

THE BOOK FORUM: APPLICATION SYSTEM WITH HYBRID FILTERING AND RECOMMENDATION USING COLLABORATIVE FILTERING AND AUTOENCODERS

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ABSTRACT

The digital era has transformed the way we discover and engage with books. However, the abundance of available options often makes it challenging for users to find books tailored to their individual preferences. To address this issue, the development of Android applications incorporating advanced recommendation techniques has gained significant attention. This review paper explores the concept of using autoencoders with collaborative filtering and hybrid filtering algorithms as the backbone for book recommendation systems within Android applications. It leverages the power of autoencoders, a type of neural network, to generate personalized book recommendations based on user ratings, reading history, and behaviors. Collaborative filtering techniques analyze user interactions to identify patterns and similarities, while hybrid filtering combines multiple recommendation models to provide accurate and diverse suggestions. Additionally, the application offers features such as popular book recommendations and genre-based suggestions to cater to a wider range of user preferences. The application for book recommendations integrates advanced recommendation techniques using autoencoders and collaborative filtering. In addition to personalized recommendations, it offers a range of functionalities. Users can create wishlists, bookmark books, and even upload their own books as authors. An admin portal ensures efficient management and moderation of uploaded books. The application also includes a forum for user discussions about specific chapters or books. Overall, this comprehensive solution enhances user satisfaction and engagement, providing a seamless reading experience. This review paper highlights the innovative idea and its implications for the book industry and digital reading community.

Keyword Book Recommendation, Collaborative filtering, Hybrid filtering, Autoencoders.

1. INTRODUCTION

A Recommend system is a type of information filtering system that provides personalized recommendations to users based on their preferences and past behaviour. Recommend systems have become increasingly popular in recent years due to the vast amount of data generated by users and the need for more efficient ways to filter through this data and provide personalized recommendations. It is mainly used in e-commerce websites, streaming platforms, social media applications, and online marketplaces. Systems have been developed to utilize various recommendation

algorithms such as collaborative filtering, content-based filtering, and hybrid approaches to improve the accuracy of recommendations.

Most recommenders use collaborative and content-based filtering, but hybrid approaches that combine both techniques have been shown to provide more accurate recommendations. Collaborative filtering uses user behaviour data, such as ratings and purchase history, to recommend items that other users with similar preferences have liked or purchased. Collaborative filtering can be further divided into user-based and item-based approaches, with the former focusing on finding users similar to the target user and the latter focusing on finding items similar to those previously liked or purchased by the target user. These similar items are recommended based on their similarity scores, ensuring that the suggested items are relevant to the user's interests. Content-based filtering, on the other hand, utilizes item features such as genre or category to recommend items that are similar to those the user has interacted with in the past. It utilizes natural language processing and machine learning techniques to analyse the content of the items that users have interacted with to recommend similar items to users. Hybrid approaches combine collaborative and content-based filtering techniques to leverage the strengths of both methods and provide more accurate recommendations. By implementing a hybrid approach, recommender systems can overcome some of the limitations and challenges faced by solely using either collaborative or content-based filtering, such as addressing data sparsity issues, overcoming the cold-start problem, and mitigating the potential for filter bubbles.

of their interests. Incorporating these advanced algorithms allows for more advanced analysis and can The neural network framework is used for developing advanced recommender systems that can adapt and learn from complex patterns in user behaviour and item features, resulting in more accurate and personalized recommendations. One of the key advantages of using such an approach is its ability to continually improve over time as it ingests more data, thereby enhancing user satisfaction and ultimately increasing the likelihood of user engagement and retention. Implementing a neural network in a recommendation system can involve various aspects, such as data pre-processing, model selection and configuration, training process optimization, and evaluation metrics definition. Additionally, the incorporation of various deep learning techniques such as autoencoders can further enhance the system's ability to capture intricate patterns and temporal dependencies, leading to a more sophisticated and effective recommendation experience.

A book recommendation system using a hybrid approach can improve the accuracy and diversity of recommendations provided to users. This is achieved by combining content-based filtering, collaborative filtering, and other algorithms to generate personalized reading suggestions tailored to individual preferences. Consequently, this fosters increased engagement with the platform and enhances users' overall reading experience. Applying neural networks with that, such as deep learning techniques, enables the system to capture intricate patterns in users' reading habits and preferences, resulting in a more sophisticated understanding lead to even more accurate recommendations.

