International Journal of Education and Science Research Review
E-ISSN 2348-6457
Volume-9, Issue-4 July-August- 2022
P-ISSN 2349-1817
www.ijesrr.org
Email- editor@ijesrr.org

A STUDY ON THE APPLICATIONS OF RECOMMENDATION SYSTEMS

Edem Suresh Babu
Research scholar
Department of CSE
Benguluru University

Dr. N. Rangitha
Professor
Benguluru University

ABSTRACT

Recommendation systems are a useful technology that can alleviate the problem of overload of information provided to users. It predicts the grade of items to be recommended to the user, creates a list of recommendation rankings for each user, and makes it possible to recommend items related to the user. Several platform services actively recommend personalized items that meet the needs of users by introducing a recommendation system. In order to improve the performance of these recommendations, studies on various recommendation filtering models and data mining techniques are being conducted.

A good performance of the recommendation system means that it recommends an item suited to the user's taste. Furthermore, not recommending items that are not suited to the user's taste is also part of a good recommendation system model. In general, Accuracy was used as an indicator to evaluate the performance of the recommendation model. Accuracy means the ratio of successful recommendations to all the recommended items. Accuracy can intuitively evaluate model performance, but it is difficult to accurately judge model performance when the information data on user preference items are unbalanced. Therefore, to evaluate performance in more detail, Precision and Recall indicators are used. Precision is derived by calculating the proportion of items that match the user's taste based on the item recommended by the model to the user. Recall is derived by calculating the ratio of items to be recommended by the recommendation model to the user based on the item selected by the actual user.

Keywords:

Recommendation, User, System

INTRODUCTION

Matrix Factorization recommendation system became widely known through the Netflix Prize, and especially solves the problem of scarcity in Collaborative Filtering. Matrix Factorization is a method to characterize items

and user data after inferring elements from user evaluation data for items and storing them as vectors. The main purpose of this technique is to find the dimension of the latent factor that expresses the user information and the user's preference by storing the user's evaluation data in the Rating Matrix. In particular, it offers good scalability and flexibility as it can analyze users' tastes by using data such as mouse movement and search pattern, as well as explicit data that the user directly evaluates for a specific item.

K-Nearest Neighbor (KNN) is an algorithm that classifies K-nearest neighbors of test tuple and train tuple to classify a dataset. KNN classifies datasets based on the closest distance by comparing the similarity between each item of data through distance- based weighting. Euclidean distance, cosine similarity, and Pearson correlation are mainly used as measures to compare similarities. When the KNN algorithm is used in a recommendation system, the user's search pattern can be classified and the user's future preference can be predicted. After analyzing the patterns of user behavior data, such as users' web server logs and click stream data, it can be used to classify items similar to users' tastes, and then use the results to recommend suitable items.

On the other hand, Jannach et al. published a study result indicating that the performance of the recommendation model studied using the KNN algorithm was poor. Since KNN must select an appropriate value for K, which governs the performance of the model, there are inefficiencies that require repeated experiments and the problem of being biased by K. In addition, the performance of KNN is degraded in analyzing data with a large input size. Therefore, when the size of the input data is large, dimensionality reduction that transforms the data into a meaningful expression should be used. The main goal of dimensionality reduction is to reduce data without loss of information, and principal component analysis (PCA) and linear discriminant analysis (LDA) are mainly used for this purpose.

Clustering is an algorithm that identifies finite categories or clusters to describe data, and is widely used in recommendation systems because of its low redundancy and ambiguity. There are many different types of clustering techniques used in the recommendation system, but K-means clustering is mainly used. K-means clustering is an algorithm that clusters around the mean after setting the number of K clusters. After calculating the similarity between all the data in the recommendation system, it is assigned to the nearest cluster and the calculation is repeated in the order of calculating the cluster center. However, if the number of clusters is small, K-means clustering is vulnerable to the scalability problem, in which the calculation speed decreases when the number of users and items increases while the recommendation system is servicing

On the other hand, Gong performed user clustering and item clustering using a similar inter-user clustering technique based on user ratings for items and conducted a study to recommend personalized recommendation items. As a result of studying the method of finding a cluster group similar to the recommended target user

based on the similarity between items in this study, the problems of scalability and scarcity, which are the disadvantages of the existing Collaborative Filtering approach, were solved.

