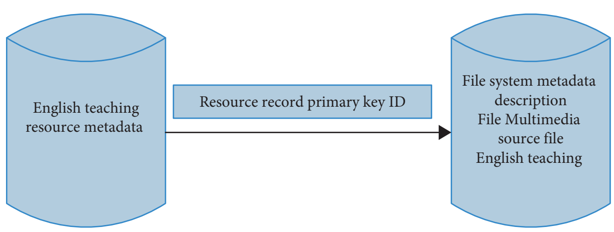

Figure 2: Information storage process of English teaching resources.

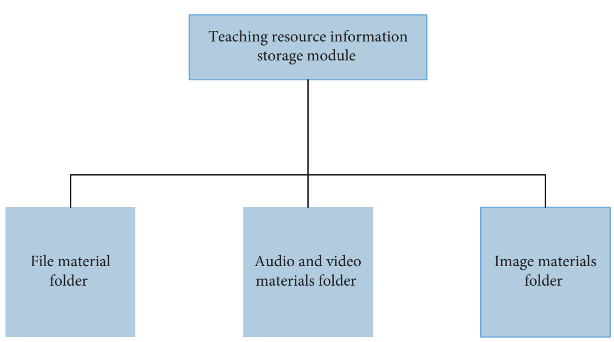

Figure 3: English teaching resource information storage module structure.

interactive page, on which users can select functions and send request information.

(2) Logical Layer

The logic layer is the most important component of system. A personalized recommendation model and application server are among its components. The logic layer is a part of the design of an English teaching resource and information management system based on collaborative recommendation technology. While the database responds to user requests, the personalized recommendation model collects user request data and sends it to the server.

(3) Data Layer

The database server and database management system compensate for this layer. The primary purpose of a database management system is to save data.

4.2. Functional Module Design. In the English teaching resource information management system architecture described above, the system is divided into four functional modules: resource management, personal space management, recommendation module, and system management, which are shown in Figure 5.

(1) Personal Space Management

This module consists of two parts: spatial resource management and spatial content management. It is to enable users learning English to learn independently and obtain the required English teaching materials in the space.

(2) Resource Management

English teachers are the main users of the resource management module. Teachers use the resource management module to upload the textbook information to the system. At the same time, they can manage or even delete the uploaded teaching information. The uploaded teaching materials can be shared with other users.

(3) English Resource Recommendation

This module is the most important part of the system, which contains users' various browsing score information and attribute feature information, and recommends interested English teaching materials to users according to this information.

(4) System Management

System management's priority is to keep the circuit of system users and complete data maintenance. This module can only be used by administrators. The administrator can divide permissions for each role and manage system log information based on the above permissions.

4.3. Design of Collaborative Recommendation Module. This study proposes a collaborative recommendation-based English teaching resource information management system. There are only two user roles: students and English teachers. From the perspective of teaching resources, there are many types, namely audio, image, and video. The traditional association rule algorithm is used to recommend English teaching content, it cannot be recommended across regions. Therefore, after comparative analysis, this study uses a collaborative recommendation algorithm design. Based on the collaborative recommendation algorithm, for registered English users, old users will give corresponding scores after reading teaching resources, so the hybrid recommendation algorithm is used for old users.

