



RECOMMENDER SYSTEM – AN OVERVIEW

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Abstract: The purpose of this paper is give an overview of the concept of recommendation systems, to highlight the existence of recommender systems in various aspects of human life and how recommendation is becoming an integral part of human life. The challenges that the recommendation systems are facing

Keywords: Recommendation, Content based, Collaborative filtering, Knowledge based, Challenges

I. INTRODUCTION

Recommender System utilizes user data and behavior and interests to suggest product and services to user. Importance of recommender systems is becoming more evident with time. Though more prominent in shopping websites and applications, yet role of recommender systems is evolving and growing fast in other service areas and knowing and unknowingly users are using or getting the suggestions generated by the recommender systems. In this paper we present an overview of the recommender systems in various service areas and the common techniques used in recommendation systems.

II. TECHNIQUES OF RECOMMENDER SYSTEM

Recommender systems' main mantra can be identified as: Choices made by a user do not change drastically and are quite similar in nature. User tends to like items and services which have common features.

Recommender system can be broadly classified as content based, collaborative filtering and knowledge based.

1. Content Based Recommendation[1]:

In content based, the system uses information from user profile and the features or content of the item. The feature or content of the item is matched with the properties extracted from user profile. The top matches are considered to recommend an item.

In this approach, let's say, Mr. X liked a product P. The algorithm analyses the properties of other products with

similar characteristics as that of product P and recommends those similar products to Mr. X.

Tables contain item names and their properties as attributes of the table. When a user interacts (buys, views, searches, comments, rates) with any item, the properties of that item are saved and are used to query out other items from the table. The query searches out items having similar properties as that of the used item. Such items are then recommended to the user. One of the parameters used to find similarity between items is Term Frequency – Inverse Document Frequency.

$$Tf(t) = \frac{\text{Frequency occurrence of term } t \text{ in document}}{\text{Total number of terms in document}}$$

$$Idf(t) = \log_{10}\left(\frac{\text{Total Number of documents}}{\text{Number of documents containing term } t}\right)$$

2. Collaborative Filtering

In this approach, the characteristic features of the items are not important. The main idea is to analyse users' past behaviour. Users' interaction with items is stored. Considering the wisdom of the crowd, the algorithm fishes out users with similar preferences and recommends an item that a user with similar choice has liked.

From the perspective of items, collaborative filtering idea somewhat reflects the idea of content based recommendation. When a user has liked an item, similar items are recommended

to the user, which is items having similar properties are recommended.

Similarity between items or users can be calculated using following methods:

- Cosine Similarity
- Euclidean Distance
- Jaccard Similarity
- Pearson's Correlation

Challenges of Collaborative filtering can be identified as

- Sparsity
- Scalability

Hybrid methods are also being formalized to combine concept of content based and collaborative filtering to enhance the quality of recommendation.

3. Knowledge-based systems

They employ comparatively extensive domain knowledge, as well as structured information about the user's true, hidden preferences to enable informed recommendations.

After a system has recommended product or services, the utility of the system is measured on basis of how accurately The parameters that are used to detect the accuracy of recommendation are

Precision: Ratio of relevant items recommended to the number of items recommended.

Recall: Ratio of relevant items recommended to the total number of relevant items available.

III. RESEARCH METHODOLOGY

This study is an explanatory study that leads to understandings of role of recommender system in various aspects of life and how recommender system is getting more and more popular and important.

IV. RECOMMENDATION SYSTEM IN VARIOUS AREAS

A. Recommendation System in Medicine

Recommendation system is not unheard of in medical field [2]. Recommendation system helps medical professionals to use the enormous volume of data available to the various medical institutes.

From point of view of the patients as well, the recommender system can help the service seekers to get recommendations on more drugs, tests, and treatments.

Each human body can react differently to various treatments and medicines. Symptoms for various ailments though common might also differ in individual cases. If the data available can be aggregated and fed in recommendation systems, the practitioners would be exposed to various possible ailments and treatments that particular symptoms can be categorised to based on test results and previous medical history.

