

Approaches of Recommender System: A Survey

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Abstract: Recommender system is subclass of information filtering system that seek to predict the 'rating' or 'preference' that a user would give to an item. Recommender system are applied in variety of applications like movies, music, news, academic events, venue, books, research articles, tourism, search queries, social tags and products in general. Recommender systems typically produce a list of recommendations in two ways-through collaborative or content based filtering. Recommender System are useful alternative to search algorithms as they help user to discover items they might not have found by themselves. In this paper we have discussed various approaches of recommender system and techniques applied to implement it. The goal of this work is to discover existing trends, open issues and possible directions for future research.

Keywords: Recommender System, Collaborative filtering, Content based filtering, Hybrid Recommender, Clustering, Similarity

I. INTRODUCTION

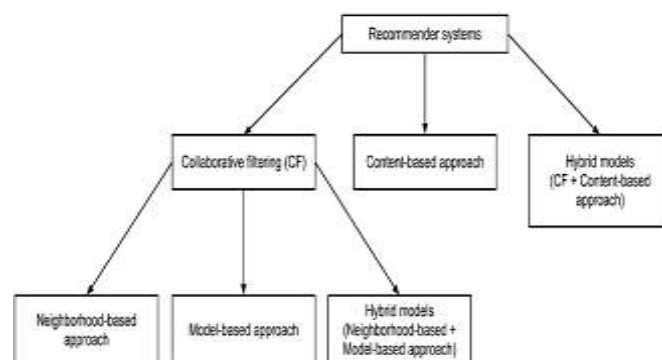
Recommender systems or **recommendation systems** (sometime replacing "system" with a synonym platform or engine) are subclass of information filtering system that explore to predict 'rating' or 'preference' that user would give to item.

Recommender systems have become common in recent years, and are applied in variety of applications. The most popular are movies, music, books, news, ,venue, research articles, search queries, social tags and products in general. However, there are also recommender system for experts, collaborators, restaurants, jokes, life insurance, financial services and Twitter followers.

Recommender systems are useful alternative to search algorithms as it help users discover items they might not have found by themselves. Interestingly, recommender systems are often implemented using search engine indexing non-traditional data

Recommender systems are used by popular websites like YouTube.com , Amazon.com, LinkedIn.com,etc.

Types of Recommender System:



Recommender systems generate list of recommendations in following ways:

- **Collaborative filtering** It builds a model from the user's past behaviour (items previously purchased or selected and/or numerical rating given to those items) and similar decisions made by other users. This model is then used to predict items (or ratings for items) that user may have an interest in. This approach suffer from three problems: cold start, scalability, and sparsity.
- **Content-based filtering** approach utilize a series of discrete characteristics of an item in order to recommend additional items to users with similar properties. In this, keywords are used to describe the items and a user profile is built to indicate the type of items this user like.
- **Demographic:** A demographic recommender system provide recommendation based on the demographic profile of user. Recommended products can be produced for different demographic niches, by combining ratings of users in those niches.
- **Knowledge-based:** knowledge based recommender suggests products based on inferences about user's needs and preferences. This knowledge will sometimes contain product features that meet user needs.
- **Hybrid recommender:** Hybrid recommender system is the one that combines multiple recommendation techniques together to produce the output. There is

no reason why some different techniques of the same type could not be hybridized, for example, two different content-based recommender can work together, NewsDude, which uses both naive Bayes and kNN classifier in its news recommendations is just one example of it.

II. LITERATURE SURVEY

Harpreet Kaur Virk et al. [1] proposed a hybrid recommender system that provide movie recommendations based on content and collaborative filtering and also using context for better recommendation. The proposed system uses the collaborative filtering, focuses on relationship between users and items. This system help users by providing relevant movie recommendation based on user feedback using simple GUI. This system will help user to deal with information overload by giving them better recommendations.

Sanjeev Dhawan et al. [2] highly facilitate the filtering of irrelevant over-abundant stuff in automotive manner. In this an attempt has been made to build a high rating recent preferences based recommendation system by using Item-to-Item collaborative filtering that provide current and highly user based recommendations. The movie data set is used to provide user recommendations based on rating and classified data. Classification is done in WEKA data mining tool using J48 pruned tree based classifier. Similarity index is calculated by using Pearson correlation, Cosine based similarity and Euclidean distance based similarity.

