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A Review on Recommendation System

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ABSTRACT: As an emerging trend and due to drastic growth in e-commerce industry the information about the products is increasing with statistical rate. In such environment the customers are facing problems to search ultimate information about products from a tremendous amount of information. Hence, to make the work of buyer simpler, the e-commerce companies have developed a recommendation system to help their customers choose the products more easily. Recent years have experienced an incredible interest in recommendation system. In this paper we describe the related search of recommendation system and introduce the different recommendation techniques with their approaches. The major challenges and issues faced by recommendation system will conclude the paper.

KEYWORDS: Recommendation System, Collaborative Filtering, Content-Based Recommendation, Hybrid Recommendation, Privacy, Cold-Start Problem

I. INTRODUCTION

Goldberg, Nichols, Oki & Terry developed the first recommender system in 1992. An electronic messaging system named Tapestry [1] was used that would allow user to rate messages by either “good” or “bad”. Recommender system is a customized information filtering technology or a software tool that provides suggestions to the user for a particular item [1] whether to use it or not. Recommender system aim to recommend items such as movies, books, videos, music, web pages [2] and so on to the interest or attraction of user. Typically a recommender system contrast a user’s profile to some reference characteristics and then pursue the ‘preference’ or ‘rating’ that a user would apply to any item which they had not considered yet. Such characteristics consist of user’s social environment commonly known as collaborative filtering or the information item which is known as content-based approach.

Content-based approach rely on profile of user preference and description of item. Collaborative filtering rely on gathering and examining huge amount of data on user’s activities behaviours or preferences and assuming what users will like based on their sameness to other users. To predict user’s interest or attraction on a particular product, information and services the recommendation system applies prediction algorithms and data mining techniques. Human computer interaction (HCI) or Information Retrieval (IR) are the neighbouring areas used by recommender systems to apply techniques and methodologies. 3 steps are used to carry out the process of data mining, namely: Data Pre-processing, Data Analysis and Result Interpretation. The famous websites like eBay, Levis, Netflix, Moviefinder.com, amazon.com, YouTube [3], Yahoo are the examples of recommender system. Despite of number of advances in recommender system there is still a requirement of improvement in recommender system and due to this improvement recommender system will become a rich research area.

II. RECOMMENDATION TECHNIQUES

Recommendation system usually generate list of recommendation in one of the two ways: through Content based filtering or collaborative filtering [4]. Hybrid recommender system is also another approach for recommendation.lifetime in [3].

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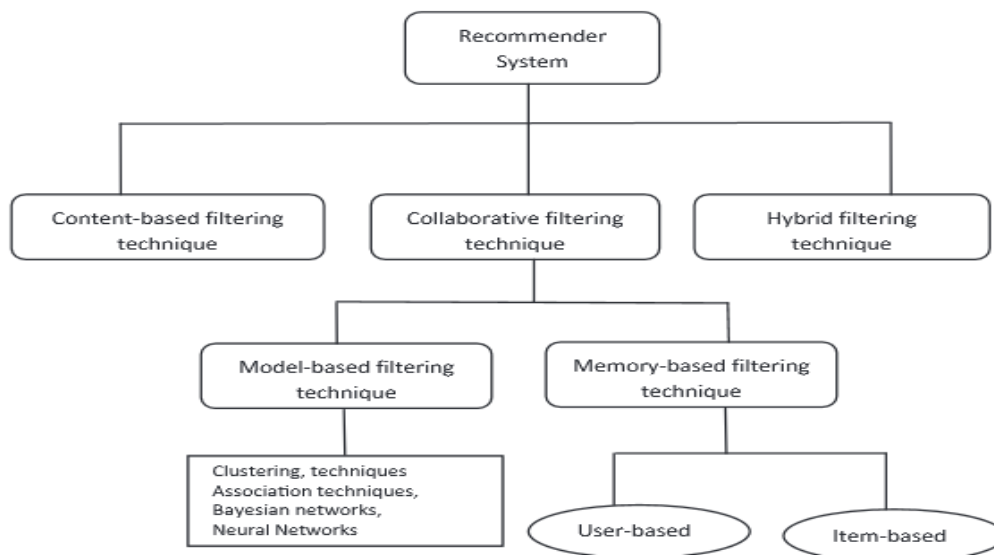