Clustering was mainly used in the Collaborative Filtering recommendation model and was generally studied in the recommendation system in the tourism, education, and e-commerce fields.

Singular value decomposition (SVD) is a method that provides predictive data to customers by analyzing various item data to transform the user and selected items into a space of the same latent factor . The algorithm offers the advantage of increasing the efficiency of the recommendation system by reducing computational overload. In the existing recommendation system, it was difficult to identify user preferences with tag and like data in the SNS field because it was possible for multiple users to make recommendations based on numerical evaluation of common items. However, Matrix Factorization is widely used because it makes it possible to provide recommendations using information collected in various ways in the SNS field.

APPLICATIONS OF RECOMMENDATION SYSTEMS

The recommendation system has been expanded and used in various service fields. In this study, we intend to analyze how the recommendation models and technologies for various recommendation systems described above are studied and utilized according to the characteristics and purpose of the actual service field. Based on the papers collected for analysis, the service fields in which the recommendation system was used were classified into seven main categories: Streaming Service, Social Network Service, Tourism Service, E-Commerce Service, Healthcare Service, Education Service, Academic Information Service. The seven main categories are divided based on the list of services that use a recommendation system with increasing users or increasing business value, and the list of services that appear frequently when ’Recommendation System’ of the Google Scholar search engine is searched as a keyword.

In the past, video content, such as movies, were mainly consumed by users through TV or movie theaters. However, recently, a significant amount of video content is consumed through streaming platforms such as Netflix and YouTube. Audio content is also changing from downloading and consuming files to a user’s local device to consuming content through streaming platforms such as Spotify. Streaming services related to media content have been developed along with the recommendation system because it is necessary to reduce users’ worries about choosing a vast amount of content and to provide content that is tailored to each user. In general, in the streaming service field, user preference data is collected centering on the user’s media content service usage history data, and after mapping user preference with all the content owned by the streaming service, recommendations are generated in the order of the content most similar to the user’s preference.

Until the early 2000s, in the streaming service field, the Content-Based Filtering model was widely used in recommendation systems. However, in the Web 2.0 era, due to the inefficiency of providing only some content to users in a streaming service that features large amounts of rich content data, 'research on the usefulness of the Collaborative Filtering method that recommends items in consideration of the similarity between users' was mainly conducted . On the other hand, the biggest feature of streaming services is that information is categorized by genre, artist, and cast of items. Due to these characteristics, studies using text mining techniques were mainly used in the study of recommending streaming services. In the study by Odic´ et al., Text Mining was performed on the properties of users' video viewing item list in order to recommend content desired by the user. In Text Mining, ontology was used to not only find movie items desired by users, but also to recommended items considering users' situational information.

Recently, the number of streaming service users has exponentially increased. Therefore, to ensure smooth service, it is necessary to reduce the overload of calculating user preference analysis. In order to solve this problem, studies have been conducted to improve various recommendation techniques and recommendation filtering models for streaming services.

Barragáns-Martínez et al. used the Singular Value Decomposition (SVD) algorithm to reduce computational overload when calculating user preferences to alleviate major problems such as limitations in scalability and data sparsity. Through this, a Hybrid Recommendation model that recommends TV programs with higher user preference was proposed. As a result of evaluating the performance of the proposed model, 0.78 was derived from MAE, and as a result of additional user testing, it was claimed that positive feedback was received.

A study by Walek et al. proposed a Hybrid recommendation model that recommends movies that fit user preferences using the SVD algorithm and Fuzzy Logic, based on user's preferred movie genres and movie ratings. As a result, promising values for Precision (81%), Recall (83%), and F-measure (82%) were achieved.