2. LITERATURE REVIEW

Table-1: Comparative analysis on Book Recommendation Systems

Title	Algorithm	Result	Drawbacks
The design of disciplinary book recommendation system based on android: a view of extra-curricular activities	DAO (Data Access Object) E-R mapping	Searched books will be presented on main interface of application from the database.	Recommends based on basic user information.

Book Recommendation Using Machine Learning Methods Based on Library Loan Records and Bibliographic Information	Machine learning modules based on Support vector machine (SVM), Random Forest, and Adaboost	Data displayed with detail records of students and books that have been previously borrowed from the library	Recommendation is performed only on loan based records and bibliographic information
Research on Personalized Book Recommendation Model for New Readers	Cosine similarity, Euclidean similarity, Jaccard similarity	At specific conditions significant algorithms are used and managed to get desired outcome.	When number of neighbour trend to increase, simultaneously the recommend effect achieves the best effect.

Online book platforms require effective recommendation systems to suggest relevant content based on user preferences and reading habits. Techniques such as Data Access Object, ER mapping, and Machine Learning (e.g., SVM, Random Forest, AdaBoost) have been used to improve accuracy and user satisfaction. Recent advancements include Personalized Recommender and Embedding Models that consider factors like reading history and user-generated content. Challenges like the cold-start problem and data sparsity need further research to enhance system performance and address limitations.

Table-2: Comparative Analysis on Content based and Collaborative Filtering Algorithms

Title	Algorithm	Result	Drawbacks
Book Recommendation for eLearning Using Collaborative Filtering and Sequential Pattern Mining	Collaborative Filtering & Sequential Data	Provides more accurate recommendations with less bias	Has cold-start and sparsity problem
A Deep Learning Based Collaborative Neural Network Framework for Recommendation System using matrix function	Collaborative filtering and matrix factorization	Recommendation of books after searching for keyword.	Correlation between several users is much larger than the number of user who express similar interest of items. Cold start problem.
Book Recommendation system based on Collaborative Filtering and Association Rule Mining for College Students	User-based collaborative filtering and association rule mining.	Book recommendation system which recommends books to users according to their price range and preferred publishers.	The recommendation system is basically used only for students which will recommend textbooks.

Recommendation systems for books predominantly rely on collaborative filtering, content-based filtering, and hybrid approaches to deliver personalized book suggestions to users based on their preferences and reading patterns. Extensive research has been devoted to enhancing the accuracy and user satisfaction of these systems through the development of various algorithms and techniques. These methods encompass matrix factorization, deep learning, and natural language processing techniques, enabling the analysis of user-item interactions and content information to significantly enhance the quality of recommendations. Overcoming challenges such as the cold-start problem, correlation issues, and data sparsity commonly encountered when dealing with limited data for new users or items is a crucial aspect of improving recommendation systems. Moreover, while some systems require an active internet connection for real-time recommendations, others are capable of providing offline suggestions based on preloaded data.

3. METHODOLOGY

3.1 Techniques and Algorithms

Collaborative filtering is a powerful technique used in recommendation systems to filter out items that a user might like based on reactions from similar users. It involves collecting user ratings and reviews to create personalized content feeds. This technique identifies users with similar tastes and combines their preferences with a mathematical model to predict the likelihood of a user liking a particular item. Several factors, such as positive ratings and the number of users who rated an item positively, are considered in the algorithm.

There are various collaborative filtering algorithms available for recommending items to users. User-based Collaborative Filtering identifies other users who have rated the same items and recommends highly-rated items from these similar users. Item-based Collaborative Filtering, on the other hand, finds other items that have been rated similarly to a given item and recommends these similar items to the user. Matrix Factorization is particularly useful when there are many users or a large number of items. It decomposes the user-item matrix into smaller matrices, representing user vectors and item vectors, and predicts ratings by calculating the dot product of these vectors.

In our approach, the autoencoder will be trained using collaborative filtering data, such as user-item ratings and reviews. The autoencoder architecture will consist of an encoder component that learns to compress the input data into a lower-dimensional representation and a decoder component that reconstructs the original input from the compressed representation. The purpose of training the autoencoder is to learn a compact representation of the user-item interactions, capturing the underlying preferences and patterns in the data.

