



A Survey Paper on Hybrid Cloud Based Recommender Systems

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Abstract—Recommender System is a useful software tool that is integrated with the e-Commerce business applications for effective information access. It provides suggestions by filtering the information from this availability of information, such that the users are provided with only those recommendations that best suits and meets the user's needs and interest. Till now different approaches and techniques have been proposed and implemented to provide accurate recommendations to user. But still there exists some gaps to provide effective recommendations to users. In this paper we describe the different approaches used for recommendations and also the challenges and drawbacks of the existing recommendations systems.

Keywords— Recommender Systems, Collaborative Filtering Approach, Content Based Filtering Approach, Hybrid Approach, Cold Start, Data Sparsness and Scalability.

I. INTRODUCTION

Every day in our life we come across different choices and options like what to eat? Which movie to watch? Which place to visit this weekend? And many more. Sometimes we feel that how helpful it would have been if we had a decision maker to guide us right? This problem is made simpler by the evolution of Recommender System, which recommends the user that information which helps him in Decision Making. This Recommender System is integrated with the e-Commerce applications to provide recommendations to user by providing sufficient options based on their interest and needs and helping them to make decisions.

II. ERA OF RECOMMENDER SYSTEMS

The first work on the Recommender system was developed by Goldberg and Terey in 1992 which is called as Tapestry which was an Experimental mail system developed at the research center of the Xerox Palo Alto. The main idea behind this Tapestry was from the increasing use of the electronic mails. This Tapestry was developed using a Manual collaborative filtering approach. This Collaborative filtering approach emerged as a most powerful solution during 1990's to provide a appropriate recommendations. Then came the automated collaborative approach which was first adopted by the Gropulens to identify the Usenet articles which are likely to be interesting to a particular user. In this technique the user where made to perform some observable actions like provide ratings and comments where their actions where compared with the other similar users actions and recommendations were produced.

This automated approach of the Collaborative filtering became an interesting and emerging research topic in the field of Human computer interaction, Machine Learning and Information retrieval research. This evolved in the creation of various recommender system in different domains for example Ringo app for Music, The Bellcore for movie recommender and others.

This increase in use of adoptive technology made recommendation approach so popular that today the leading applications like Amazon, Flipchart, Quicker and almost all e-Commerce business application is integrated with this recommendation software tool.

At the end of 1990's the collaborative filtering approach was over taken by the content based filtering approach. This approach actually considers the item or attribute of the item to be recommended to the user based on his previous browsing histories.

As the popularity of this recommender approach began growing day by day today the Hybrid approach is in use the most which is nothing but the combination of the former two approaches i.e., Collaborative Filtering approach and Content based Filtering approach. This Hybrid approach got attention in 2006 when Netflix launched the Netflix Prize to improve the existing recommendations for the movie system.

As the interest on this Hybrid approach got increasing Burke and his colleagues built a Restaurant recommendation system called Entre by comparing the Performance and also the Effectiveness of the various types of the Hybrid recommendation Systems. Which was built using the idea of Case based reasoning that is this Entre makes use of the interactive critiquing dialogue between the system and the user who tries to find out the interested restaurants recommendations.

As the experiments over this Hybrid approach was successful it formed the dominance approach over the existing traditional recommender approach. This hybrid approach proved that it can overcome the Cold Start problem. The

Hybrid approach proved promising as it can overcome lot of drawbacks of the traditional recommender approach.

After burke in 2005, another experiment was conducted by Shadbolt .N.R and team and proved the effectiveness of the hybrid approach.

Some of the examples of hybrid approaches adopted by researchers are in 2002 a graph based recommender approach was proposed by Huang z et.al. Again in 2002 content boosted collaborative filtering approach was proposed by Melville p et.al. In 2003 Item based clustering approach was proposed by Li Q and Kim B.M. Also in 2003, the approach of clustering in constructing the hybrid systems was introduced by Li. Q and Kim B.M. A dynamic user interface was created in 2005 by combining Collaborative filtering and Content Based approach by Schafer. Further in 2005, O Donovan and Smyth .B introduced and proved that new experiments can be carried on Hybrid technique by considering the Trust aspect which offers a new perspective to view the collaborative recommendation problem. All the new experiments conducted by the researches showed effective results for Hybrid approach. Only limitation is proper care must be taken in selecting the different approaches which best suits our requirements.

III. TECHNIQUES USED IN RECOMMENDER SYSTEMS

Basically three primary approaches are used for this Recommendation System.