Since the music streaming service field exerts a greater influence on user preference compared to other content, high predictive power is required for user preferences . To this end, studies on a Content-Based Filtering recommendation model considering user data and audio content data and on a Hybrid recommendation model study that combines a Collaborative Filtering model that considers evaluation data of other users similar to the user were performed.

On the other hand, in the field of music streaming service, the study of music content recommendation was mainly conducted in consideration of audio characteristics such as genre, melody, and rhythm that reflect the user's taste. Wang et al. analyzed the item properties of music using Text Mining, extracted audio signal features such as the rhythm and melody of music data, and recommended items. This study proposed a Hybrid recommendation model that recommends music that users prefer using a Neural Network. As a result of

comparing the RMSE values of the Hybrid model proposed in this paper and the general Content- Based Filtering model, the RMSE of the Hybrid model was 0.255 and the result of the Content-Based Filtering RMSE 0.270 was derived. Therefore, it could be confirmed that the Hybrid model proposed in this paper showed better recommendation performance.

McFee et al. proposed a study to analyze audio similarity through content analysis of data samples preferred by similar user groups obtained through Collaborative Filtering. Through the similarity analysis results for each audio signal of the optimized audio content, a Hybrid recommendation model that enables the recommendation of various lesser- known music was proposed. In other words, this study proved the expandability of the recommendation system for music streaming service by solving the weakness of Content- Based Filtering, the narrow range of user preference items.

In the field of SNS, a number of studies on Hybrid recommendation models have been conducted. Amato et al. proposed a Hybrid recommendation model that can provide recommendations based on user interaction and generated multimedia content on multiple SNSs. Through Text Mining, we analyze user preference data, text comments that can relate user emotions, behavioral data such as past logs performed by users, and user evaluation data for various contents. As a result of the analysis, similar items were clustered to provide user-centered recommendations for social networks.

In the study by Capdevila et al., the user's preference was also analyzed using the user's geographic location and the full text data of the SNS using the Text Mining technique. A personalized item was recommended to the user according to the analysis result. Furthermore, in this study, a Hybrid recommendation model that can recommend even a location to a user was proposed.

As the demand for travel has increased, recommendation systems have begun to be used in the tourism service field to recommend tourist destinations, route recommendations, and transportation methods. As the travel-related recommendation system uses situational data, such as review data and location data, user location, time, and weather, collected through SNS, research on recommendation systems using SNS has increased in the tourism service field.

DISCUSSION

In Sulikowski et al.'s study, the Evaluation of a Recommending Interface (PERI) framework was implemented and similar performances were shown, regardless of the vertical and horizontal directions of the interface, for a fixed period of time. However, in terms of purchase commitments, the recommendation performance of the vertical layout increased by more than double. In addition, by providing a vertical arrangement and a visual effect of slowly blinking, the user's interest in the item was further elicited.

In the field of health recommendation systems that help users with professional treatment, the main goal is to provide suitable treatment methods according to the symptoms of various types of diseases and the stages of each disease. To this end, the health recommendation system analyzes the patient's information and the characteristics of the disease, offers an accurate diagnosis of the disease to the patient, and recommends an appropriate treatment according to the diagnosed disease. To this end, the Content-Based Filtering model is frequently used because it is necessary to analyze the patient's information and the characteristics of the patient's disease.

Duan et al's research is representative as a recommendation system study using the Content-Based Filtering model. In this study, Text Mining was conducted by creating a tree structure of prefixes of the item dataset to recommend treatment plans. Therefore, a study was conducted to recommend a patient care management plan that provides clinical decision support, nursing education, and impression quality management by composing an item ranking list.

A study by Chen et al. divided a patient's disease into stages, and according to each stage, a disease diagnosis and treatment recommendation system (DDTRS, Disease Diagnosis and Treatment Recommendation System) that recommends an accurate disease diagnosis and treatment plan was proposed. The DDTRS clustered large historical disease diagnosis and treatment data sets extracted from patients' examination reports. Furthermore, by applying the association analysis algorithm, the similarity of the content information of the disease, diagnosis and treatment data similar to the user was searched, and an accurate disease diagnosis and effective treatment plan were recommended. Five factors, effectiveness, chronergy, non-harmful side-effects, economy, and patient satisfaction, were utilized as indictors for the evaluation of the quality of treatment recommendations provided by DDTRS.