Once the autoencoder is trained, it can be used to encode both user and item data into meaningful latent representations. These representations can capture the essential characteristics and preferences of users and items, enabling more accurate recommendations. By incorporating the autoencoder into the collaborative filtering framework, we can effectively exploit the non-linear relationships and dependencies present in the data, leading to improved recommendation performance.

With context-aware filtering. This involves considering additional contextual information, such as user demographics, time, and location, to further refine the recommendations. By combining collaborative filtering with context-aware filtering, we can provide more personalized and relevant recommendations that align with the user's current context and preferences.

3.2 Data Preparation

In the book recommendation system, the initial dataset consisted of two separate data frames: one with user ratings and reviews, and another with book details. Data preparation involves processing these data frames by handling missing values, duplicates, and normalizing ratings. The book details frame can be enriched by adding features like publication year and number of pages. External data sources, such as book reviews, can be incorporated to improve recommendations.

Data cleaning involves checking for missing values, outliers, duplicates, and inconsistencies. Data integration combines different datasets into a single source. Data transformation converts the data into a suitable format for machine learning algorithms. Feature engineering selects relevant features for accurate predictions.

The data is then split into training and testing sets for model evaluation. Data pre-processing prepares the data for training the machine learning model. Autoencoders, combined with collaborative filtering, can effectively build the recommendation system. Collaborative filtering recommends items based on user behaviour, while autoencoders encode and decode user-item data for predicting missing ratings. The model is trained on ratings data, optimizing with a loss function like RMSE or MAE for accurate predictions.

