



Study of Big Data Applications Based On Recommendation Systems

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Abstract-As Data are growing enormously, they are collected and warehoused as big data. From these collected data the information's are filtered and some knowledge is obtained. Recommendation system filters information and obtains knowledge in order to recommend something to the users. For these recommendations there are lots of methods which are available. This paper, focus on different recommendation techniques and provides brief description about the shortcomings on each approach and conclude that every recommendation system is best with their application.

Keywords- Recommendation system survey, Content based Recommendation, Collaborative filtering, hybrid recommendations.

I. INTRODUCTION

Now-a-days the data are growing more in every web site and every format those data are collected and managed by the emerging technology called Big Data. For processing those data big data uses hadoop framework. The products and the customer requirements are more and changing over time. They are confused of choosing their required product for that the recommendations Systems are implemented.

A. Recommendation Techniques

Recommendation Systems filters data for recommending something for users/customers. With the interests of customer/user the items are recommended. The users preferences, items ratings, behaviour of users and user's profile from these information the information are filtered and recommendation is provided for the

customers/users. Fig. 1. shows the main categories of Recommendation Systems.

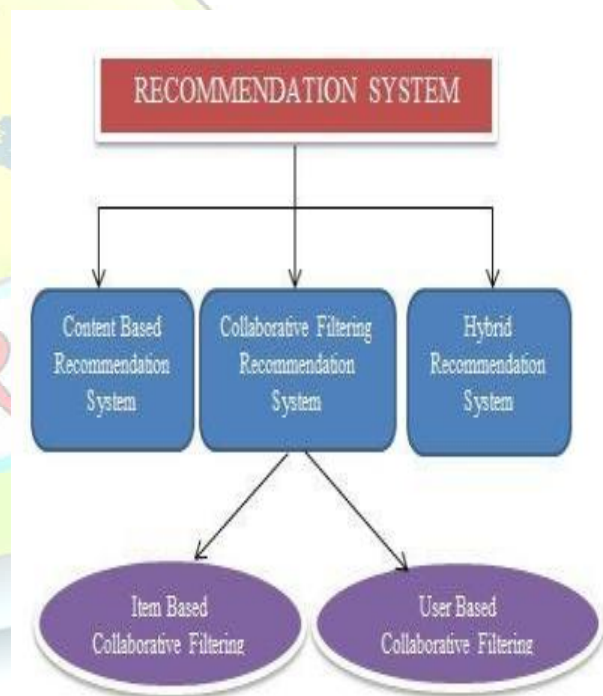


Fig. 1. Categorization of Recommendation System

1) Content Based Recommendation System

Content Based Recommendation System Recommends items based on the user's previous history which the items selected by the same user. Similarity is calculated for the item and the user's previously selected



2) Collaborative Filtering Recommendation System

Collaborative filtering recommendation system recommends the user based on the similar tastes preferred. Collaborative filtering has two categories: Item Based Recommendation system and User Based Recommendation System. Item Based Recommendation System recommends the items based on the rating of the other similar items by the same user. User Based Recommendation System recommends the items based on the ratings of the same item by similar users.

3) Hybrid Recommendation Systems

Hybrid recommendation systems combine any two recommendation techniques and take the both techniques advantages within it. Hybrid recommendation system takes advantages of one system to controls the disadvantages of another one.

4) Modern Techniques

Some more Modern Recommendation techniques are Knowledge Based Recommendation, Utility Based Recommendation, Context-Aware Approaches, Item-to-Item Collaborative Filtering, etc., These Techniques are mostly used in the modern world and all these are minor changes in traditional Recommendation Systems.

II. RELATED WORKS

A. Content Based Recommendation Systems

Content based recommendation system recommends items based on similar items that are rated by the same user. Milan Bjelica (2010) uses machine learning, pattern recognition with information retrieval like vector space and cluster hypothesis for TV Recommender system and overcomes overspecialization [11].

Chhavi Rana et al., (2012) combine user preferences with similar users and also other users to provide diverse recommendation that change on time. Here a new dimension is added as temporal dimension with a counter value for each item which gets update with time and thereby improves the recommendation process by providing diverse recommendations even though the user has less rating on an item for the particular user [8].

B. Item Based Collaborative Filtering Systems

Item based collaborative filtering system recommends items based on the similar items chosen by the same user. But when new items are added dynamically those items are not recommended by this system. Junhao Wen et al., (2012) introduce an improved item based collaborative filtering system based on clustering and overcome the above problems. Here dynamic item clustering method recommends good recommendations with less resource consumptions [9].

C. User Based Collaborative Filtering Systems

User based collaborative filtering system recommends item based on the rating of the item based on the similar users. Zhao Kai et al., (2014) implements recommendation system and avoid data scarcity and scalability problem on similarity calculation method [7].

D. Hybrid Recommendation Systems

Hybrid recommendation system combines any two techniques for obtaining both of their benefits within. Ujwala H.Wanaskar et al., (2013) combines the collaborative filtering and the content based recommendation techniques based on weighted Association Rule Mining and text mining for Web Page recommendations by the frequency of visiting and time spends on that web page. The main drawback with the recommendation system is the pages which are newly added are not recommended this problem had overcome by this work [4].

Yu Liangxing et al., also combines the Content based recommendation technique with the Collaborative filtering algorithm gives high quality services to the apparel customers based on the three things: the items purchased by same type of customer recently, the items similar to or the same item which the customer selected recently and the items that other customers who has the same tastes with the active customer have chosen recently. By achieving high quality recommendations there is still limitation here is time consumption is more while calculating distance among all membership customers [6].

