Comparative Study on Modern Approaches of Recommender System

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Abstract:

Recommender system is a kind of tool for filtering information and items of user interest. There are large number of different approaches for filtering data and information. In this paper a comparative study is made on different modern approaches in particular. All the modern approaches along with traditional recommender systems are listed and explained with their merits and demerits. Some common challenges are also addressed in this context.

Keywords: Data mining, Recommender System, Filtering Approaches

1. Introduction

The Internet has created lot of scope for the users to share knowledge, information and opinion with others. The social media such as Face book, Twitter, You Tube and other are playing vital role in this context. Business organizations have identified more number of customers and profit in the internet. Online shops addressing the particular community also increased in the internet [1]. It became very easy for the customers to buy the items of their internet from their home from any county through internet. The amount of information and items regarding the particular thing was very huge, which even can force user in a ambiguity state. Hence, it became a difficult task for the users to choose and get items of their interest more effectively. With the help of Search engines like Google, Bing, Yahoo, and Baidu etc.; [2], user can get the huge amount of information of interest, but not according to the exact point of interest. The user has to identify from the information according to his or her requirements. This is where, user has to spend lot of time to identify and get clarity of that item from the likeminded people. This has lead Researchers to give a solution in the form of Recommender System. Recommender Systems are tools that can filter large amount of information and items according the user's interest.

In this paper different approaches [3] of Recommender Systems are discussed. The Approaches of Recommender Systems have been categorized into two categories: Traditional and Modern Approaches as shown in the Figure1. The Traditional approaches are again categorized into Collaborative Filtering, Content based Filtering and Knowledge based Filtering. The Modern approaches are gain categorized into Context-aware, Semantic-based, Cross-domain based, Peer-to-Peer and Cross-Lingual Approaches. The Recommender Systems can deal efficiently with information overload [5] by suggesting the user that are potentially of their interest.
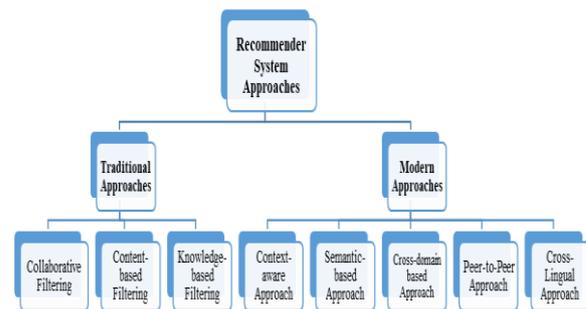

Figure 1. Approaches of Recommender Systems

2. Working of Recommender System

The general working model of Recommender System is explained in the Figure 2. The user who needs recommendation of a particular item or information posts a request. The user along with his or her interest also post preferences of interest [4]. The Recommender System uses any one or combination of the above mentioned filtering approaches to generate the information or items with the given preferences probably the user can like. The Recommender System can also give list of other people of same interest, which in turn can help user to take decision based on the like-minded community or people.
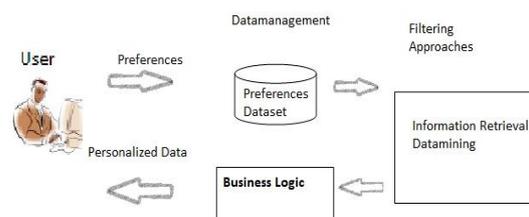

Figure 2. Model of Recommender System

3. Categories of Approaches

As shown in the Figure 1, Approaches of recommender systems broadly categorized into two categories: First, Traditional Approaches, these are categorized into three categories: Collaborative Filtering, Content based Filtering and Knowledge based Filtering. Generally, the traditional recommender systems represent a user/customer as N-dimensional vector of items along with positive and negative ratings [6] as shown in the Table 1. These algorithms make recommendations based on similarity of the user. To find this similarity it uses different methods such as Euclidian distance, and cosine distance etc.

Traditional approaches gather the rating information from the users and items. This information is then used to make recommendation. If only users rating information is used in constructing the recommendation, it is called "Memory-based" or "User-based" collaborative filtering. On the other hand, if only item rating information is used in constructing the recommendation it is called "Item-based" or "Model-based" or "Content-based" collaborative filtering. Sometimes both of these can be integrated to construct the recommendation more efficiently; it is called "Knowledge-based" or "Hybrid-based collaborative filtering". These approaches are computationally very expensive.