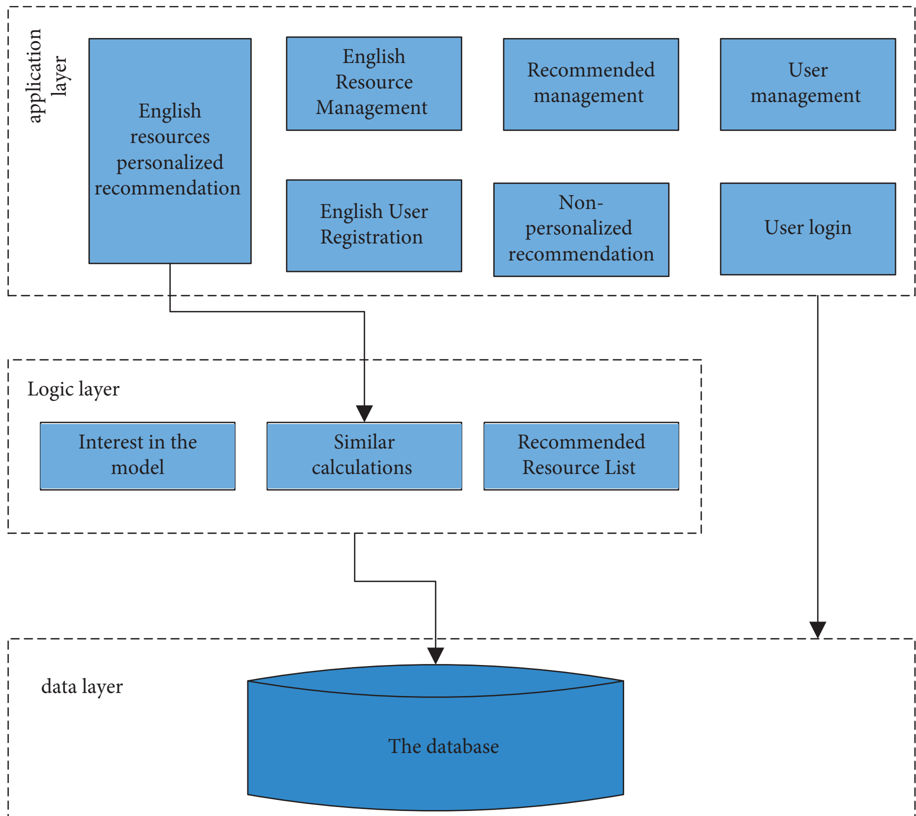

Figure 4: Overall system architecture.

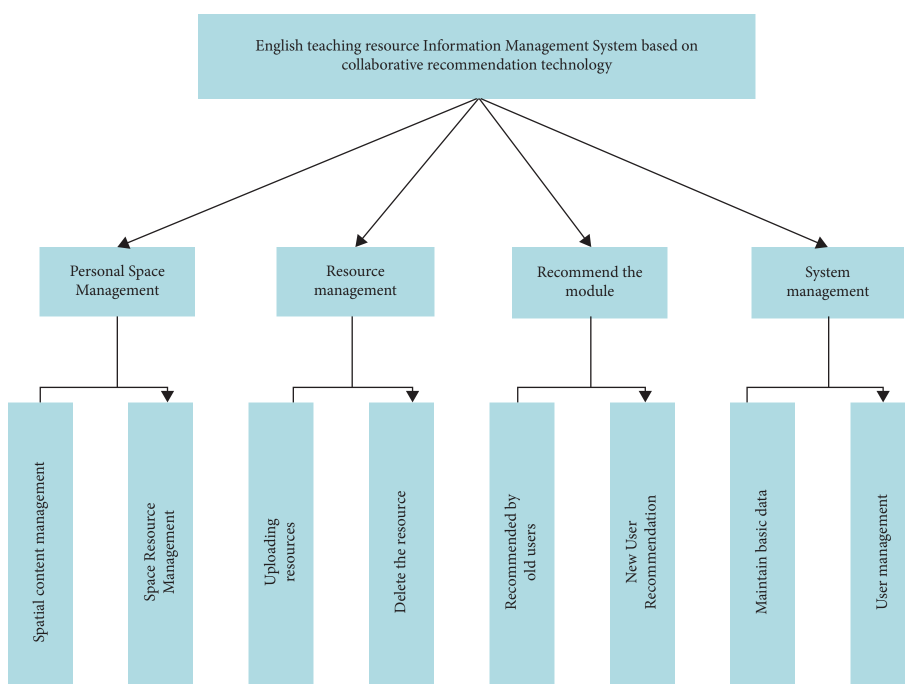

Figure 5: System function module.

4.4. Design of Hybrid Recommendation Algorithm. For the old users who have registered the system, they will give an evaluation after learning and reading teaching resources on the system. Let $U = \{U_1, U_2, \ldots, U_m\}$ represent the user group set, and let $D = \{D_1, D_2, \ldots, D_m\}$ represent the resource item set; the scoring information is represented by a matrix, and the specific contents are shown in Table 2.

