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# Book Recommendation System Using Machine Learning

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**ABSTRACT:** A recommender system is a kind of filtering system that predicts a user's rating of an item. Recommender systems recommend items to users by filtering through a large database of information using a ranked list of predicted ratings of items. When selecting a book to read, individuals read and rely on the book ratings and reviews that previous users have written. In this paper, Hybrid Recommender system is used in which Collaborative Filtering and Content-Based Filtering techniques are used. The datasets are used which are downloaded from the Goodreads Website which contains the features of users and books. The content-based filtering system uses only book features for recommendation whereas the Collaborative Filtering system uses Books and Users features and the results are displayed in the Front end.

**KEYWORDS:** Book Recommender System; Truncated-SVD; Clustering; Root Mean Square Error

## I.INTRODUCTION

A Hybrid recommender system is used to boost our recommendations. The technique used by recommender systems is Collaborative filtering. This technique filters information by collecting data from other users. Collaborative filtering systems apply the similarity index-based technique. The ratings of those items by the users who have rated both items determine the similarity of the items. The similarity of users is determined by the similarity of the ratings given by the users to an item. Content-based filtering uses the description of the items and gives recommendations which are similar to the description of the items. With these two filtering systems, books are recommended not only based on the behaviour of user but also with the content of the books. So, our recommendation system recommends books to the new users also. In this paper, we used two methods i.e., K-means and Gaussian mixture for clustering the users. Root Mean square Error is used to measure the error between the absolute values and obtained values. That RMSE value is used to find the fundamental accuracy.

## II.LITERATURE SURVERY

Most researchers used Pearson's Correlation Coefficient function to calculate similarity among book ratings to recommend books.

Avi Rana and K. Deeba, et.al. (2019) [1] proposed a paper "Online Book Recommendation System using Collaborative Filtering (With Jaccard Similarity)". In this paper, the author used CF with Jaccard similarity to get more accurate recommendations because general CF difficulties are scalability, sparsity, and cold start. So to overcome these difficulties, they used CF with Jaccard Similarity. JS is based on pair of books index which is a ratio of common users who have rated both books divided by the sum of users who have rated books individually. Books with a high JS index are highly recommended.

G. Naveen Kishore, et.al. (2019) [2] proposed a paper "Online Book Recommendation System". The dataset used in this paper was taken from the website "good books-10k dataset" which contains ten thousand unique books. Features are book\_id, user\_id, and rating. In this paper, the author adopted a Keras deep learning framework model to create neural network embedding.

Uko E Okon, et.al. (2018) [3] proposed a paper "An Improved Online Book Recommender System using Collaborative Filtering Algorithm". The authors designed and developed a recommendation model by using a quick sort algorithm,

collaborative filtering, and object-oriented analysis and design methodology (OOADM). This system produces an accuracy of 90-95%.

Jinny Cho, et.al. (2016) [4] proposed a paper “Book Recommendation System”. In this paper, the author uses two approach methods which are Contentbased (CB) and Collaborative Filtering (CF). They used two algorithms as UV-Decomposition and K Nearest Neighbors (KNN). They obtained a result with an accuracy of 85%.

Sushma Rjpurkar, et.al. (2015) [5] proposed a paper “Book Recommendation System”. In this paper, the author used Associative Rule Mining to find association and correlation relationships among a dataset of items. They used CB and CF approaches to build a system.

Abhay E. Patil, et.al. (2019) [6] proposed a paper “Online Book Recommendation System using Association Rule Mining and Collaborative Filtering”. The author detected recurrently occurring patterns, correlations and uses various databases such as relational databases, transactional databases to form associations. They used two approaches i.e., User-based and Item-based Collaborative Filtering, and used the Pearson correlation coefficient to find similarity between the items.

Suhas Patil, et.al. (2016) [7] proposed a paper “A Proposed Hybrid Book Recommender System”. In this paper, the author used techniques such as Demographic, Collaborative Filtering, Content-based to build a system and rarely they combined the features of these techniques to make a better recommendation system.

