

Review Different Methods for Recommendations

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ABSTRACT

A system that suggests items or data to a user based on a user's needs or interests is known as a recommendation system. To build these systems, recommended methods can be used. This paper analyzes some of the strategies used to build a recommended system. Some researchers combine two or more algorithms to create a recommended system. Each strategy has its advantages and disadvantages and researchers have used these methods according to their ease. In this review paper, there are about 25 pages updated.

1. Introduction

Nowadays, large amounts of data, applications and objects are available online. All retailers entice the user to purchase their products by offering tempting ads. But in reality all the products available online are not for the user and are held by false sellers. "To protect the user from these false sellers, various recommendation systems are in place. In addition, these recommended programs save a user's time by recommending things that are different to their interests.

The recommendation system is becoming a public and industrial necessity as more information and information is available online and the user needs more to get useful information in bulk data. In industry, the recommended system helps them to make the most of the advantages by distinguishing themselves from their competitors. For example, Netflix has set a challenge for its users to do better in order to recommend an app and win a \$ 1 million prize. Therefore, it is regarded as a useful and powerful tool in today's world of e-commerce."

2. Recommendation Techniques

Recommendation System is build with various techniques and algorithms. Some of them are as follow:

1. Content Based Recommended System
2. Collaborative Filtering Recommended System
3. Hybrid Filtering Recommended System

Content-Based Recommendation Program: "The first method of the Recommended Program is known as the Content-Based Approach. In this process, the problem is first classified as a retrospective problem or a separation problem. In this process, the model is designed for retrofit and problem solving based on content taken from previous users' behavior. For example, editing and retrieval focused on user feedback. Therefore, this approach is also known as a focused approach. As all is well done, calculations and modeling are done on objects. This model captures learning data from users by asking users questions and then using their answers to train the system. A product that has received the highest level of user satisfaction is recommended first. In other words, the level provided by the user helps the system to balance things. In the second case, when we work with the features of the item, our

method is then centered on the user. All the computations, modeling, and optimization are done by the user.

The main advantage of Content-Based Methods is that it is a transparent method for recommending items to the user. Whereas its disadvantage is that it has limited content to analyze and requires overspecialization.

Collaborative Filtering Recommender System: The next technique for recommending a system to the user is the collaborative filtering method. This system works on getting data from different users that have similar interest. Collaborative Filtering methods are further divided into two categories:

- a. Memory Based Technique
- b. Model Based Technique

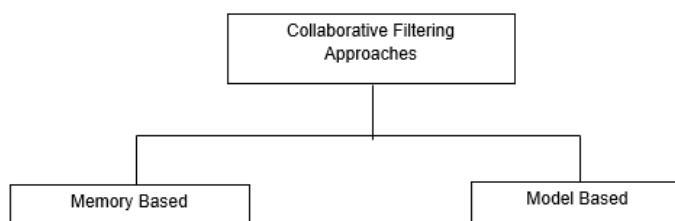


Figure 1: Categories of Collaborative Filtering Methods

Memory Based Technique: A memory-based collaborative method is further divided into two sub-categories: User-based and Object-based. In user-based memory strategies, a new recommendation is given to the user with the help of a nearby neighbor strategy where a new recommendation is given by identifying the most popular types of user-selected items." This method examines distances between different users and represents objects based on user interaction. "Therefore, it is known to be user-focused as similar user behavior is considered in order to recommend something new to the user.

In second type that is in Item Based Collaborative Filtering approach a new recommendation to the user is provided with the help of item based technique in which the main aim is to find the items that the user has already brought or interacted. Hence, from its past buying or window shopping, the new items are suggested to the user. Moreover, in item-

centered technique the researchers evaluate the distances between the items.

Table 1: Comparison between User based and Item based Collaborative Filtering Models

S. No.	Parameters	User-Based	Item Based
1	Interactions	User-Users	Item-Items
2	Variance	High	Low
3	Degree of bias	Low Bias	Highly Bias
4	Results Obtained	More Personal	Less Personal
5	Centered Around	User	Items

Model Based Techniques: In Model based collaborative filtering method, a user-item interactions are represented in the form of latent model with the help of matrix factorization algorithm. This algorithm decomposes the data taken from user-item interaction into dense and smaller matrices by taking product of the interactions. There are two matrices whose product is taken." First factor matrix contains the data taken from user and second factor matrix contains item data.

Table 2: Comparison between Memory Based and Model Based Collaborative Filtering Method

S. No.	Parameters	Memory Based	Model Based
1	Recommendation with the help of Interactions	Calculates similarity between user and items	Pre computed model
2	Data Representation	No specific Format	Matrix representation
3	Techniques used	Pearson correlation algorithm, adjusted-cosine based, correlation-based and cosine similarity	Decision tree, Clustering, Association Rule, Regression
4	Disadvantages	Time consuming, Scalability	Expensive, Data may be lost because of putting data in particular format.

Hybrid Filtering Technique: "As its name suggests, the Hybrid filtering method is a combination of the two methods mentioned above (Content filtering and Shared Filtering Techniques). Therefore, it contains your features in both content filtering and integrated filtering methods. It can be done in two ways: first, these two methods are used sequentially and secondly, these two methods are combined and used. The two approaches are combined to overcome from the problem of sparsity and cold start. For example, News Dude.

The following are the seven main hybridization Techniques.