M is the total number of teaching resources in the system, M is the number of users, and $U(m, n)$ is the score of U_m users on D_i teaching resources. When building the similarity between um and U_i users, we should first obtain the evaluation resources corresponding to their scores to establish the English teaching resource collection $I_{im} = I_i \cup I_j$. Facing the nonrated items on some users, the similarity between the nonrated teaching resource items and the rated English teaching resource items is calculated, and the scoring results of the user nonrated items are predicted according to this value. The above process until all scoring items are filled in is cycled.

4.4.1. Calculate Similarity. In the procedure of calculating the traditional similarity, the user-oriented item scoring matrix is used to replace the non-scored items with 0. The disadvantage of this Taichong method is that if the user's scoring items are lower than 1%, it means that the non-scoring items are higher than 99%, and the similarity between the two is greater than 98%. However, the result cannot show the similarity between users. To avoid having this problem impact on the recommendation results, the project score without teaching resources is evaluated, and the user similarity is used for prediction and then solved by the Pearson similarity algorithm:

$$sim(i, m) = \frac{\sum_{u \in U}\left(R_{u,i} - \overline{r}_i\right)\left(R_{u,m} - \overline{r}_j\right)}{\sqrt{\sum_{(u \in U)}\left(R_{u,i} - \overline{R}_i\right)^2}\sqrt{\sum_{(u \in U)}\left(R_{u,m} - \overline{R}_m\right)^2}}. \tag{8}$$

The above formula U indicates the user's common score; R_i represents the average score of a user i in U; R_m represents the average score of the user m on the U set; the item set score of the user i is represented by R_i; and the item set score of the user m is represented by R_m. A similarity set between N most similar users and U_i users is built based on the above scoring items.

4.4.2. Generate Recommendations. Based on Pearson's similarity, the prediction score between D_m teaching resources and U_i users is calculated by the following formula:

$$P(i, j) = \overline{R}_i \frac{\sum_{n \in Ni} \mathrm{sim}(i, N) \cdot \left(R_{n,j} - \overline{R}_N\right)}{\sum_{n \in Ni} \mathrm{sim}(i, N)}. \tag{9}$$

After the above prediction, we can obtain the top-N recommendation set, and finally, the results are recommended to users.

5. System Performance Analysis

5.1. Simulation Test. Based on the collaborative recommendation technology, this study successfully designs the information management system for English teaching resources, applies the system in practice, and analyzes the application effect of the system utilizing a simulation test [30]. The traditional management system is utilized as the control group in the simulation experiment due to a large number of English teaching resources in the system. Figure 6 shows the simulation curve of English teaching resource information based on the results.

Table 2: Matrix of user-item scoring.

Matrix	Resources 1	......	Resources j	......	Resources n
$User_1$	U (1,1)	......	U (1, j)	......	U (1, n)
......	......	......	......	......	......
$User_m$	U(m,1)	......	U (m, j)	......	U (m, n)

Figure 6 produces ten sets of simulation data. You can prepare two computers with higher configurations and the same model before starting the simulation test. They are installed on the same simulation software, and then, 10 sets of simulation data are imported from Figure 6 into it. Before the formal simulation test, two no-load experiments are performed. Two no-load experiments are performed before the simulation test. It is the simulation software's data structure that connects to the computer and the general English teaching resource information system. The response time of the English teaching resource information management system based on collaborative recommendation technology can be simulated. Then, by sampling and analyzing the data obtained, it is possible to get the time of English teaching resources for different groups of users in different systems.

5.2. Simulation Test Results and Analysis. The time taken for users of the general system and the collaborative recommendation algorithm-based system to obtain information about English teaching resources is calculated using the simulation experiments above, and the time is plotted as a time curve in Figure 7.

When the information on English teaching resources is less than 300 copies, according to the simulated experimental data in Figure 7, users of the conventional system and the collaborative recommendation algorithm system take roughly the same amount of time to receive information on English teaching materials. However, when more than 300 copies of information about English teaching resources are added, the outcomes demonstrate that the average system users' acquisition of English teaching practice is gradually shortened, and the acquisition time of users based on the collaborative recommendation algorithm system is rapidly reduced, with a minimum of 17.5s.

