RESEARCH REVIEW JOURNALS
Volume-04
Issue-03
March -2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com [UGC Listed Journal]

A Study: "Analysis On Recommendation Techniques"

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ARTICLE DETAILS

Article History
Published Online: 15 March 2019

Keywords
algorithms, recommended techniques, recommended system

ABSTRACT

A system which recommends the items or data to the user according to the needs or interest of the user is known as recommendation system. To build these systems, recommended techniques could be implemented. This paper analyzes some of the techniques that are used to build a recommended system. Some of the researchers combine the two or more algorithms to create a recommended system. Each technique has its own merits and demerits and researchers used these techniques according to their ease. For this review paper, there are approximately 25 papers are reviewed.

1. Introduction

In the modern era, a huge amount of data, applications and items are available on the internet. All the vendors attract the user to buy their products by offering tempting advertisements to them. But in reality all the products that are available on the internet are not good for the user and they got trapped by the false vendors. To protect user from these false vendors, various recommendation systems come into existence. Moreover, these recommended systems save the time of the user by recommending different items to them according to their interest.

Recommendation system is becoming the need of the society and industries as a lot of data and information are available on the internet and user need some to get useful information from a bulk amount of data. In industries, recommended system helps them to earn a great amount of profit by standing out differently from their competitors. For example, Netflix has organized a challenge for their users to perform better to recommend the application and win a price having worth of 1 million dollars. Hence, it is considered as a useful and powerful tool in the modern world of the 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 Recommended System: The first technique of Recommended System is known as Content Based Method. In this technique, the problem is firstly categorized as a regression or a classification problem. In this technique, a model is build for regression as well as classification problem on the basis of content taken from the users past behavior. For classification and regression model the main focus is on the answers given by the users. Hence, this approach is also known as item centered approach. As all the optimization, computations and modeling are done on the items. This model takes the data for learning from the users by asking questions from the users and then uses their answers for training the system. The product which got highest ranking from the users is recommended first. In other words, the ranking given by the user helps the system to rank the items.

In second case, when we work with features of item, our method is then centered on user. All the computations, modeling and optimization is done by the user.

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

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

a. Memory Based Technique
b. Model Based Technique

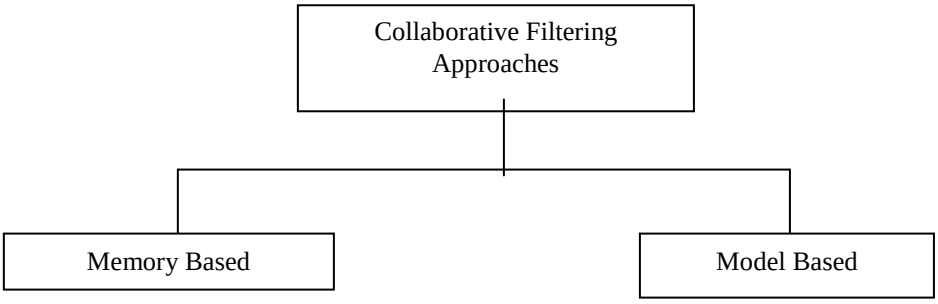

Figure 1: Categories of Collaborative Filtering Methods

Memory Based Technique: The memory based collaborative filtering technique is further divided into two sub categories: User based and Item Based. In users based memory techniques, the new recommendation is provided to the user with the help of the nearest neighbors technique in which the new recommendation is given by identifying the most popular types of items selected by the user. This method evaluates the distances between the various users and represents the items based on the interactions of the users. Hence, it is known as user centered as the users similar behavior is taken into consideration for recommending new item 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	Calculates similarity between user and items	Pre computed model
1	Interactions	User-Item, Item-Item	User-Item
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 suggest, Hybrid Filtering technique is the combination of above two mentioned (Content filtering and Collaborative Filtering) methods. Hence, it contains thefeatures of both content filtering and collaborative filtering methods. It can be implemented in two ways: firstly, the two techniques are implemented one after another and secondly, these two techniques are combined and then implemented. These two techniques are combined to overcome from the problem of sparsity and cold start. For example, NewsDude.

The following are the seven main hybridization Techniques.

1. Weighted hybridization: In weighted hybridization, the numerical component values of different recommendation are added. The output of this system gives a linear combination produced by the intermediate results.
2. Switching Hybridization: In this technique, the various components are available to the user to select one from different recommendation components.
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 technique, one recommendation model is act as an input to the other recommendation model to provide output.

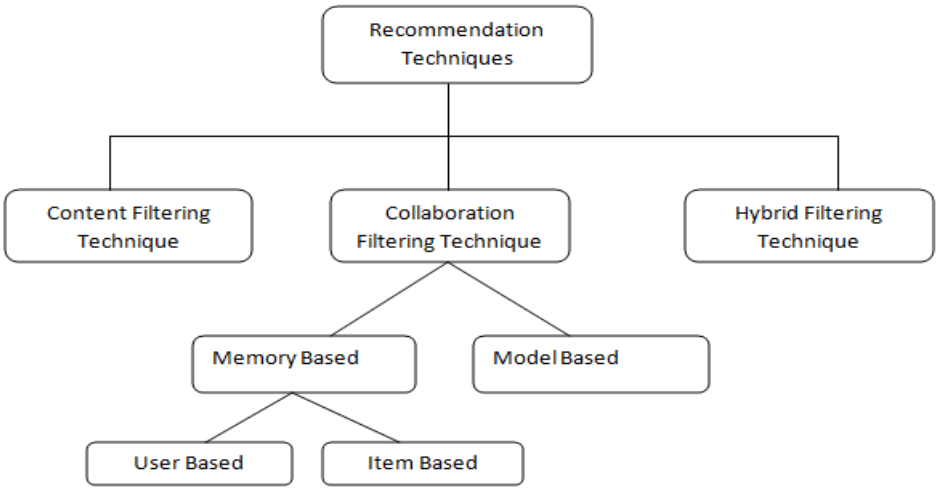

Figure 1: Classification of Techniques

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

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.
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 manuscript provides information about the filtering techniques used for recommending items to the users. It also contains the comparison between the various filtering techniques of recommending system. From above, it is concluded that every technique is different from other techniques. Content Based filtering technique is based on the content of the users or the items whereas a collaborative filtering technique is further divided into categories: Memory based technique and Model based technique. In former case, user-user or item-item interactions help in recommending the system. In later case, a model is build to recommend items to the user that based on user-item interactions. In hybrid filtering, the both techniques are combined.

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