1. **Weighted hybridization:** In heavy-duty hybridization, numerical fractional values for different recommendations were added. The output of this program provides a combination of a line produced in the middle results.

2. **Changing Hybridization:** In this process, various components are available to the user to select one of the different recommendations.
3. **Mixed Hybridization:** In this technique, a set of the recommendations are generated independently for every component and these components are joined together to rank them provide to the user.
4. **Feature Hybridization:** In this, the features of different techniques are added together to form a one recommendation system to the user.
5. **Feature Augmentation:** In this technique, the set of features are given to the intermediate method and then this intermediate method provides final output as a recommendation system.
6. **Cascade Hybridization:** In this technique, the priorities are given to the items and the recommendations to the items are given according to the priorities of the items.
7. **Meta Level:** In this process, one recommendation model acts as an input to another recommendation model in order to provide output.

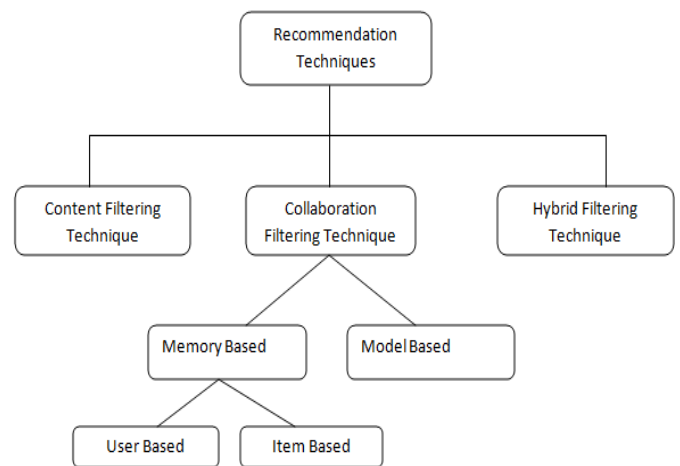


Figure 1: Classification of Techniques

Table 3: Comparison of Content Filtering, Collaboration Filtering and Hybrid Filtering

S. No	Parameters	Content Filtering	Collaborative Filtering	Hybrid Filtering
1	Recommendation Based on no. of users	Single User	Many users with similar interest	Combination of both
2	Information about user	Personal information of the user is required	Do not required	Depend upon situation
3	Recommendation based on	Content (characteristics) of user or items	User-user and item-item interactions	Combination of both
4	Demerits	Require more specialization	Scalability, Data sparsity, cold start problem	Expensive, Increase complexity
5	Merits	Transparency and independent of the user	Serendipitous Recommendation	Overcome problems of both the techniques

6	Interpretability	Easy to Interpret	Hard to Interpret	Hard to Interpret
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3. Challenges Faced by the Recommendation System

1. Privacy: The main problem faced by the recommendation system is the privacy. As the reviews from different users are taken with the help of questionnaires and answers are not hidden from other users. Hence, there is no privacy in the recommendation system and users easily see the answers of other people and try to copy the answers.
2. Scalability: As the number of users increase, the recommendation has more data to be processed. Hence, the recommendation system should be scalable so that system can easily handle the additional data which increases with the result of increase in the number of users.
3. Interpretability: As the data comes from different sources, it is difficult to interpret the data in the recommendation system. The data in content based recommendation system gets easily interpret as compared with collaborative based recommendation system.
4. Synonymy: It is very difficult for the machine to find difference between two similar data. So recommendation systems are not able to understand the synonyms of the word and treated it as a different word which is given by the user as a review for recommending the system.
5. Cold Start: The other problem faced by the new users is known as cold start because it is difficult for the recommendation system to suggest new items to a new users as their profile of buying the products are empty and system could not able to recommend items according to their interest.”

4. Literature Review of different Authors

S. No.	Authors	Research Work
1.	Jaysri et al. [2]	Review various filtering techniques, mainly focus on collaborative techniques.
2.	Ekstrand et al. [3]	Provide outlook to the techniques of recommendation system.

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3.	Gunawardana and Shani [4]	Provide a way how to choose various algorithms for their recommendation system.
4	Portugal et al. [5]	Reviewed a use of Machine Learning in the recommendation system.
5.	Ouhbi et al. [6]	Proposed a system to overcome a problem of existing approaches by using the concept of deep learning.
6	Zhang et al. [7]	Reviewed a technique based on deep learning recommendation system
7	M. Z. Kurdi [8]	Have used lexical classifiers which help in detecting the feelings of users using content based recommendations
8	M. A. Ghazanfar and A. Prügel-Bennett [9]	Have focused on extending the methods to handle the problems of scalability and cold start.

5. Evaluating Methods

The recommendation system is evaluated in ways.” If the recommendation system is based on numeric values such as matching probabilities or ratings prediction. Then, the system is evaluated by finding Mean Square Error metric.” In second case, if the recommendation system is not producing numeric values, then it is evaluated by the Humans. For examples, the review stars given by the humans to every items.

6. Conclusion

This document provides information about filtering techniques used to recommend things to users. It also contains comparisons between various filtering techniques of the recommended program. From the above, it concludes that every strategy is different from other strategies. The content-based filtering process is based on user content or objects while the collaborative filtering process is further divided into categories: Memory-based method and model-based methods. In the previous case, the user-to-user interaction or object helps to recommend the system. In the latter case, the model is designed to recommend things to the user based on the interaction of the user object. “In mixed filtering, both strategies are integrated.

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