D.K. Yadav et al. [3] introduced a movie recommendation system named MOVREC. It is based on collaborative filtering approach that make use of information provided by users, analyzes them and then recommends the movies that is best suited to user at that time. The recommended movie list is arranged according to ratings given to these movies by previous users and it uses K-means algorithm for this. The system is developed in PHP using Dreamweaver 6.0 and Apache Server 2.0. The proposed recommender system generates recommendation using data about users, the available items, and the previous transactions stored in customized databases. MovieREC allows a user to select the choices from a given set of attributes and then recommend a movie list based on the cumulative weight of different attributes and using K-means algorithm.

Manisha Chandak et al. [4] presented an effective hybrid technique for book recommendation with the use of Ontology for user profiling to increase system efficiency. They combined Collaborative Filtering and Content-based technique along with demographic attributes to form Hybrid technique that gives best recommendations. Cold start problem for new users and new items has also overcome by using demographic attribute for finding user co-relation to get recommendation.

Utkarsh Gupta et al. [5] proposed efficient technique for recommender system based on Hierarchical clustering. The user or item specific information is grouped into a set of cluster using Chameleon Hierarchical clustering algorithm. Further voting system is used to predict the rating of particular item. It is observed that proposed approach produces lower Mean Absolute Error, identifies better quality clusters as compared to existing K-Means based approach. On the other hand K-Means has lower running time as compared to chameleon clustering algorithm. This opens the scope of reducing running time of chameleon by using any parallel framework like map reduce.

Hirdesh Shivhare et al. [6] Used combinatorial approach by combining fuzzy c-means clustering and genetic algorithm based weighted similarity measure to develop recommender system and provide optimal similarity measures and similarity metrics with movie lens dataset. The proposed recommender system can be used in all collaborative filtering systems and does not even require any hybrid model to get implemented with.

Jyoti Gupta et al. [7] proposed hybrid recommender system that combine prediction using item based collaborative filtering and demographic based user cluster in weighted scheme. To make system scalable, item similarity and user cluster are computed offline. To solve cold start problem, a new user is added to cluster with nearest centroid based on demographics. The system achieves lower MAE and higher coverage than traditional collaborative filtering algorithm.

Suman Datta et al. [8] proposed clustering based scalable context aware recommender system for improving scalability. A decomposition technique is used that divides users' space into smaller clusters on the basis of the different contextual attributes like age, gender, occupation etc. Then recommendation algorithm is applied on clusters separately to improve running time. Algorithm is tested on MovieLens dataset in this, but recommendation approach is perfectly generalized.

Artem Umanets et al. [9] developed a mobile and web application, named GuideMe that provide consultation, publication, and recommendation of touristic locations. Every user can consult places of touristic interest, receive suggestions of previously unseen touristic places according to other users recommendations, and can perform its own recommendations. The recommendations are carried out using well-known Mahout Library. The key feature of GuideMe is its integration with social networks and the unique set of options offered in the application.

Jayasimha Katukuri et al. [10] introduced similarity-based recommendation architecture that

can handle huge volumes of dynamic inventories, is scalable and provides control over similarity. Solution consists of offline process for generating long term cluster and online system to use these clusters to focus on similarity dimensions. Clusters are generated using Hadoop map reduces. The system is deployed on several eBay sites.

Zebin Wuet et al. [11] introduced personalised recommendation algorithm by improving similarity calculation method to solve problem of similarity. Then algorithm use user' similarity fuzzy clustering to narrow the scope of nearest neighbour .After that algorithm used matrix to produce recommendation. This effectively improves accuracy and real time response speed.

Eric Medvet et al. [12] proposed a venue recommendation system which requires only title and abstract to generate venue recommendation in couple of seconds.

Ling Yanxiang et al. [13] proposed a novel approach to improve the accuracy of cold-user recommendation. The major idea behind paper is to use users-based clustering to divide users into groups and to generate a top-N recommendation. The vector cosine method is used to obtain the user's similarity matrix and to cluster users into different groups. They produce top-N recommendation by averaging ratings of every item and selecting the top N items on the list.MovieLens-1M dataset is used to demonstrate consistent improvements in overcoming cold-start problem.

Hideyuki Mase et al. [14] resolves the problem in collaborative filtering of data smoothing in entire user database by incorporating hybrid clustering after introducing a smooth-based method in entire database which provide high precision.

Li Chao et al. [15] recommendation system is applied to Social Networking Services. Recommending items that will be accepted by users is a key point. In this they combined recommendation based-on content with collaborative filtering .The concept of user intimacy based on the interaction between users is proposed. With these three aspects hybrid recommender model is build.