Table 1. (a) Memory-based filtering

User/ Item	User1	User2	User3	User4
Item1	3	4	2	4
Item2	3	4	3	5
:	:	:	:	:
Item k	:	:	:	:

(b) Item-based filtering

Item/ User	Item1	Item2	Item3	Item4
User1	3	4	2	4
User2	3	4	3	5
:	:	:	:	:
User k	:	:	:	:

Modern approaches have been sub categorized into four: First, Context-aware approach, in which information of the user and details of the situation are gathered. This information plays a vital role in constructing the recommendation. Some users prefer some food in the evening rather than in the morning for the product to sell. Here number of users showing interest about the food item in the evening is gathered for recommendation. This type approach is called "Context-aware" approach. Second, Semantic-based in which new text mining methods which users can easily understand and use are gathered. Here some semantic analysis is done, along with tags and key words. The performance of semantic recommender systems is based on knowledge base usually defined as a concept diagram (like taxonomy) or ontology [7].

Third, Cross-domain based in which similarities computed for each user according to the domains. The vector is constructed for users against domains in which they are interested. This is used to construct the recommendation. Fourth, Peer-to-Peer in which users can relate to the peer group in which they are interested. These users get recommendations from this peer. This is decentralized recommendation system, because recommendations are purely generated from the peer group. Fifth, Cross-Lingual approaches in which users receive recommendations from recommender system based on cross-lingual approach about the items that have descriptions in languages they don't speak and understand.

4. Challenges of Recommender System

These are many challenges in the recommender systems are listed and explained below.

(1) Cold-Start
The recommender system faces lot of difficulty in recommending the items or things to the new user. Because, it does not contain any useful information belongs user interest. This problem is known as "Cold-Start" problem. This problem can be solved or addressed by gathering the information from the user that meets his/her interests.

(2) Trust
Users who are participating in rating frequently have great profile history, whereas the user who rarely do this have less profile which may sometimes lead to ambiguity. To address this problem some sort of priorities is given to the users based on their profile. These priorities can be considered into account while constructing the recommendation.

(3) Scalability
The enormous increase of users and things or items for what search is made, also demand the number of resources to process and construct the recommendation. Sometimes the existing filtering mechanisms may not help in filtering content, new filtering systems have to be designed combining the two or more filtering systems. It creates a demand for Hybrid Recommender Systems in such a context.

(4) Sparsity
Some users in the online shopping always like very few items according to their interest. They don't have knowledge of other items, in such a situation information about such users is collected from their friends or neighbors' profiles. The fewer are the items chosen by user, the higher is the difficulty in determining. This lack of information about the items in the shopping, can push the customers in the ambiguity.

(5) Privacy
Information Security and personal privacy is the main factor in almost all the online transactions. To address these issues many online shopping applications employ some data encryption algorithms like data encryption standard and advanced encryption standard are used. These algorithms ensure the user privacy and the location also [8].

5. Conclusion

The recommender systems have really new and optimized ways for searching and filtering the information of interest. These systems have removed worry from the users about the searching the information. There are, as stated above number of approaches for filtering information. There is no specific approach for filtering. The filtering approach varies according the requirements of the user. Each approach has its merits and demerits. It is suggested to combine two or more approaches to get accurate and focused information according the context.

6. References

[1] Karypis, George. "Evaluation of item-based top-n recommendation algorithms." Proceedings of the tenth international conference on Information and knowledge management. ACM, 2001.

[2] https://www.reliablesoft.net/top-10-search-engines-in-the-world

[3] Gediminas Adomavicius and Alexander Tuzhilin, "Toward the Next Generation of Recommender Systems: A Survey of the State-of-the-Art and Possible Extensions", IEEETKDE: IEEE Transactions on Knowledge and Data Engineering, 17, 2005.

[4] Meenakshi Sharma, Sandeep Mann, "A Survey of Recommender Systems: Approaches and Limitations", International Journal of Innovations in Engineering and Technology, Special-Issue ICAECE-2013.

[5] Aiswarya Thomas and A.K.Sujatha, " Comparative study of recommender systems", Circuit, Power and Computing Technologies (ICCPCT), 2016 International Conference on, 18-19 March 2016.

[6] Greg Linden, Brent Smith and Jeremy York "Amazon.com Recommendations Item-to-Item Collaborative Filtering", IEEE Internet Computing, Jan-2003.

[7] E. Peis, J. M. Morales-del Castillo, and J. A. Delgado-Lpez, "Semantic recommender systems. analysis of the state of the topic." Seoul, South Korea: Department of Computer Science, Yonsei Univerisity, 2008.

[8] B. Sarwar, G. Karypis, J. Konstan, and J. Reidl, "Item-based collaborative filtering recommendation algorithms," in Proceedings of the 10th international conference on World Wide Web, ser. WWW '01. New York, NY, USA: ACM, 2001, pp. 285–295. [Online]. Available: http://doi.acm.org/10.1145/371920.372071.