Fig. 1 Recommendation System

Collaborative Filtering is the most prosperous type of recommendation system and has become one of the most researched techniques of recommender system. In 1997 Paul Resnick and Hal Varian described the Collaborative Filtering approach [5]. The basic idea of this approach is to search users in an area that share appreciation. If two users rate a particular item equally then it is considered that they have identical tastes. This equality or similarity of taste between two users is calculated based on similarity on the rating history of two users. A group or neighbourhood is built on the basis of these users. As the relation of two or more users is considered collaborative filtering is also considered as “people-to-people correlation”. A user also gets recommendation to those items which he or she hasn't rated before, this is because those items were rated by the users in his or her neighbourhood.

Various approaches of collaborative filtering are:

- A. *User Based Approach*: In the end of 1990s professor of University of Minnesota Jonathan L. Hellocker proposed this user-based approach. In this approach the main lead role is performed by the users. If a majority of users or customers have same choice then they link into a single group. Recommendations are suggested to users based on estimation of items by other users construct the same group [9] with whom the user share their common preferences. If a particular item will be recommended to user only if that item will be positively rated by the community.
- B. *Item Based Approach*: The researcher of University of Minnesota proposed this approach in the year 2001. This approach usually assumes that the taste of users remains stable or rarely changes. Based on this assumption neighbourhoods are built on similar items. After building neighbourhoods the system generates recommendation with items in the neighbourhood that will be preferred by the user.

Content-based filtering is also known as cognitive filtering [6]. Content-based filtering recommends items based on the contrast between the user profile and the contents of the items. Those user profiles are being created at the beginning when the user enters the system. The user profile has the information related to the user and also about the choice or interest of user. Choice will depend on the how the user will rate the item. Web pages, news articles and TV programs are especially used for recommendation purpose. In recommendation process, the engine always compares the items that were previously rated by user with those items which he did not rate at all tries to look for commonness. Finally the user will get a recommendation on those items that are positively rated ones.

Every content based system has some things in common like that of user profiles or the techniques. When implementing content-based system several issues need to be considered. First issue is that terms can be allocated either

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manually or automatically. Secondly the terms have to be represented in such a way that both the items and user profiles can be measured in a meaningful way. Lastly a learning algorithm need to be selected that is able to understand the user profile based on the seen items and can generate recommendations based on user profile.

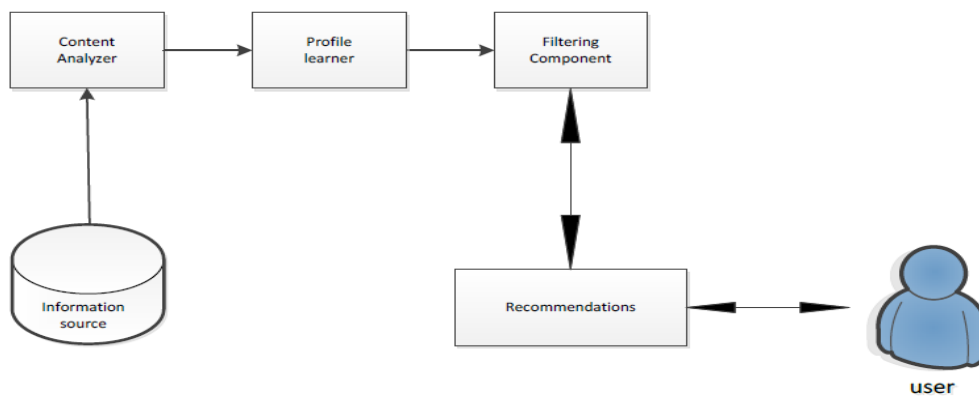


Fig. 2 Content Based Recommendation

Hybrid recommender systems are those systems that merge multiple recommendations [7] technique together to acquire a unity between. Usually content based filtering and collaborative filtering is combined together to generate hybrid recommendation technique. When combining two or more recommendation system hybrid recommendation systems gain better performance and also overcomes some drawbacks.

