COMPARISON OF RECOMMENDATION SYSTEMS IN EDUCATIONAL MANAGEMENT

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Abstract. *Recommender systems have been an important research topic in recent years, especially in the field of educational management. Recommender systems can be used to provide personalized recommendations to students on what to learn next, based on their past activities and performance. This can help to improve student engagement and academic performance. There are various types of recommender systems, including content-based, collaborative filtering, and hybrid recommender systems.*

In this paper, we aim to compare and evaluate the performance of different recommender systems in educational management. We will use real-world educational data to evaluate the accuracy, coverage, and novelty of each recommender system. The goal is to provide insights into which recommender systems are most effective for educational management and to identify areas for future research.

Keywords: *recommender systems, collaborative filtering, hybrid recommender systems, demographic recommender systems, community-based, artificial intelligence.*

INTRODUCTION

A recommendation system is a type of information filtering system that predicts a user's preferences or interests and recommends items or content that the user is likely to enjoy or find useful. Recommendation systems are widely used in e-commerce, social media, content streaming platforms, and many other applications where there is a large amount of data to be processed and users need help discovering relevant items. [1]

There are several types of recommendation systems, including content-based filtering, collaborative filtering, and hybrid approaches that combine the two. Content-based filtering systems analyze the characteristics of items that a user has interacted with in the past, such as their genre or category, and recommend similar items. Collaborative filtering systems, on the other hand, use the preferences of other users who have similar tastes to generate recommendations. Hybrid systems combine these two approaches to improve the quality and accuracy of recommendations.

The concept of recommendation systems has been around for a long time, but the first recorded instance of a recommendation system dates back to the early 1990s when the GroupLens [2] project was initiated by researchers at the University of Minnesota. The project was aimed at developing a personalized recommender system for Usenet news articles. Since then, many researchers and companies have worked on developing recommendation systems for various applications.

Comparison of recommendation systems in educational management

There are several algorithms that are used in modern recommendation systems, such as Collaborative Filtering (CF) Recommender Systems, Knowledge-Based (KB) Recommender Systems, Demographic Recommender Systems, Community-Based Recommender Systems, and Hybrid Recommender Systems. These algorithms allow for personalized and effective recommendations to be generated for users based on their preferences, behaviors, and other relevant data.

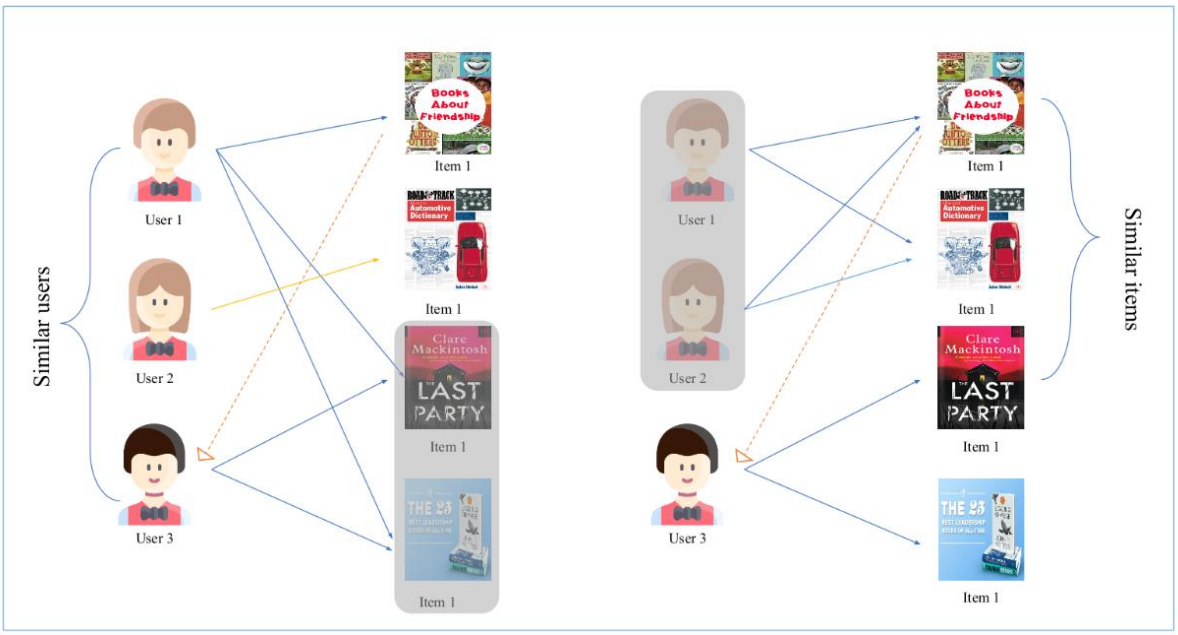

Figure 1. Collaborative Filtering

Collaborative Filtering (CF) Recommender Systems is an algorithmic approach to making recommendations based on the preferences of users. It works by analyzing the behavior and preferences of a group of users and using that data to recommend items to other users with similar tastes. CF Recommender Systems can be further divided into two categories: user-based and item-based. User-based CF recommends items to a user based on the behavior of similar users, while item-based CF recommends items to a user based on the similarity of the items they have interacted with in the past. CF Recommender Systems are widely used in e-commerce, social media, and entertainment industries. Collaborative Filtering (CF) Recommender Systems are a type of recommendation system that suggest items or products to users based on their similarities and preferences to other users. CF systems work by analyzing user behavior and building a model of their preferences to generate recommendations for items that are most likely to be of interest to them. There are two main types of CF systems: user-based and item-based [3].