In addition, the field of health recommendations can suggest similar treatment modalities to other patients with similar symptoms to the patient. The Collaborative Filtering model is frequently used in studies of health recommendation systems that recommend other patient groups with symptoms similar to those of the patient.

The study by Thong et al. derived relational data after calculating the similarity between patients using the fuzzy clustering technique. Based on the relational data derived in this way, a medical diagnosis recommendation system that classifies patients into groups according to disease characteristics was recommended. In this study, after finding a patient group with similar disease characteristics to the diagnosed patient, the Collaborative Filtering recommendation model was used to diagnose the patient by checking the medical diagnosis record of the corresponding patient group.

On the other hand, in the field of e-health services, health data customized to the user are used to help the user independently control their health data. In the field of e-health services, we provide a variety of content

containing the health data needed by users without having to go through a specialist, and we focus on enabling users to access personalized health information as well as everyday health information at anytime and anywhere. Therefore, in this field, the recommendation system based on the Content-Based model that provides personalized health contents based on the user's health data has mainly been used.

CONCLUSION

Research related to the recommendation system in the E-commerce field is increasing rapidly every year. In addition, recently, research on advanced recommendations related to the interface of the digital platform has been conducted. As the number of items advertised in E-commerce increases, the user's level of interest gradually decreases. Therefore, research related to arranging an effective interface to increase user interest is being conducted.

REFERENCES

1. Bokde, D.K., Girase, S., Mukhopadhyay, D.: An approach to a university recommendation by multi-criteria collaborative filtering and dimensionality reduction techniques. In: Proceedings of the 2015 IEEE International Symposium on Nanoelectronic and Information Systems, iNIS 2015, pp. 231–236 (2016)
2. Tan, H., Guo, J., Li, Y.: E-learning recommendation system. In: 2008 International Conference on Computer Science and Software Engineering, pp. 430–433 (2008)
3. Cho, J., Kang, E.Y.: Personalized curriculum recommender system based on hybrid filtering. In: Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics. LNCS, vol. 6483, pp. 62–71 (2010)
4. Pinto, F.M., Estefania, M., Cerón, N., Andrade, R.: iRecomendYou: a design proposal for the development of a pervasive recommendation system based on students profile for Ecuador's students' candidature to a scholarship. In: New Advances in Information Systems and Technologies, vol. 445, pp. 537–546 (2016)
5. Ansari, M.H., Moradi, M., Nikrah, O., Kambakhsh, K.M.: CodERS: a hybrid recommender system for an E-learning system. In: Proceedings - 2016 2nd International Conference of Signal Processing and Intelligent Systems, ICSPIS 2016, pp. 14–15 (2017)
6. Kong, X., Boll, S., Heuten, W.: Towards recommender systems supporting knowledge sharing and transfer in vocational education and training. In: 2013 Second International Conference of E-Learning E-Technologies Education, pp. 25–30 (2013)

7. Ibarra, M.J., Serrano, C., Navarro, Á.F.: Recommender system to identify students with learning deficiencies in assessments. In: 2016 International Symposium on Computers in Education, SIIE 2016. Learning Analytics Technologies (2016)

8. Zaiane, O.: Building a recommender agent for e learning systems. In: Computers in Education, Citeulike.Org, pp. 55–59 (2002)

9. Zhou, J., Luo, T., Lin, H.: A novel recommendation system with collective intelligence. In: Proceedings - 2010 IEEE 2nd Symposium on Web Society, SWS 2010, 151–157 (2010)

10. Valdiviezo-Díaz, P., Aguilar, J., Riofrio, G.: A fuzzy cognitive map like recommender system of learning resources. In: 2016 IEEE International Conference on Fuzzy Systems, FUZZ-IEEE 2016, pp. 1539–1546 (2016)