3.3 System Implementation

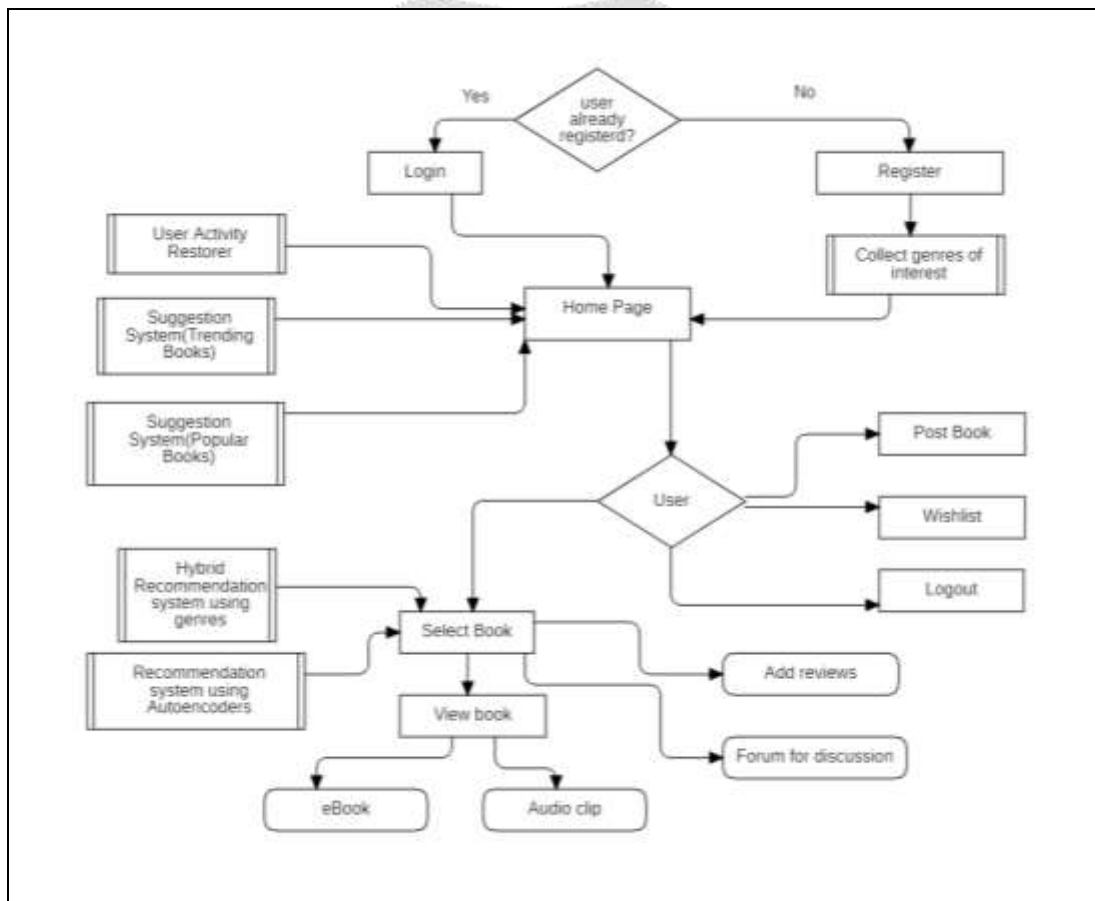


Fig -1 Workflow of System Application

The implementation of the book recommendation system involves incorporating collaborative filtering with autoencoders, hybrid recommendation techniques, popular books, genre-based recommendations, user review discussions on a forum, and an audio feature for eBook reading.

Collaborative filtering with autoencoders plays a crucial role in the recommendation system. It utilizes user ratings and reviews to capture latent patterns and preferences, enabling accurate and personalized book recommendations. By leveraging the power of autoencoders, the system can effectively encode and decode user-item data, making predictions for missing ratings and enhancing recommendation accuracy. The system also employs hybrid recommendation techniques, combining collaborative filtering with other algorithms such as content-based filtering

or context-aware filtering. This approach takes advantage of multiple recommendation methods to provide diverse and tailored book suggestions to users. Hybrid recommendations help overcome limitations and improve the overall quality of recommendations.

In addition to collaborative and hybrid filtering, the system incorporates popular books as a recommendation feature. It analyzes user ratings, reviews, and purchase history to identify books that are currently trending or highly rated, ensuring users have access to popular and well-received titles. Genre-based book recommendations further enhance the system's personalization capabilities. By analyzing user preferences and book characteristics, the system suggests books from specific genres that align with the user's interests, allowing for more targeted and relevant recommendations. To encourage user engagement and facilitate discussion, the system includes a forum where users can share their book reviews and interact with other readers. This feature provides a platform for users to exchange thoughts, recommendations, and insights, fostering a sense of community and enhancing the overall reading experience. Moreover, the system offers an audio feature for eBook reading. This functionality allows users to listen to the content of the books, providing an alternative reading experience and catering to users who prefer audio formats or have visual impairments.

By integrating collaborative filtering with autoencoders, hybrid recommendation techniques, popular books, genre-based recommendations, user review discussions, and an audio feature for eBook reading, the implemented book recommendation system offers a comprehensive and personalized experience for users, enhancing their engagement, satisfaction, and enjoyment of the platform. An easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

4. RESULTS AND DISCUSSION

In the results, the autoencoders with collaborative filtering model outperformed existing systems with an impressive RMSE value of 0.01951 after 10 epochs. This indicates that the model achieved better accuracy in predicting user ratings and providing personalized book recommendations compared to previous approaches. The improved RMSE value demonstrates the effectiveness and superiority of the proposed recommendation system in generating more accurate and tailored book suggestions for users.

5. CONCLUSION

In conclusion, the recommendation system application incorporating autoencoders and hybrid filtering, along with additional features such as eBook reading and listening, wishlist functionality, and user review sharing, provides a comprehensive and interactive platform for book enthusiasts. By utilizing autoencoders, the system accurately captures user preferences and behavior, enabling personalized book recommendations. The hybrid filtering approach enhances recommendation diversity and accuracy by combining collaborative and content-based techniques. The inclusion of eBook reading and listening features caters to different user preferences and accessibility needs, offering a versatile reading experience. The wishlist functionality allows users to save and track desired books, while the user review sharing feature fosters a vibrant community where users can express their thoughts and recommendations. Additionally, empowering users to become authors and upload their own documents adds a unique dimension to the platform, further enriching the content and engaging users as active participants. With an admin portal for document review and approval, the system ensures content quality and moderation. In conclusion, this recommendation system application provides an immersive and inclusive environment for book lovers, promoting discovery, interaction, and creativity within a dynamic reading community.

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