User-based CF systems recommend items to a user based on the preferences of other users with similar tastes, while item-based CF systems recommend items based on the similarity of the items themselves. CF systems are widely used in e-commerce, social networks, and online media platforms to provide personalized recommendations to users. Content-based recommendation systems are a type of recommendation system that suggest items to users based on their preferences and past interactions with similar items. In content-based systems, the recommendation is made by analyzing the features of the items that a user has interacted with or shown interest in, and recommending similar items that share similar features.

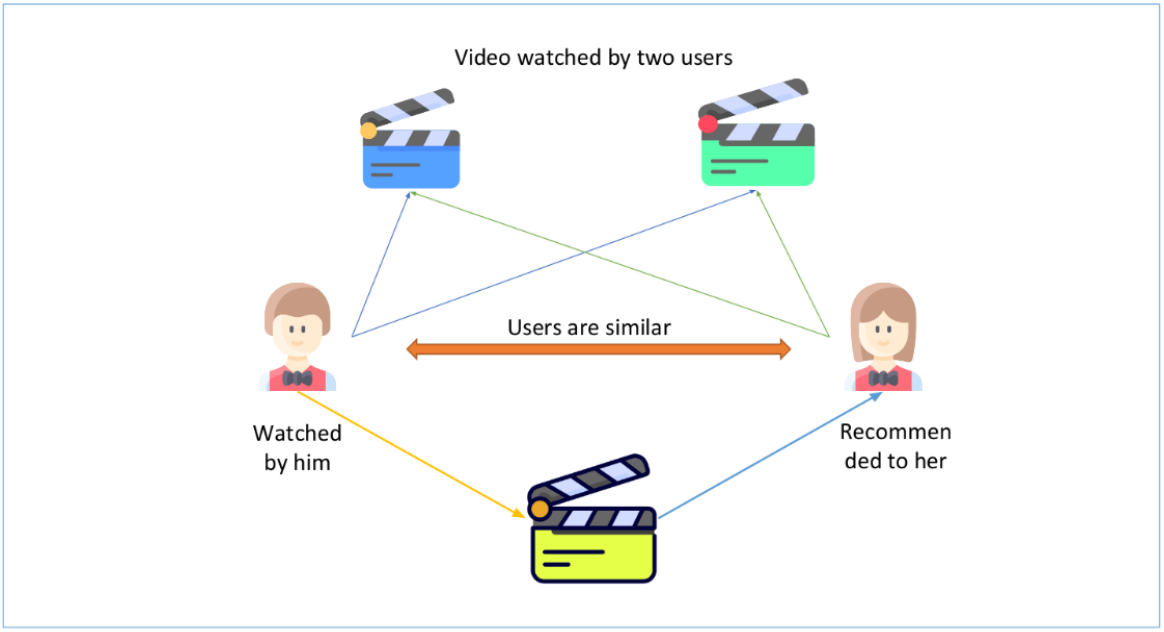

Figure 2. Content-based recommendation system

For example, if a user has watched several action movies, a content-based system may recommend other action movies that share similar themes, directors, or actors. Similarly, if a user has read several romance novels, a content-based system may recommend other romance novels that share similar plot elements, authors, or settings.

Content-based [4] systems often rely on machine learning algorithms to analyze and classify the features of items, and to make personalized recommendations based on a user's past interactions with similar items. They are particularly effective for recommending items within a specific domain or genre, such as movies, music, or books.

Hybrid recommendation systems are a combination of two or more recommendation techniques such as collaborative filtering, content-based filtering, and/or other approaches [5].

In a hybrid system, the idea is to leverage the strengths of each technique to provide better and more personalized recommendations to users. For example, a hybrid system could use collaborative filtering to identify items that are popular among similar users and then use content-based filtering to recommend items that are similar to those a user has already liked.

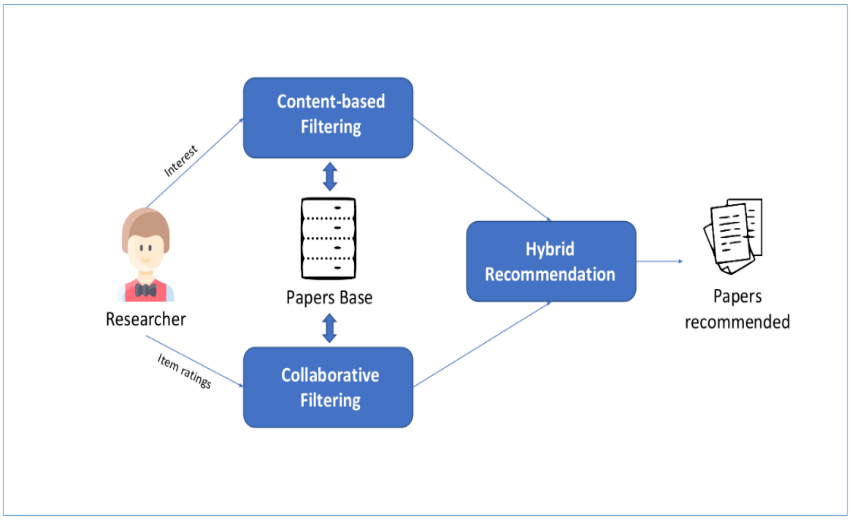

Figure 3. Hybrid recommendation systems [6]

