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Movie Recommendation System Using Machine Learning

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Abstract- With the continuous expansion of digital streaming platforms, personalized movie recommendations have become essential to enhance user experience. This paper presents a machine-learning–based movie recommendation system utilizing content-based filtering, collaborative filtering, and hybrid approaches. The system is evaluated using the MovieLens dataset, and performance is measured using RMSE and MAE. The results indicate that hybrid models outperform individual approaches due to their ability to integrate user–item interactions with content features.

Keywords— Recommendation System, Machine Learning, Collaborative Filtering, Content-Based Filtering, Hybrid Models, Movielens Dataset.

I. INTRODUCTION

Recommendation systems play a crucial role in platforms such as Netflix, YouTube, and Amazon Prime by predicting user preferences and providing personalized suggestions. With the vast amount of available content, users face difficulty selecting relevant movies. Machine learning-based recommendation systems address this problem by learning patterns from user behavior and item features.

II. RELATED WORK

A. Collaborative Filtering

Sarwar et al. introduced user-based and item-based collaborative filtering, which relies on similarities among users or items.

B. Content-Based Filtering

This method recommends movies based on features such as genre, cast, and plot.

C. Hybrid Approaches

A combination of collaborative and content-based approaches improves accuracy and reduces cold-start issues.

III. METHODOLOGY

A. Dataset Description

This study uses the MovieLens dataset, which contains user ratings, movie genres, titles, and timestamps.

B. Preprocessing

- Handling missing data
- Multi-hot encoding for genres
- Normalization of ratings

C. Algorithms Used

1) Content-Based Filtering: Cosine similarity between movie feature vectors.
2) Collaborative Filtering: SVD-based matrix factorization.
3) Hybrid Model: Weighted combination of CF and content-based predictions.

IV. SYSTEM ARCHITECTURE

The proposed architecture consists of four layers:
1. Input Layer: User and movie IDs.
2. Processing Layer: Feature extraction and similarity computations.
3. Prediction Layer: Generating movie recommendations.
4. Evaluation Layer: RMSE and MAE calculation.

V. IMPLEMENTATION

The model is implemented using Python, Scikit-learn, NumPy, Pandas, and the Surprise library. A sample code snippet is shown below:

```
from surprise import SVD, Dataset, accuracy
from surprise.model_selection import train_test_split
```

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```
data = Dataset.load_builtin('ml-100k')
trainset, testset = train_test_split(data, test_size=0.2)

model = SVD()
model.fit(trainset)

predictions = model.test(testset)
rmse = accuracy.rmse(predictions)
```

VI. RESULTS AND DISCUSSION

A. Evaluation Metrics

- RMSE (Root Mean Square Error)
- MAE (Mean Absolute Error)

B. Comparative Analysis

Content-Based Model: RMSE=0.98, MAE=0.78
Collaborative Filtering (SVD): RMSE=0.89, MAE=0.70
Hybrid Model: RMSE=0.84, MAE=0.66

VII. LIMITATIONS

Cold-start problem

- Computational complexity
- Performance depends on metadata quality

VIII. CONCLUSION

This research demonstrates the effectiveness of machine learning techniques in movie recommendation systems. Hybrid models combining collaborative and content-based filtering show superior performance. Future enhancements may include deep learning models, autoencoders, and transformers for more refined predictions.

REFERENCES

[1] B. Sarwar et al., “Item-Based Collaborative Filtering Recommendation Algorithms,” WWW Conference, 2001.
[2] P. Resnick et al., “GroupLens: An Open Architecture for Collaborative Filtering,” CSCW, 1994.
[3] GroupLens Research, MovieLens Dataset.