A. Collaborative Filtering Approach

Collaborative filtering (CF) is a popular and widely used recommendation algorithm which is based on its predictions and recommend's based on the ratings or behaviour of other users in the system. The primary assumption behind this method is that other users' opinions can be collected and minimized in such a way as to provide a reasonably accurate prediction of the active user's preference. Intuitively, it is based on the assumption that, if users agree about the quality or relevance of some items, then they will likely agree about other items (2)

B. Content Based Filtering Approach

Content based Recommendation System produces recommendations to user based on the keywords entered by the user. It finds the match for the keywords and produces the recommendations (3). The content based approach creates a model or profile of the user based on the searches and ratings made by the current user previously. The profile or model generated is a structured data comprising of users interest which is adopted to generate new recommendations.

This approach helps in generating a appropriate recommendations by filtering the matches with profile and decide on what to recommend for the user and also very useful in deciding what not to recommend for the user in the negative scenario.

C. Hybrid Approach

Current Recommender Systems use Hybrid Approach which is nothing but the combination of two approaches i.e., Content Based Filtering and Collaborative Filtering, to overcome the drawbacks of the individual recommender systems. The two approaches can be combined in any one of the following four ways. (1)

- 1) By implementing both Content Based and Collaborative based Filtering approach separately and by the combining their predictions to produce the recommendations.
- 2) Incorporate some of the characteristics of the Content Based filtering into collaborating filtering approach.
- 3) This is vice versa of step 3; incorporate some of the characteristics of the Collaborating Filtering into Content Based approach.
- 4) Incorporate the characteristics of both the Content Based and Collaborative Filtering approach by constructing the general unifying model.

IV. CHALLENGES AND LIMITATIONS

A. Data Sparseness

The Recommender System recommends usually by creating a neighbourhoods for the user who share similar interests for a particular item. Here, the recommendation is based on assumption that if user A and User B share similar interest for item 'x' then there is a probability that both share the similar interest for item 'Y'. But, generally users rate very few items, so it is very difficult to determine his references and needs which may lead to the creation of wrong neighbourhood(9) and appropriate recommendations will not be generated. So, sparseness is the issue that arises because of the lack of information about the items which user may have rated.

B. Scalability

The number of users using the system and the items entering the system are increasing day by day. Many of the existing traditional recommender system suffer from this scalability issue(8). It's a major challenge for the recommender system to provide real time recommendations where complex computations have to be done by parsing this huge volume of data in very less time to provide suitable recommendations. Some of the recommender systems employ the Machine learning and Data mining techniques to generate a subset of dataset. Because there is a direct link between the reduced dataset generated and the quality of the recommendations generated.

C. Cold Start

The typical problem that exists in the recommendation system is the cold start problem. We know that the work of the recommendation system is to recommend to user based on his previous history or searches made by the user. But,

what the system should recommend if the user is new to the application since there is very less information available about the user to recommend him something this situation is referred to as “Cold Start” problem.(5) This Cold Start problem is not just restricted to the user it also relates to item. When the item is new in the system and has not been rated before. Then it is difficult to recommend for the item.

D. Privacy

With the increase in the online shopping culture the privacy concern is also Increasing because it includes our personal information like credit Card details, Demographic data and also the Location data of a particular user. Hence, privacy plays a major concern to protect ones sensitive data.(6) And also the privacy aspect is interrelated to other major characteristics like Reliability, Security and the Confidentiality of the given information.

E. Trust

In this trust issue evaluations plays a major role. Different peoples have different history. Some are very active and some are not so active in Rating, Commenting and giving opinion for a particular item. It cannot be concluded that the person who are very active always (7) give correct rating. Hence, Trust factor plays a vital role in evaluating the suitable person to extract the information to provide the recommendations.

V. CONCLUSIONS

Recommender systems are becoming a powerful and new technology for extracting useful, needed and additional information for a business from its user databases. These Recommender systems help users find qualitative items to be recommended which they want to buy from a business. Recommender systems benefit users by enabling them to find items they like and need for the search made by them. Conversely, they help the business also by generating more sales and improve the productivity and profit. Recommender systems are rapidly becoming a crucial and integral tool in E-commerce on the Web. Parallely these Recommender systems are also being stressed by the huge volume of user data in existing corporate databases, and will be stressed even more by the increasing volume of user data available on the Web. New technologies or the combination of the existing technology with the hybrid approach is needed that can dramatically improve the scalability of recommender systems.

Recommender Systems have become the strength and Integral part of all the e-Commerce business applications. Even though various techniques and Approaches are used in building the Recommender Systems they still have some of the gap in providing the exact recommendations. This paper presented the era of Recommender system and also the various techniques and approaches for building the Recommender Systems. And also this paper covers the various Limitations and Challenges of the Existing Recommender Systems.

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