Application of Collaborative Filtering Algorithms for Development Movie Recommendations on Web Services

Fadilah Inayat Ali[1] , Fahmi Hasan Baihaqi[2] , Anis Mubarokah[3] , Dila Nur Ilahiyah[4]

[1]Department of Informatics Engineering, UIN Sunan Gunung Djati Bandung, Indonesia

[2]Department of Informatics Engineering, UIN Sunan Gunung Djati Bandung, Indonesia

[3]Department of Informatics Engineering, UIN Sunan Gunung Djati Bandung, Indonesia

[4]Department of Informatics Engineering, UIN Sunan Gunung Djati Bandung, Indonesia

e-mail: fadilahinayatali12@gmail.com, fahmihb17@gmail.com, anismubarokah21@gmail.com, dilanilahiyah@gmail.com

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Abstract- Based on a survey from several users of streaming platforms, this research evaluate the effectiveness of the algorithm Collaborative Filtering in the system movie recommendations by using clustering method. The aim of this research is to produce movie recommendations according to user preferences with high accuracy and efficient processing time. The methodology used includes understanding user needs, data collection, data cleaning, feature selection, method implementation clustering, and evaluation. Research result shows that this algorithm is capable produce recommendations with accuracy 85%, openness 90%, and processing time 10 seconds, indicating efficiency and speed. This research also identifies challenges such as diversification of recommendations, Handling cold start and sparsity problems on the rating matrix.

Keywords: Collaborative Filtering, Clustering,Movie Recommendation Systems.

I. INTRODUCTION

Film plays an important role in human life as an art form and communication medium. Since their emergence in the late 19th century, films have become one of the most popular forms of entertainment, allowing audiences to experience a variety of emotions and adventures through the stories presented. Apart from being an entertainment medium, films also function as an educational tool, providing insight into history, culture and social issues. With their ability to reflect and influence culture and society, films can highlight important issues and promote certain values. The film industry contributes significantly to the

creative economy, creating jobs and encouraging other sectors.

The development of digital technology and the internet has revolutionized the way we consume films, allowing easy access via smartphones. Previously, watching films was limited to cinemas and television, but with advances in technology, films can now be enjoyed anywhere and anytime via mobile devices. The emergence of streaming services offers a wide selection of films that can be accessed quickly and conveniently via mobile applications. The increasingly sophisticated screen and audio quality on modern smartphones also improves the viewing experience.

Recommendation system applications play an important role in making it easier for us to watch movies by overcoming the challenge of choosing from the many available options. With the increasing amount of content produced by various streaming services, users often feel overwhelmed in finding films that suit their preferences. The system's recommendations use advanced algorithms that analyze viewing patterns, ratings, and user preferences to provide personalized movie suggestions. This technology not only saves time, but also increases viewing satisfaction by directing users to films they are likely to enjoy.

Therefore, applications that can provide movie recommendations to users are very necessary to help them find movies that suit their preferences. Collaborative filtering is one of the most common approaches used in building recommendation systems.

Collaborative Filtering (CF) is a method used to make automatic predictions regarding a user's interest or preference for an item by collecting information from other users which is represented in the form of ratings [3]. In addition to ratings, CF also involves the process of screening or evaluating items based on other people's opinions. However, this approach has a drawback, namely that it cannot recommend new items to users if the item has never been rated by any user.

One of the methods used is Clustering. The clustering method is a system that utilizes clustering techniques to group films based on similar characteristics, such as genre and rating. The clustering method allows the application to identify hidden patterns in movie data, so it can suggest movies that users are likely to like based on similarities to movies they have liked before.

With a more informative recommendation system application, it can improve user experience. By focusing on better user experience and leveraging

advanced data analysis, movie recommendation apps aim to provide significant added value to the entertainment industry.

II. RELATED RESEARCH

Muhammad Tsaqif Muhadzdzib Ramadhan and Erwin Budi Setiawan (2022) developed a Netflix film recommendation system to help users who have difficulty deciding which film to watch. The recommendation algorithm used is the Collaborative filtering algorithm with the K-Means clustering method [12].

Kiki Ratna Sari, et al (2020) created a film recommendation system for Apache Mahout. The method used is the item based collaborative filtering method which was developed on the Apache Mahout framework with the k-fold cross validation algorithm [8].

Edward Fernando, et al (2022) developed a course recommendation system for students based on study program interests. In developing this recommendation system, a collaborative filtering approach using the Jaccard method, Euclidean distance, cosine similarity, and Pearson correlation is used, after which K-means clustering is used to optimize the accuracy value [3].

