

Recommendation of Recommender System

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Abstract: Recommender System is the system that creates important suggestions in predicting user response to options to end users for things or items that may intrigue them. Recommender system vary in the way they analyse these information sources to create thoughts of liking amongst end-user and things which can be utilized to recognize the likely coordinated sets. RS is not only restricted to certain industry but is used in overall market/industry. The setup of such RS depends on upon the space and the particular characteristics of the data accessible. Collaborative Filtering examine authentic connections alone, while Content-based Filtering depend on profile traits; and Hybrid strategies endeavour to join both of these outlines. The design of recommender system and their assessment on real world problems is an active area of research.

Keywords: Recommender System, Collaborative Filtering, Content-based filtering, Hybrid Strategies

I. INTRODUCTION

Recommender systems have become an important research area and plays a vital road in today's web. Recommendation systems suggest the right item to the user in an automated fashion to satisfy long term objective. Most of the work of the recommender system is to give recommendations to users.

The task is usually conducted by first predicting a user's ratings for each item and then ranking all items in descending order [1].

The recommender framework predicts client's interest taking into account the past conduct. Recommender system tries to make expectations on client inclinations and make suggestions which ought to intrigue clients.

Whether you are in charge of client experience, online procedure, versatile methodology, showcasing, or whatever other client affecting part of an association, you're as of now mindful of a portion of the ways proposal innovation is utilized to customize substance and offers.

E-business organizations are by all account not the only ones that utilization suggestion motors to influence clients to purchase extra items. Recommender frameworks can be utilized as a part of different ventures and also have distinctive application.

Recommendation System have been continuously researched upon and have vast potential of improving the business. Recommendation System are usually classified into three categories, based on how recommendations are made:

a. Content - based recommendations: In here, user will be recommended items similar to the ones preferred in the past they can either rely on the properties of the items that each user likes, discovering what else the user may like.

Content-based filtering techniques normally base their predictions on user's information, and they ignore contributions from other users.

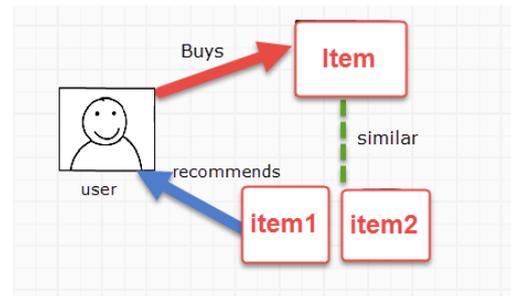


Fig. 1 Content-based recommendation

b. Collaborative recommendations: In here Collaborative filtering user will be recommended on likes and desires of other users in order to compute a similarity index between users and recommend items to them accordingly it uses their opinion to recommend items to the active user

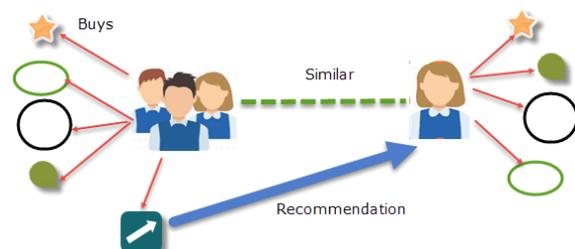


Fig. 2 Collaborative recommendation

c. Hybrid Approaches: In here, Hybrid filtering, which combines two or more filtering techniques in different ways in order to increase the accuracy and performance of recommender systems the methods combine collaborative and content based methods to build a more prosperous recommendation engine.