Recommendation medical applications can also be used for personal healthcare. Users can use the recommendation applications to feed in their daily vitals to understand their current health conditions and can take precautionary measures if required.

Medical recommender system can be programmed as:

- Ontology and rule-based medicine recommendation systems [3]. Doctors can use the system to search for a drug and find details on the drugs and their interactions with other drugs.

- Data mining and machine learning-based medicine recommendation systems [4] analyses test records and uses test results with similar data to recommend further treatment.

- Even collaborative filtering can be used to diagnose medical conditions [6].

Major challenge in Medical recommendation system is that health is most important aspect in human life. A user would prefer to put responsibility of his life on wisdom of a doctor rather than a recommender system. A recommender system would use stored data to recommend a treatment, which would not consider any symptom which is uncommon.

The medical recommender systems available are more for helping the practitioners to take a better decision rather than for replacing them.

B. Recommendation System in Finance

In comparison to conventional areas of recommendation, financial recommendation systems needs to understand that financial recommendation needs a long term focus and commitment. Since utility of money is not always instantaneous and depends on several external factors like market scenario, governmental regularizations, currency value, foreign trades.

The challenges in financial recommender system are that, to prevent loss and financial risk, people wants a very reliable financial recommender system. Secondly, people do not want to share their financial information and monetary status fully, thus data needed for generating recommendations are protected and not readily available. Thirdly, as discussed earlier, financial planning is a long term aspect, where several unforeseen constraints can result in wrong recommendations. Thus expert knowledge is necessary to judge which one is a good financial choice [11].

Now a days, we get product based financial recommender system, which recommend financial products like mutual funds, insurance, loans, fixed deposits for investments. These recommendations are very non specific and can easily be generated based on any search or query made by the user. Recommending financial products does not need intimate knowledge of users' financial status. Even, recommending impersonalized stocks do not need financial background of the user, but apart from product based recommendations, there are other financial aspects as well, like trading and portfolio management.

Portfolio management needs acute knowledge of users' financial profile and future forecast considering the various sources affecting financial health of a country rather than an individual, where financial health of a country can even depend on diversified issues like election, rain, natural disaster.

Trading Recommendation systems were initially defined as ones in which "people give recommendations as inputs, system applies some internal calculations and aggregates it and provide result to appropriate users" [5].

Researchers are in two minds. Some Cowles [7, 8] has observed stocks follows a random trend, thus it is difficult to or rather impossible to profit from stock. But recent studies show that it is possible to predict stock movements. Nair, et al. in their paper has proposed a stock trading recommender

system based on temporal association rule mining [9]. In his work, he has proposed a system where recommendations for the next trading day is made based on association rules obtained from transaction database created from symbols obtained from stock time series generated by Symbolic Aggregate Approximation Method.

C. Recommendation System in Sales

Most popular of the recommendation systems available today are for recommending products in the e-commerce sites. Recommender systems are changing from novelties used by a few E-commerce sites, to serious business tools that are reshaping the world of E-commerce. The recommendations are becoming very serious research area for e-commerce sites. Not only search and purchase data, sites are fishing out user choices from voice recognition techniques and camera focus techniques, social media uploads to recommend products to users. Every e-commerce site uses recommendation algorithms and these algorithms are well accepted by user because they do not deal with medical or financial aspect of human life and thus are considered to be safe.

V. CONCLUSION

Recommender systems appeared in the mid-90s, however, they are drawing lot of attention since the Netflix Prize [10]. Nowadays, recommender systems are applied in a very broad scale of domains such as movies, books or music.

Generally speaking, recommender systems are useful in any domain, where a significant amount of choice exists in the system and users are interested in just a small portion of items. Recommender system is a small subset of Information Filtering.

When on internet, there is no private user data and those are readily available and are getting used to scan through user behaviour and requirements. Along with this, it should be understood that to build more accurate recommender system, the algorithms need to get more and more data about a user, jeopardising the privacy of a user.

Recommending products to a user is becoming more quick and accurate with advancement in recommender system, but few areas like health and finance though has started using recommender systems, yet they may never be able to fully do away with human intervention and for such areas, reliability, trust, privacy would always remain an obstacle.

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