Ankit Khera, et.al. (2008) [8] proposed a paper “Online Recommendation System”. In this paper, the author used the User similarity matrix, Vogoo which is PHP-based CF, Fuggy logic, Context Engine for building recommendation systems. Pearson Correlation is a similarity function in this paper.

Anagha Vaidya and Dr. Subhash Shinde, et.al. (2019) [9] proposed a paper “Hybrid Book Recommendation System”. In this paper, the author used techniques such as Collaborative Filtering etc. and used the Pearson correlation coefficient. It was published in International Research Journal of Engineering and Technology (IRJET)

### **III. PROPOSED SYSTEM**

This paper is divided into five sections. In Section 3.1, Dataset was collected from Good Reads Website in which three datasets are present i.e. Books Dataset, Ratings Dataset, Users Dataset. In Section 3.2, Datasets were preprocessed to make suitable for developing the Recommendation system. Truncated-SVD is used to reduce the features of the dataset. In Section 3.3, Content Based Filtering System is developed in which book description is taken as an input. In Section 3.4, Data splitting is done in which training dataset and testing dataset are divided into 80:20 ratio.

In Section 3.5, Collaborative Filtering System is developed by building a model using K- Means Algorithm over Gaussian Mixture after comparing with Silhouette scores.

An architecture diagram gives the high-level overview of major system components and relationships among them. It represents the flow of execution of paper. The architecture diagram of our recommendation system is shown in fig 1.