Calculating the average value of 10 sets of data, the following conclusions can be drawn: compared with the general system, the cooperative recommendation-based information management system for English teaching resources developed in this study can reduce the time for users to find information about English teaching resources, which is more useful in sharing information about English teaching resources.

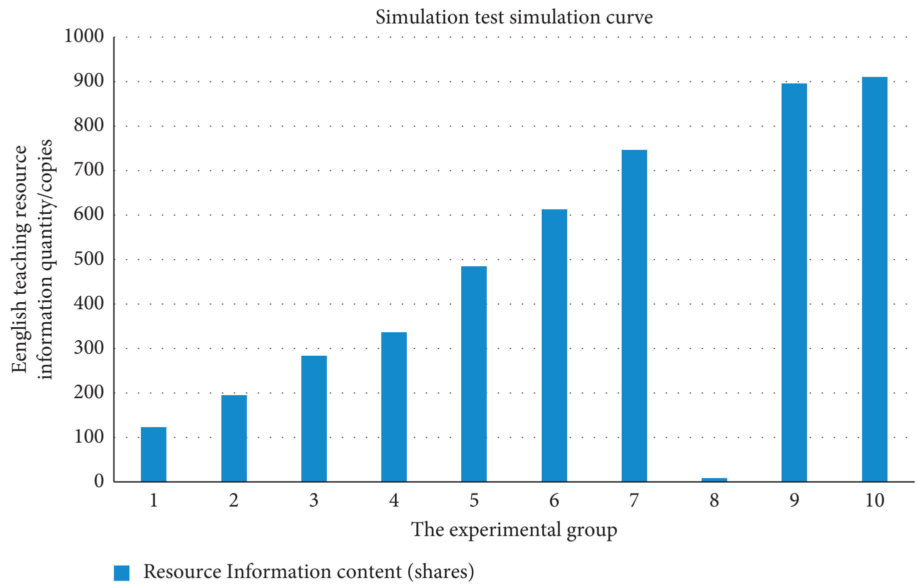

FIGURE 6: Simulation curve of simulation experiment.

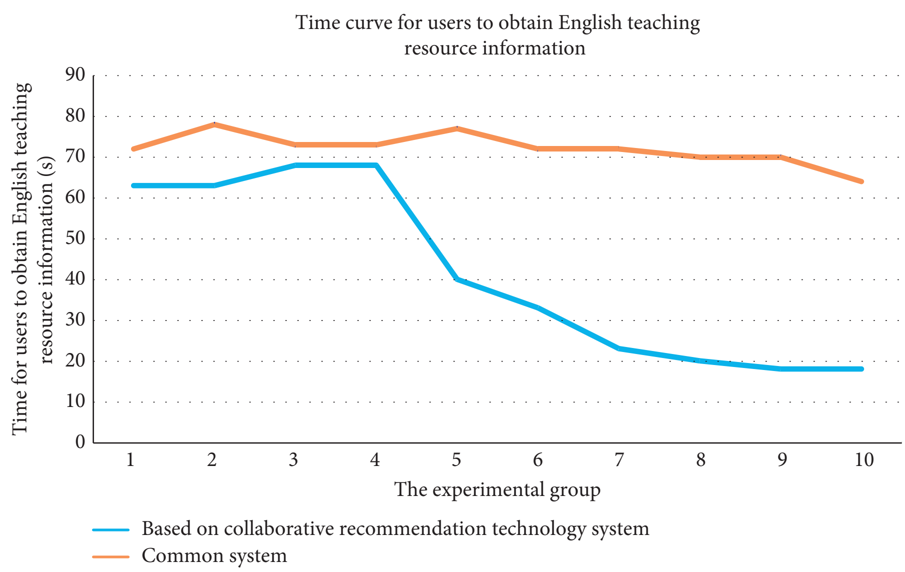

FIGURE 7: Time curve for users to get information about English teaching resources.