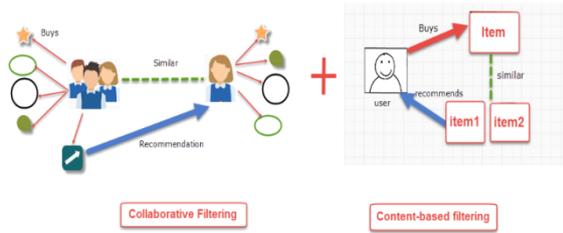


Fig. 3 Hybrid Approaches

II. RELATED WORK

Currently, a lot of research scholars are working in the case of sparsity, cold start. Scalability and improve the accuracy of algorithm. Rong Hu, Dou & Liu are using clustering based CF approach is used which aims at recruiting similar service in the same clusters to recommend services collaboratively, because of which it is expected to reduce the online execution time of CF[2].Gupta & Gadge uses number of rated score of users(demographics) and item cluster in a weighted scheme, which is scalable in successfully addressing the user cold start problem also achieves lower MAE and higher coverage than traditional CF[3]. Barman & Dabeer proposes PAF algorithm to find out popular items among friends by recommending some item to the user when certain rating are available by analysing binary random matrix model[4]. Jiaqio Fan,Pan and Jiang combines user and item based CF techniques which gives each user an option to adjust the diversity of their own recommendation list by using the prevalence rate and novelty rate parameters. Qiang Liu calculates the nearest neighbour of each user and analysis to extract the star of trusted users, it use the star user to predict other rating so as to improve the prediction precision of the algorithm [5].

Manh, Cao and Jarke used cluster and CF instead of rating data where they are using social relationship between users to identify their neighbourhood that can be used efficiently to generate the recommendation. Recommender system was defined as a means of assisting and augmenting the social process of using recommendations of others to make choices when there is no sufficient personal knowledge or experience of the alternatives [6]. Recommender system handle the issue of data over-burden that users typically experience by giving them customized, elite content and service recommendations. Recently, different methodologies for building Recommendation system have been produced, which can use either Collaborative filtering, content-based Filtering or hybrid filtering [7].

III. TECHNIQUES

The utilization of effective and exact recommendation methods is critical for a system that will give great and valuable suggestion to its individual user which gives an importance of understanding the features and potentials of different recommendation system Fig.4gives the flow of different recommendation techniques.

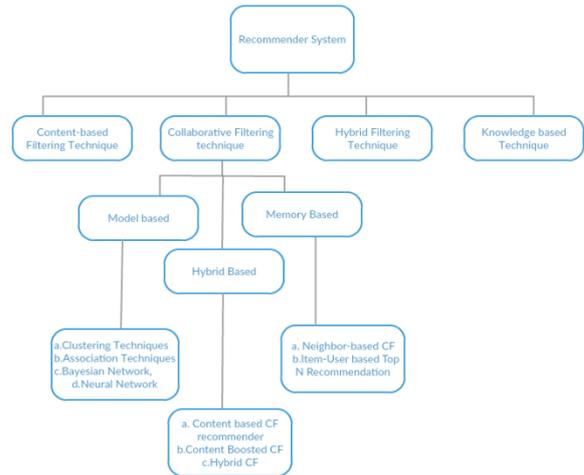


Fig. 4 Recommendation Techniques [7-9]

A. Content- Based Filtering Techniques

Content-based technique is a domain-dependent algorithm and it emphasizes more on the analysis of the attributes of items in order to generate predictions [7].

Content-based filtering constructs a recommendation on the basis of a user's behaviour. This approach uses historical browsing information. Items that are mostly related to the positively rated items are recommended to the user. [10]

The table Figure 5 focus on the user Ginger. If you use a book ranking that specifies that reader who read about Love story might also enjoy reading about Horror Book and Autobiography, you can easily recommend, on the basis of her current reading habits, that Ginger read Love story. This approach, illustrated in Figure 5, relies solely on content that a single user accesses, not on the behaviour of other users in the system [10].

Books Type	Ginger
Love story	10
Suspense	
Horror Book	7
Non Fiction	-
Autobiography	1
Comics	-

Books Read per user

Recommended Books

- Love Story
- Horror Book
- Autobiography

Fig. 5 Example of content-based technique

B. Collaborative Filtering Techniques

Collaborative filtering is a domain in dependent prediction technique for content that cannot easily and adequately be described by metadata[7].

Collaborative filtering gives recommendation that is based on prior behaviour of user, this model can be constructed on single user as well as other users with similar traits. When more users are involved collaborative filtering uses group knowledge to form a recommendation based on related users. Consider an example, suppose you are building a website to recommend books, by using the information of the member to read the books, in here you can group together a group of member who read several of same type of books, from this information you can identify

which book is popular among that group, this popular book then can be recommended for members of group be it member or non-member of the site.

In the table Figure 6, a set of books type forms the rows, and the columns define the reader. The intersection of book type and reader contains the number of books read by that reader of that book type. By clustering the readers based on their reading habits (Using Clustering algorithm), you can see groups formed of the reader depending on their reading habit. Note the similarities in the reading habits of the members of each cluster: Alice and Paul, who both read books on Non Fiction and Suspense, form Cluster 1. In Cluster 2 reside Pepper and Ginger, who both read several articles about Love Stories and Horror books[10].