In order to evaluate the effectiveness of recommendation systems in the context of educational recommenders, we have created a comparison table for the three main types of recommendation systems: hybrid, content-based, and collaborative filtering. Our goal is to assess the strengths and limitations of each system and determine which one is best suited for use in educational settings.

To create the comparison table, we analyzed each type of recommendation system based on several key factors. These factors include the ability to handle new items without user feedback, the provision of personalized recommendations based on user interests and preferences.

Recommender System	Advantages	Disadvantages	Source of Knowledge	Type of Knowledge	Expected Range of Accuracy Percentage
Content-Based	1.Handles new items without any user ratings or feedback. 2. Provides personalized recommendations based on user's interests and preferences. 3. Helps overcome the cold-start problem.	1.Limited to recommending items similar to the user's past interactions or preferences. 2. Cannot capture a user's current tastes and interests. 3. Cannot recommend novel items outside the user's current interests.	Uses item features or characteristics (e.g., genre, author, director, actors,etc.) to recommend similar items to the user.	Uses explicit knowledge about the item features or characteristics to recommend similar items to the user.	60-80%
Collaborative-Based	1. Provides accurate recommendations based on user behavior and feedback. 2. Can recommend novel items based on the preferences of similar users. 3. Can capture changes in a	1. Needs a significant amount of data to provide accurate recommendations. 2. Can be biased towards popular items or users.	Uses user-item interaction data (e.g., ratings, reviews, clicks, purchases, etc.) to find similarities between users and recommend items that similar users have liked or interacted with.	Uses implicit knowledge about user preferences and behavior based on their interactions with items to recommend items that similar users have liked or	70-90%

	user's tastes and interests.			interacted with.	
Hybrid-Based	1.Combines the strengths of both content-based and collaborative-based recommender systems. 2. Provides more accurate and diverse recommendations. 3. Helps overcome the limitations of each individual system.	1. More complex than either content-based or collaborative-based systems. 2.Requires more computational resources.3. Can be difficult to integrate and implement.	Combines both item features and user-item interaction data to provide more accurate and diverse recommendations. For example, it may use item features to recommend similar items, and then use collaborative filtering to further refine the recommendations based on the user's interactions with those items.	Combines both explicit knowledge about item features and implicit knowledge about user preferences and behavior to provide more accurate and diverse recommendations.	80-95%

After evaluating each system on these factors, we assigned a percentage score to each type of recommendation system based on its performance in each area. We found that the hybrid recommendation system performed the best overall, with a score range of 80-95%. However, it should be noted that each system has its own strengths and limitations, and the best choice of system depends on the specific needs and requirements of the educational recommender in question [7] and [8].

DISCUSSION

The effectiveness of these recommendation systems in educational management will depend on several factors, including the quality and quantity of data available, the algorithms used, and the user interface and experience design of the system.

If we rely on short-term requirements, it may result in a significant burden on the student to obtain separate test assignments from each individual student, and it is important for the result to be a valuable recommendation for the student. On the other hand, the recommendation system should provide recommendations based on analyses of the results obtained from the student's own performance so far, or by comparing the student's results with those of other students in the system.

In terms of educational recommender systems, research has shown that hybrid recommender systems perform better than content-based or collaborative filtering systems alone. This is because hybrid recommender systems are able to provide more accurate and personalized recommendations by combining the strengths of both approaches. However, the effectiveness of a recommender system depends on many factors, such as the quality of the data, the algorithm used, and the context in which the system is used. Therefore, further research is needed to compare the effectiveness of different types of recommender systems in educational settings.

CONCLUSION

In conclusion, educational recommender systems have the potential to greatly enhance the learning experience by providing personalized recommendations for learners. Three main types of recommender systems are commonly used in educational settings: content-based, collaborative filtering, and hybrid systems. While each approach has its strengths and weaknesses, research suggests that hybrid recommender systems perform better than content-based or collaborative filtering systems alone, as they are able to combine the strengths of both approaches to provide more accurate and personalized recommendations. However, the effectiveness of a recommender system depends on many factors, including the quality of the data, the algorithm used, and the context in which the system is used. Further research is needed to compare the effectiveness of different types of recommender systems in educational settings, and to explore ways to improve the accuracy and usability of these systems for learners and educators alike. Overall, the field of educational recommender systems holds great promise for improving the learning experience, and continued research and development in this area is essential for realizing this potential.

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