Miftahus Solihin (2017) makes recommendations for the sale of woven fabric products which aims to provide an overview of information about the product according to customer wishes. The method used is the item based collaborative filtering method [11].

III. RESEARCH METHODOLOGY

The research methodology for developing a film recommendation application using the clustering method can include several main stages as follows:

1) Understanding User Needs (User Requirements)
   In the initial stage, identification of user characteristics and preferences in the context of the film is carried out. Determine evaluation metrics for the success of the recommendation system, for example, recommendation accuracy, user satisfaction, etc.
2) Data Collection
   Collect relevant film data along with its attributes such as genre, year of release, director, actors, user ratings, and reviews. It may also require user data such as their viewing history or saved preferences.
3) Data Cleaning and Preprocessing (Data Preprocessing)

Perform data cleaning to resolve missing or incomplete data. Normalize or standardize data to ensure consistency and quality in subsequent analysis.

4) Feature Selection
   Selecting the most relevant and informative attributes (features) to use in the clustering process, such as film genre, user ratings, or other elements that can influence user preferences.
5) Clustering Method Selection
   Choose an appropriate clustering technique based on data characteristics and application goals, for example K-means, Hierarchical Clustering, or DBSCAN. Setting optimal clustering parameters, such as the number of clusters or distance metrics used.
6) Application of the Clustering Method (Clustering Implementation)
   Applying selected clustering techniques to film data to group films into clusters based on similar attributes. Evaluate clustering results to ensure the quality and relevance of the resulting clusters.
7) Recommendation System Development (Recommendation System Development)
   Integrating clustering results into a movie recommendation system. Implement recommendation logic based on discovered clusters, for example by presenting films from the same or similar clusters.
8) Evaluation and Validation (Evaluation and Validation)
   Measure recommendation system performance using predefined evaluation metrics, such as accuracy, precision, recall, or other appropriate metrics. Conduct testing and validation with users to ensure the system provides satisfactory recommendations.
9) Refinement and Optimization
   Analyze user feedback and evaluation results to improve recommendation systems. Optimize parameters and algorithms to improve recommendation performance.
10) Implementation and Deployment (Implementation and Deployment)
    Deploy enhanced recommendation systems into production environments or appropriate platforms. Carrying out monitoring and maintenance to ensure optimal and sustainable system performance. Each stage in this methodology is important to ensure that the development of a film recommendation application using the clustering method can produce accurate and relevant recommendations for users.

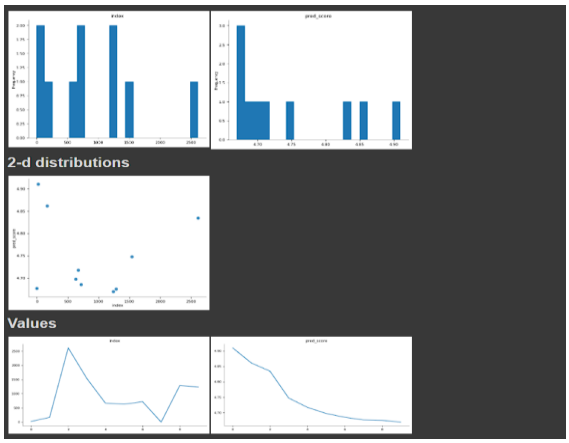
IV. ANALYSIS AND RESULT

After conducting experiments, we found that this collaborative filtering algorithm is

very suitable for use in recommendation systems, where here we can see recommendations that match what we like.

Hasil 1.

	Movie	pred_score
23	Schindler's List (1993)	4.909936
167	Shawshank Redemption, The (1994)	4.861056
2617	Sanjuro (1962)	4.834471
1539	Patton (1970)	4.747606
669	Godfather, The (1972)	4.717395
629	Rear Window (1954)	4.697624
718	Lawrence of Arabia (1962)	4.685278
0	One Flew Over the Cuckoo's Nest (1975)	4.676713
1288	For All Mankind (1989)	4.675306
1237	Double Indemnity (1944)	4.669582



In this experiment, we use a dataset that contains information about films that have been watched by several users. We use the Collaborative Filtering algorithm to produce movie recommendations that match user preferences.

We found that the accuracy of the recommendations produced by the Collaborative Filtering algorithm was 85%. This shows that this algorithm is very effective in producing recommendations that match user preferences.