Books Type	Readers Name					
	Alice	Ginger	Penny	Paul	Pepper	Goldy
Love story	1	10		-	12	
Suspense	9	1		15	1	
Horror Book	2	7		1	4	
Non Fiction	20			17		
Autobiography		1			1	3
Comics			4			
	Cluster1	Cluster2		Cluster1	Cluster2	

Fig. 6 Example of Collaborative Filtering

Based upon the above table Paul will be recommended to read Love Story which Alice has read as both of them show similarities in reading [10]. Collaborative filtering can be divided into three categories: memory-based and model-based and hybrid based,

1. Memory based technique:

This approach uses user rating data to compute the similarity between users or items. This is used for making recommendations. This was an early approach used in many commercial systems. It's effective and easy to implement. Typical examples of this approach are Neighbourhood-based CF and Item/user based top-N recommendations. The neighbourhood based algorithm calculates the similarity between two users or items, produces a prediction for the user by taking the weighted average of all the ratings. Similarity computation between items or users is an important part of this approach. Multiple measures, such as Pearson correlation and cosine correlation based similarity are used. The user/item based top-N recommendation algorithm uses a similarity-based vector model to identify the k most similar users to an active user. After the k most similar users are found, their corresponding user-item matrices are aggregated to identify the set of items to be recommended. The advantages with this approach are, the explainability of the results, which is an important aspect of recommendation systems, easy creation and use, easy facilitation of new data, good scaling with co-rated items. There are also several disadvantages with this approach. Its performance decreases when data gets sparse, which occurs frequently with web-related items[11].

2. Model Based Technique

The design and development of models can allow the system to learn to recognize complex patterns based on the training data, and then make intelligent predictions for the collaborative filtering tasks for test data or real-world data, based on the learned models. Model-based CF algorithms, such as Bayesian models, clustering models, and dependency networks, have been investigated to solve the shortcomings of memory-based CF algorithms.

The advantage of model based technique are better in addressing the sparsity, scalability and other problem, it also improves prediction performance and give an intuitive rationale for recommendation. The short coming of the technique is that it is expensive and have tradeoff between prediction performance and scalability, it can also lose useful information for dimensionality reduction techniques.

3. Hybrid Technique

The two major classes of CF approaches, memory-based and model-based CF approaches, can be combined to form hybrid CF approaches. The recommendation performances of these algorithms are generally better than some pure memory CF algorithms and model-based CF algorithms. The content-boosted CF algorithm uses naïve Bayes as the content classifier; it then fills in the missing values of the rating matrix. Content-based recommender systems make recommendations by analyzing the content of textual information, such as documents, URLs, news messages, web logs, item descriptions, and profiles about users' tastes, preferences, and needs. [7]

C. Hybrid Filtering Techniques

Hybrid filtering technique combines different recommendation techniques in order to gain better system to avoid some limitations and problems of pure recommendation systems [13, 14]. The idea behind hybrid techniques is that a combination of algorithms will provide more accurate and effective recommendations than a single algorithm as the disadvantages of one algorithm can be overcome by another algorithm [7]. Using multiple recommendation techniques can suppress the weaknesses of an individual technique in a combined model. The combination of approaches can be done in any of the following ways: separate implementation of algorithms and combining the result, utilizing some content-based filtering in collaborative approach, utilizing some collaborative filtering in content-based approach, creating a unified recommendation system that brings together both approaches.

D. Knowledge based Techniques

Knowledge-based recommender systems (KBR) [15] are a specific type of recommender system that are based on explicit knowledge about the item assortment, user preferences, and recommendation criteria. The system tells which item should be recommended in which context. A knowledge-based recommender asks a user about the requirement of wanted products and reasons about what products meet the user's requirements based on the

answers. It exploits its knowledge base of the' product domain [16]

IV. CONCLUSION

The Recommender systems open new opportunities of retrieving information on the Internet. This paper discussed various methods and algorithm to deal with the different type of data available and various learning algorithms used in generating recommendation models and different learning calculations utilized as a part of producing proposal models and evaluation metrics used in measuring the quality and performance of recommendation algorithms. This learning will enable analysts and serve as a road map to improve the state of the art recommendation techniques.

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