Chenguang Pan et al. [16] proposed a novel method for research paper recommendation. They proved by experiment that by making topic analysis on research papers and introducing thematic similarity, they recommend highly relevant papers and considerably alleviate the cold start problem. Even when the user has just rated very few papers, it still generate satisfactory recommendations.

Kam Fung Yeung et al. [17] presented a proactive personalised news recommender PPNews that automatically deliveries news articles to mobile user based on user's interest and news content. Bayesian Network is developed to predict user interest and combines the CF/CBF technique which make use of users preference and community histories. The AHP model is developed for news ranking. The weight of contexts is automatically adjusted via individual-based and group based assignment. The experiments show that the proposed AHP model is effective.

Jia Rongfei et al. [18] proposed a new similarity measure for clustering. Firstly, a basic similarity function is used to discover neighbour vectors of items. Secondly, cosine similarity of the neighbour vectors for clustering is calculated. Thirdly, clustering process is finished by using adjusted DBSCAN. The experiments on the group lens dataset show that this method outperforms the previous method in the field of collaborative filtering.

Zheng Wan et al.[19] introduces framework of a recommendation filtering system in mobile commerce to improve quality of mobile service. The basic idea is to record users' operations ("implicit feedbacks") on recommendation in the form of short message to obtain users' interests and to update users profile continuously. At the same time when receiving new recommendation, the system computes similarity between user profile and recommendation message, and then judges whether the message is a spam.

L. Martínez et al. [20] introduced recommender system for restaurants, called REJA, composed by a collaborative and a knowledge-based model in order to avoid the cold start problem. REJA introduces a new facility for its users that consists in a geographic information module which provide geographic information referred by Google Maps about the recommended restaurants. This system has been developed with information related to the province of Jaén in Spain, but is easy to extend to any other geographic area.

Table No.1: Comparison of different Approaches and Algorithms used in Recommender System

S.No.	Author and Year	Approach Used	Technique and Algorithm Used
1	Harpreet Kaur Virk,2015	Hybrid Recommender (collaborative+content+context)	Advance Algorithm
2	Sanjeev Dhawan,2015	Item to Item Collaborative Filtering	Classification and Similarity
3	D.K. Yadav,2015	Collaborative Filtering	K-means Clustering Algo.
4	Manisha Chandak,2015	Hybrid Recommender (collaborative+content)	LSH/MinHash Algorithm
5	Utkarsh Gupta, 2015	Collaborative Filtering	Chameleon Hierarchical Clustering along with voting
6	Hirdesh Shivhare, 2015	Collaborative Filtering	Fuzzy c-mean clustering &Genetic algorithm based weighted similarity measure(FCM-GEN)
7	Jyoti Gupta, 2015	Hybrid Recommender (collaborative +Demographics)	K-means Clustering & Similarity
8	Suman Datta, 2015	Context aware recommender	Clustering
9	Artem Umanets,2014	Collaborative Filtering	Representational State Transfer (REST),databases and data model
10	Jayasimha Katukuri,2014	Similarity based Recommender	Clustering using Hadoop map-reduce
11	Zebin Wuet, 2014	Collaborative Filtering	Improved Similarity & Fuzzy c-mean clustering
12	Eric Medvet, 2014	Topic matching procedure	Cavnar-Trenkle and LDA+clustering
13	Ling Yanxiang, 2013	Collaborative Filtering	Vector cosine similarity and user based clustering
14	Hideyuki Mase,2012	Collaborative Filtering	Hybrid Clustering
15	Li Chao,2012	Hybrid Recommender (collaborative+ content)	Similarity and user intimacy
16	Chenguang Pan,2010	Collaborative Filtering	Thematic Similarity
17	Kam Fung Yeung,2010	Hybrid Recommender (collaborative+ content)	Bayesian Network and Analytic Hierarchy Process Model
18	Jia Rongfei,2010	Collaborative Filtering	Cosine Similarity and clustering using adjusted DBSCAN
19	Zheng Wan,s2009	Filtering Recommendation based on Personalized recommendation and spam filtering	Similarity
20	L. Martínez,2009	Hybrid Recommender (collaborative+ knowledge based)	Similarity

III. CONCLUSION AND FUTURE SCOPE

Nowadays, recommender system is used various fields like movie, songs, video, venue, news, books, tourism and e-commerce sites etc. In this paper we have discussed different recommendation system that use content based filtering, collaborative filtering or both (hybrid). Techniques like Clustering, Similarity and Classification are used to get better recommendations thus reducing MAE, high precision and accuracy.

In future we will work on hybrid recommender using clustering and similarity for better performance.

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