Lina Yao et al., (2014) unifies the Content based Recommendation and Collaborative Filtering approaches and considers both the rating data and sentiment data on web using probabilistic generative model for providing best service recommendations. Author considers 3,693 real-



world data of Web services and proves the high-tech results on recommendations [2].

E. Utility Based Recommendation Systems

Utility Based recommendation system recommends based on the utility function of each item for the user. Shiuli Huang (2010) compares the holistic utility and decomposed methods of e-commerce context for recommendation in terms of user preferences, accuracy and time expenditure. Overspecialization and new user problems are rectified and though user preferences can change as time the accuracy may decrease, so the recommendation is to be provided immediately [10].

Deng Feng (2015) overcomes the user burden of giving utility function by calculating using genetic algorithm and user browsing behaviour and recommends cloth in accordance with accuracy, satisfaction, usefulness and time expense. Here limitations only on the short-term user preferences and used in online contexts only [1].

F. Knowledge Based Recommendation Systems

Knowledge based recommendation system recommends items based some knowledge: how a specific

item can satisfy the specific user's need, reason for the relationship among user need and the items [12].

G. Hierarchical Clustering Based Recommendation Systems

Hierarchical Clustering recommendation system uses clustering technique that users and their preferences are grouped into the same clusters. Utkarsh Gupta et al., (2015) used Chameleon Hierarchical clustering algorithm in voting system to predict the different user's ratings and shows less errors while comparing with K-means Clustering Algorithms [5].

H. Friend of Friend Recommendation Systems

Friend of Friend Recommendation systems are used in many social networks for recommending friends for the users. Melike Yigit et al., (2015) generates the relationship among the users and also considers many other mentions about the user's recommendations and over receiver operating characteristic (ROC) curves and precision-recall graphs. And provides the best results in comparison with graph-based and Conceptual Fuzzy Set based algorithms [3].

TABLE I. COMPARISION TABLE OF RECOMMENDATION TECHNIQUES

S. No.	TITLE	APPROACHES	TECHNIQUES AND ALGORITHM USED	ADVANTAGES	DISADVANTAGES
1.	Towards TV Recommender System: Experiments with User Modelling	Content Based Recommendation	Information Retrieval	Overspecialization	Accuracy depends on large historical data set.
2.	Designing utility-based recommender systems for e-commerce: Evaluation of preference-elicitation methods	Utility Based Recommendation	Multi Attribute Rating Technique	Appropriate recommendations in different context.	Accuracy may decrease because user preferences can change over time. User to specify their utility function
3.	Utility-based Recommendation Systems using Implicit Utility and Genetic Algorithm	Utility Based Recommendation	Implicit Utility and Genetic Algorithm	Reduces user burden by calculating utility function.	Only short-term user preferences are considered.
4.	A Hybrid Web Recommendation System based on the Improved Association Rule Mining Algorithm	Hybrid Recommendation	Weighted Association Rule Mining	New web pages can also be recommended.	Stability Vs Plasticity problem.



5.	Recommender System Based on Hierarchical Clustering Algorithm Chameleon	Hierarchical Clustering Based Recommendation	Chameleon Hierarchical Clustering	Provides Less error while Comparing to K-means Clustering.	Running Time is more than the K-means Clustering.
6.	Hybrid Product Recommender System for Apparel Retailing Customers	Hybrid Recommendation	Keyword Similarity Method	Provides High Quality Recommendations	Time complexity is more while calculating the distance among membership customers
7.	Improved Collaborative Filtering Approach Based on User Similarity Combination	User Based Collaborative Filtering	Similarity Fusion	Scalability and avoids Scarcity.	New item problem.
8.	Building a Book Recommender system using time based content Filtering	Content Based Recommendation	Ranking Counter Temporal Algorithm	Considers diverse users preferences	New user problem
9.	An Improved Item-based Collaborative Filtering Algorithm Based on Clustering Method	Item Based Collaborative Filtering	Dynamic Item Clustering	Overcome the problem on new items added dynamically	Efficiency of recommendation decreases because number of items increased in a single cluster even after division.
10.	Hybrid Recommender Systems: Survey and Experiments	Knowledge Based Recommendation	Case Based Reasoning	Provides good recommendations based on some knowledge	Knowledge retrieval overhead.
11.	Extended topology based recommendation system for unidirectional social networks	Friend of Friend Recommendation	Topology Based Algorithms	Recommendations are provided based on the user relations, the recommendation will not provide to the user they don't know.	Accuracy decreases when working with large datasets.
12.	Unified Collaborative and Content-Based Web Service Recommendation	Hybrid Recommendations	Content Based Recommendation and Collaborative Filtering	Provides better recommendations for web services and overcomes new user and new item problem	Real World Web Service data are increasing tremendously, here only less of them are considered and evolved.

III. PERFORMANCE EVALUATION

Some real world data are collected and analysed with three the recommendation systems: Content Based, Item Based and Utility Based. Content based recommendation system provides results with the time complexity of $O(MN^2)$, Item based provides with time complexity of $O(M^2NK)$ and Utility based provides with $O(M^2N)$. Where, M is number of user ratings, N is number of items presents and K indicates similarity Calculation. While comparing these three recommendation systems when items are more than user rating we can use Content based otherwise Utility based, if user feels that burden to give some utility value can use Item based recommendation system. Finally every recommendation system provides best results according to their application based.

IV. CONCLUSION

All existing recommendation techniques such as Content Based, Item Based, User Based, Hybrid Recommendation, Utility Based, Knowledge Based, and Hierarchical Clustering Based are compared. These techniques have balancing advantages and disadvantages. Most of the disadvantages in each one of the techniques can be flattered by the other technique. Though every technique has its own disadvantages based on the application each technique will provide its best recommendation. In Future, User who needs recommendation can choose any existing recommendation techniques based on their application need.



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