6. Conclusions

At present, there is a serious waste of English teaching resources. English learners are not very specific in choosing English teaching resources, and they cannot bring their own value into play. This study proposes and implements a collaborative recommendation-based information management system for English teaching resources to address this problem. Before the design, the collaborative recommendation algorithm is mainly analyzed. This algorithm provides the user-based collaborative filtering algorithm and the item-based collaborative filtering algorithm, both of which are significant algorithm support for system development. After that, the storage structure model is further developed, as well as the overall structure of the English teaching resource information management system based on collaborative recommendation technology. The most important module is the collaborative recommendation module, which mainly describes the process of the system recommending English teaching information, describes the mixed recommendation algorithm process, finds the similarity of English teaching resources, and recommends them to other users based on the similarity. Using a simulation test to test the application effect of this system, the result shows that this system can shorten the time for users to obtain English teaching resources compared with other common systems. As a result, the technique proposed in this work can fully use the collaborative recommendation algorithm and perform brilliantly. The system overhead is high, and its temporal complexity will be very high, due to the collaborative recommendation technique's high computational complexity. Therefore, greater study into systems that might be employed in the future is required.

Data Availability

The data can be made available based on initiating a request to the corresponding author.

Conflicts of Interest

For the publication of this study, the authors declare that there are no conflicts of interest.

References

[1] T. A. Syed, V. Palade, R. Iqbal, and S. S. K. Nair, "A personalized learning recommendation system architecture for learning management system," in *Proceedings of the 9th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management*, vol. 1, pp. 275–282, Madeira, Portugal, November 2017.

[2] X. Zhang, "Intelligent recommendation algorithm of multimedia English distance education resources based on user model," *Journal of Mathematics*, vol. 2022, Article ID 2012700, 8 pages, 2022.

[3] Y. Tang and Y. Yu, "A personalized recommendation system for English teaching resources based on multi-K nearest neighbor regression algorithm," *Security and Communication Networks*, vol. 2022, Article ID 7077123, 11 pages, 2022.

[4] Y. Su, X. Kong, and G. Liu, "Algorithm Based on Attention-LSTM Model," *Massive Machine-Type Communications for Internet of Things*, vol. 2021, Article ID 9940232, 11 pages, 2021.

[5] M. Zhong and R. Ding, "Design of a personalized recommendation system for learning resources based on collaborative filtering," *International Journal of Circuits, Systems and Signal Processing*, vol. 16, pp. 122–131, 2022.

[6] S. Rochmiyati, I. Ghozali, and L. Tiasari, "The character values-based folklores as teaching resources to support English acquisition," *Journal of Educational and Social Research*, vol. 10, no. 3, p. 159, 2020.

[7] Y. Koren, R. Bell, and C. Volinsky, "Matrix factorization techniques for recommender systems," *Computer*, vol. 42, no. 8, pp. 30–37, 2009.

[8] Z. Sun, M. Anbarasan, and D. Praveen Kumar, "Design of online intelligent English teaching platform based on artificial intelligence techniques," *Computational Intelligence*, vol. 37, no. 3, pp. 1166–1180, 2021.

[9] H. Du, "An English network teaching method supported by artificial intelligence technology and WBIETS system," *Scientific Programming*, vol. 2021, Article ID 8783899, 9 pages, 2021.

[10] R. Y. Li, M. Tapaswi, R. J. Liao, J. Jia, R. Urtasun, and S. Fidler, "Situation recognition with graph neural networks," in *Proceedings of the 2017 IEEE International Conference on Computer Vision*, pp. 4183–4192, Venice, Italy, October 2017.

[11] F. Wu, T. Zhang, A. H. Souza, C. Fifty, T. Yu, and Q. Kilian, "Simplifying graph convolutional networks," in *Proceedings of the 36th International Conference on Machine Learning*, pp. 6861–6871, Long Beach, CA, USA, June 2019.

[12] M. F. Aljunid and M. D. Huchaiah, "An efficient hybrid recommendation model based on collaborative filtering recommender systems," *Journal of Intelligent Technology*, vol. 6, no. 4, p. 13, 2021.