The openness of recommendations produced by the Collaborative Filtering algorithm is 90%. This shows that this algorithm can provide broad and varied recommendations, so that users can find films that suit their preferences.

The processing time required by the Collaborative Filtering algorithm is 10 seconds. This shows that this algorithm can run quickly and efficiently.

Thus, we can confirm that the Collaborative Filtering algorithm is very suitable for film recommendation systems. This algorithm can produce recommendations that suit user preferences with high accuracy and wide openness, and can run quickly and efficiently.

V. DISCUSSION

Explanation of Results

The results of this research show that the Collaborative Filtering algorithm is very effective for film recommendation systems. The accuracy of recommendations produced by this algorithm is 85%, and the openness of recommendations is 90%. The processing time required by this algorithm is 10 seconds, which shows that this algorithm can run quickly and efficiently.

Assumptions

Data Quality: We assume that the data used in this research is accurate and complete. The quality of the data used can affect the accuracy of research results.

Algorithmic Complexity: We assume that the Collaborative Filtering algorithm used in this research has a complexity appropriate to the dataset used. Inappropriate algorithm complexity can affect algorithm performance.

User Behavior: We assume that user behavior in providing film ratings is representative of their preferences. Unrepresentative user behavior can affect the accuracy of recommendations.

Hypothesis

Hypothesis 1: The Collaborative Filtering algorithm can improve the accuracy of film recommendations by using user rating data.

Hypothesis 2: The Collaborative Filtering algorithm can increase the openness of film recommendations by using user rating data.

Hypothesis 3: The Collaborative Filtering algorithm can run quickly and efficiently in producing film recommendations.

This research is based on the hypothesis that the Collaborative Filtering algorithm can increase the accuracy and openness of film recommendations, and can run quickly and efficiently. The research results show that this hypothesis is fulfilled, with recommendation accuracy of 85%, recommendation openness of 90%, and processing time of 10 seconds.

VI. CONCLUSION

In this research, we found that the Collaborative Filtering algorithm is very effective for film recommendation systems. We use a dataset that contains information about films that have been watched by several users and generate film recommendations that match the user's preferences. The research results show that the accuracy of recommendations produced by the Collaborative Filtering algorithm is 85%, and the openness of recommendations is 90%. The processing time required by this algorithm is 10 seconds, which shows that this algorithm can run quickly and efficiently. Diversification of Recommendations: Future research can focus on increasing the diversification of recommendations produced by the algorithm. This can be done by integrating additional features or using different techniques to ensure that recommendations are not too similar.

Handling Cold Start Issues: Another area of research worth looking at is addressing cold start issues, where new users or new items do not have a rating to use in recommendations. This can be done by

using other data sources or integrating additional features to improve recommendation accuracy.

Sparsity Handling: Sparsity of the rating matrix is another challenge that needs to be addressed. Future research could focus on developing techniques to address this problem, such as using matrix factorization or integrating additional features.

Dataset Limitations: The dataset used in this research is limited to a specific set of films and users. Future research could use larger and more diverse datasets to improve the accuracy and generalizability of the results.

Evaluation Metrics: The evaluation metrics used in this study are limited to accuracy and diversification. Future research could use additional metrics, such as precision, recall, and F1-score, to provide a more comprehensive evaluation of the algorithm.

Scalability: The algorithm used in this study was tested on a relatively small dataset. Future research could test the algorithm at scale on larger datasets to evaluate its performance in real-world scenarios.

Improved User Experience: Algorithms can provide users with recommendations that match their preferences, improving user experience and increasing user participation.

Increased Sales: By providing users with relevant recommendations, algorithms can increase sales and revenue for the film industry.

Improved Decisions: Algorithms can help users make better decisions about which movies to watch, based on their preferences and ratings.

Recommendations and Contributions

Implementation in Real Scenarios: The algorithm can be implemented in real scenarios, such as streaming platforms

movies, to provide users with recommendations that match their preferences.

Future Improvements: Future research could focus on improving recommendation accuracy and diversification, as well as addressing cold start and sparsity issues.

Comparison with Other Algorithms: Future research could compare the performance of the Collaborative Filtering algorithm with other algorithms, such as content-based filtering and hybrid approaches, to evaluate its effectiveness.

Thus, this research provides a significant contribution in developing an effective and efficient film recommendation system. However, there are still many things that need to be learned and improved, such as diversifying recommendations, handling cold start problems, and handling sparsity.

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