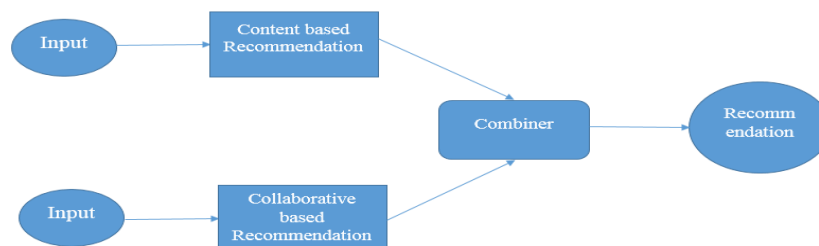


Fig. 3 Hybrid Recommendation System

There are number of ways to perform hybridization such as:

- Incorporating some content-based features into collaborative filtering.
- Incorporating some collaborative features into content-based approach.
- Implementing collaborative filtering and content-based differently and then combine their assumptions.
- Building a unifying model that consists of both collaborative and content-based attributes and features.

Recommendation Approach	Technique Used	Disadvantages
Content-Based	Information Retrieval and filtering	New user problem, limited content analysis
Collaborative	Nearest Neighbour	Sparsity, new item and new user problem
Hybrid	Combine content based and collaborative	Sometimes quality and accuracy gets affected

Table 1. Comparison of Recommendation Techniques



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III. CHALLENGES AND ISSUES

A. Cold Start:

Cold-start problem [3] occurs whenever a new item or user enters the system because it is a tough job to provide recommendations to newly entered users as their profile is almost empty. There are three types of cold-start problem: new item problem, new user problem, and new system problem [6]. The new user type of problem is the most difficult solve because there is very little information available about the new user as well about new items so no rating are available for new users and items at such time collaborative filtering cannot generate any recommendations for the sake of new items as well as new users. But content-based approaches can provide recommendation in such situations as they do not rely on any past rating information of user for the sake of recommendations. Hybrid approaches [10] can also solve the cold-start problem.

B. Sparsity:

Sparsity is the problem of shortage of information. Sparsity problem [5] is the greatest problem that is being experienced by the recommendation systems and eventually data sparsity provides a greater impact on recommendation. The main cause [8] behind data sparsity is that many user do not rate the items and eventually the rating that are generated are optimally sparse. Data sparsity usually affects collaborative filtering because collaborative filtering is completely dependent on ratings. Many researchers are yet trying to solve this sparsity problem but yet they need some more research in deep to overcome this problem.

C. Trust:

When evaluation of certain customers do come at that time the problem of trust occurs. Distribution of priorities of users [7] is the only technique to solve this problem.

D. Privacy:

Privacy is one of the biggest problem in recommendation system [10]. In a manner to receive the accurate and perfect recommendation, the system must obtain the most amount of data regarding the user which should include information about the position or spot of user or demographic data. Finally the issues of security, confidentiality and reliability do occur. Specialized algorithms and programs can be conducted to solve this this privacy protection problem.

E. Scalability:

With the enormous growth of users and items the system requires more resources [9] for the purpose of processing information and then generating recommendations. Most of the resources are being consumed with the motive of discovering users with same choice or taste. By combining various types of filters this problem of scalability can be solved. Even if solving scalability problem improves performance but yet there occur an issue of accuracy.

IV. CONCLUSION AND FUTURE WORK

This paper presented the techniques and approaches required to build the recommendation system. Several recommendation systems are based on content-based filtering, collaborative filtering and hybrid recommendation system. Though there are number of methods for recommendation but these methods also have many problems and these problems have been considered as a research work in future. It is necessary to work on this research area to find out new methods that will overcome the problems and generate a more better and flexible recommendation system.

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