[13] N. Manouselis, R. Vuorikari, and F. Van Assche, "Collaborative recommendation of e-learning resources: an experimental investigation," *Journal of Computer Assisted Learning*, vol. 26, no. 4, pp. 227–242, 2010.

[14] P. Dewi, E. Elihami, M. I. Usman, A. Asbar, and S. Saidang, "Technology-enhanced learning research in higher education: a recommendation system for creating courses using the management systems in the E-learning 5.0," *Journal of Physics: Conference Series*, vol. 1933, no. 1, Article ID 12125, 2021.

[15] K. Wahyudi, J. Latupapua, R. Chandra, and A. S. Girsang, "Hotel content-based recommendation system," *Journal of Physics: Conference Series*, vol. 1485, no. 1, Article ID 12017, 2020.

[16] R. C. Konapure and L. M. R. J. Lobo, "Video content-based advertisement recommendation system using classification technique of machine learning," *Journal of Physics: Conference Series*, vol. 1854, no. 1, Article ID 12025, 2021.

[17] R. H. Wang, "Research and application of hybrid recommendation model for library based on XGBoost: a case study of communication university of China library," *The Library Journal of Henan*, vol. 42, no. 1, pp. 104–108, 2022.

[18] B. Yu, H. L. Yang, and M. Leng, "Recommendation algorithm based on user interest model," *Computer Systems & Applications*, vol. 27, no. 9, pp. 182–187, 2018.

[19] G. L. Ge, L. Y. Yuan, and X. C. Wang, "Personalized user interest modeling based on context aware," *Application Research of Computers*, vol. 34, no. 4, pp. 995–999, 2017.

[20] J. J. Geng, "Research on automatic classification and sharing system of English digital teaching resources in colleges and universities," *Techniques of Automation and Applications*, vol. 40, no. 1, pp. 177–180, 2021.

[21] H. Y. Sang and X. H. Sun, "Design of English teaching resources information integrated management system of based on artificial intelligence," *Modern Electronics Technique*, vol. 43, no. 10, pp. 173–175, 2020.

[22] L. Y. Lei and G. L. Liu, "Investigation and thinking on the efficiency of dormitory resources utilization in teaching hospital," *Chinese Hospital Architecture & Equipment*, vol. 20, no. 2, pp. 93–96, 2019.

[23] J. X. Shen and M. Y. Bao, "Research on optimized collaborative filtering recommendation algorithm based on hadoop platform," *Computer Engineering & Software*, vol. 39, no. 2, pp. 1–5, 2018.

[24] Y. Xu, Y. Bu, Y. Z. He, and Y. Zhao, "A preliminary study on university course integration and recommendation from the perspective of information resource development," *Modern Information*, vol. 37, no. 3, pp. 57–61, 2017.

[25] Z. Y. Liu, F. Wang, and Y. X. Zhang, "Students'Preference for course selection based on collaborative filtering algorithm: taking hebei north university as example," *Journal of Hebei North University (Natural Science Edition)*, vol. 37, no. 11, pp. 57–64, 2021.

[26] Z. Y. Wang and X. F. Wang, "An improved personalized recommendation algorithm for matrix filling based on user interest difference," *Computer Applications and Software*, vol. 37, no. 12, pp. 224–230, 2020.

[27] G. F. Zhang, L. Xu, F. C. Yu, and D. S. Li, "Research on a modified recommendation algorithm based on user-based collaborative filtering," *Video Engineering*, vol. 43, no. 14, pp. 5–10, 2019.

[28] F. S. Jiao and S. Q. Li, "Collaborative filtering recommendation based on item quality and user ratings," *Data Analysis and Knowledge Discovery*, vol. 3, no. 8, pp. 62–67, 2019.
[29] Q. Li, J. Zhong, X. Li, and Q.. Li, "Memory management mechanism for hybrid memory architecture based on new non-volatile memory," *Acta Electronica Sinica*, vol. 47, no. 3, pp. 664–670, 2019.
[30] S. X. Hu, "Hepatic flavin-containing monooxygenase and aldehyde oxidase activities in male domestic pigs at different ages," *Drug Metabolism Letters*, vol. 12, no. 2, pp. 125–131, 2018.