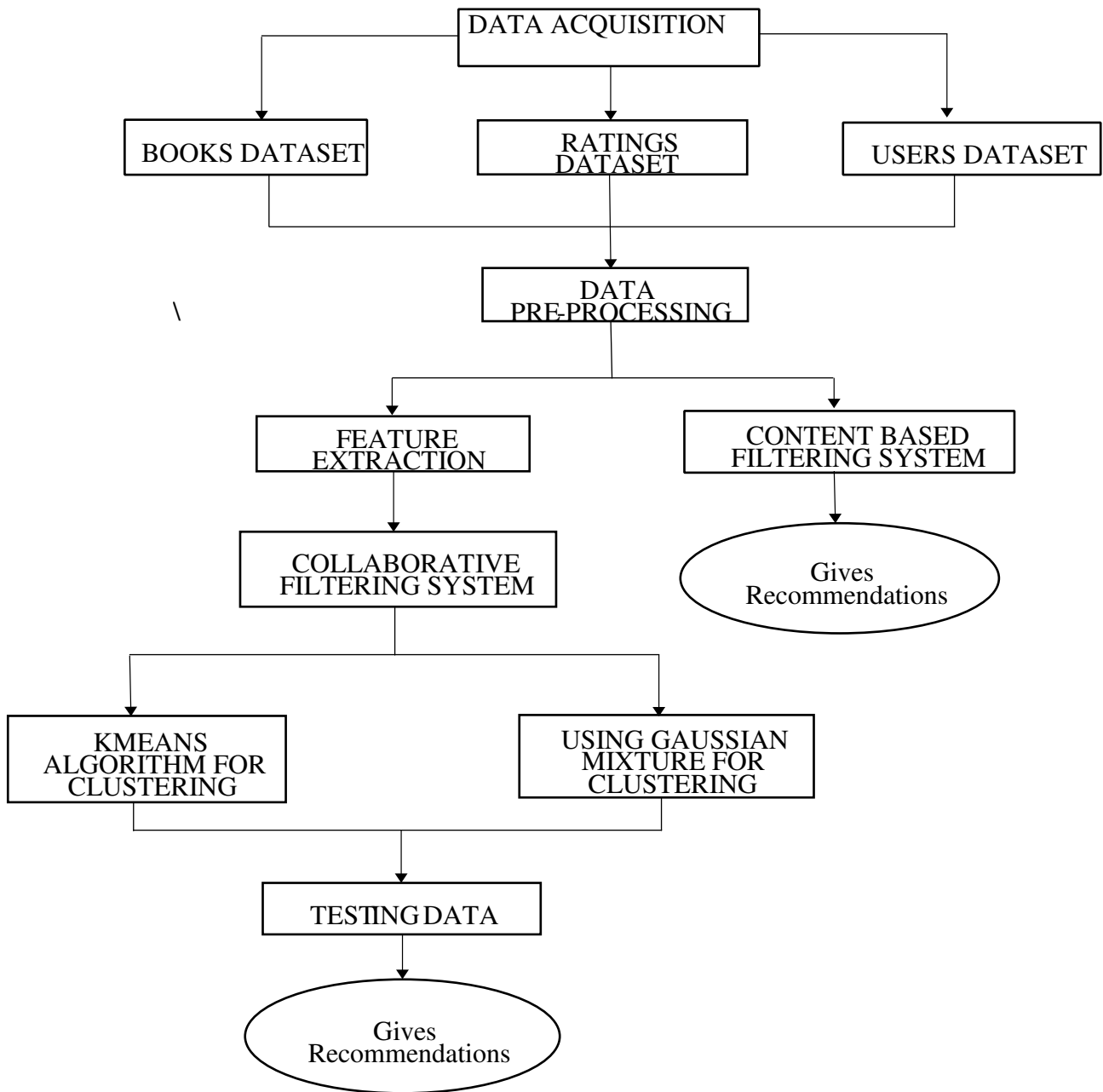


Fig. 1. System architecture

#### IV. PERFORMANCE ANALYSIS AND RESULTS

In this step, we analyse the performance of a model and checks the results. While clustering, we have applied K-Means and Gaussian mixture to cluster the users. The model which gave the best silhouette score would be used for building the system. Silhouette score is used to test the efficiency of clustering. Positive value of Silhouette score indicates good clustering whereas negative value indicates bad clustering. First, we built the model by using the K-means method and then we fit and predict the model with the training dataset. Then, we calculate the silhouette score with the developed model.

```

Clusterer_KMeans=KMeans(n_clusters=7)
.fit(book_ratings_training)
    
```



```
Preds_KMeans=Clusterer_KMeans.predict (book_ratings_training)
Kmeans_score=silhouette_score(book_ratings_training,preds_KMeans)
Print(Kmeans_score)
```

Now, we built the model by using Gaussian mixture and then we fit and predict the model using same and predict the model with the training dataset. Then, we calculate the silhouette score with the developed model.

```
Clusterer_GMM=GaussianMixture(n_components=7).fit(book_ratings_trainin)
Preds_GMM=Clusterer_GMM.predict(book_ratings_training)
GMM_score=silhouette_score(book_ratings_training,preds_GMM)
Print (GMM_score)
```

	K-Means	Gaussian mixture
Silhouette Score	0.0433968332 584411	0.01677887231 3688933

Table-1: Silhouette scores of two models

After checking the two scores, we consider the model using K-Means method with cluster count of 7 because of higher score. Then, this model is used to cluster the users.

The difference between average mean ratings of books per test user and average mean rating of books for cluster's favourite is calculated. The average mean rating is calculated by:  $\text{Average mean rating} = \frac{\text{Sum}(\text{ratings})}{\text{len}(\text{ratings})}$

Mean rating for 10 random books	3.8876949740034736
Mean rating for 10 books of cluster's favourites	4.373500866511135

Table-2: Comparing Mean ratings

Difference between ratings: 0.48580589254763984.

RMSE (Root mean square error) measures the error caused by the deviation between the sample values and predicted values by the model. The accuracy calculated by taking the RMSE value is known as Fundamental vertical accuracy whose value is computed by  $1.96 * \text{RMSE}$ .

## V.CONCLUSION

In this paper, we recommended the books for a user using K-Means model clustering which is an unsupervised machine learning algorithm. We compared the two methods for clustering and identified the best model by calculating silhouette





score. We used the datasets which are downloaded from the Good reads website. We implemented the functionalities in the system according to the requirements after understanding all the modules of the system.

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