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Providing highly accurate service recommendation over big data using adaptive system

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Abstract - *Numerous approaches have been proposed to provide recommendations. Manifestly, recommendation system has a variety of properties that may need experiences of a user, such as user prediction, rating, trust, etc. On the internet, where the number of choices is enormous, there is a need to filter, prioritize and efficiently deliver relevant information to mitigate the problem of many internet users. Recommender systems(RSs) are one of information filtering systems, estimating the items that may be of additional interest to a user within a big set of items based on a user's interests. Recommender systems are currently useful in both the research and in the commercial areas. The paper presents an approach for Recommended System to generate meaningful recommendations of a collection of users for items that might interest them. This approach uses adaptive recommender system which combines two recommendation techniques to increase the overall performance. The main aim of using multiple recommendation techniques to overcome the drawbacks of the traditional techniques in a combined model. The anatomy is based on the hierarchy and input/output relations of recommenders. The present system improves the speed and accuracy of recommendation in big data application.*

***Key Words*: *Adaptive Recommendation System*, clustering, data mining and Big data.**

1.INTRODUCTION

Big Data relates large-volume, growing and complex data sets with multiple and independent sources. In Big Data applications, data collection has increased terribly and it is beyond the ability of commonly used software to capture, manage, and process that data [3]. The most crucial challenge to Big Data applications is to inspect the large volumes of data and get useful information or knowledge for future actions. Service users nowadays encounter unrivalled difficulties in finding ideal services from the enormous services. These days, it is common for people to choose web as the platform to buy or sell something. Therefore, there exist many online shops in different forms, varying from private websites to eCommerce forums. This leads to both advantages and disadvantages for customers in different ways [1] The main advantage is that a customer has more options to buy and at the same time, it can also have the drawback, because with many options customers will face difficulty to choose one single product keeping in view various criteria e.g. which shop has good customer service, and who offers the best price. Therefore, the big issue is that there is no one-stop place to search wide information about e-Commerce. The information which is required to relate to online selling and buying includes list of products, list of online shops and a set of recommendations about choosing product and shop.

Recommender system is an information filtering system that deals with the problem of information excess [7]by filtering vital information out of large amounts of dynamically generated information as per the user's preferences, observed behavior about item or interest [9]. Recommender system has capacity to forecast whether a user would select an item on the user's profile. Collaborative filtering (CF) techniques such as item-, user- and utility-based are the governing techniques applied in RSs. However, traditional CF techniques are sound and have been successfully applied in many RSs. They face two main challenges in big data application:1) to explore useful recommendations from so many services and 2) to take a decision within limited time. A critical step in traditional CF algorithms is to compute likeness between every pair of users and/or services which may take long a time, also beyond the processing capability of current RSs. The ratings of dissimilar users or services may influence the accuracy of predicted ratings. One solution is to reduce the number of services that need to be processed in real time. Clustering are such techniques that can decrease the data size by a large factor by grouping similar services together. Therefore, the paper proposes a clustering and collaborative filtering with adaptive recommendation technique. Clustering is approach that separate big data into manageable partitions [4]. Besides, since the ratings of similar services within a cluster are more pertinent than that of dissimilar services, the recommendation accuracy based on users' ratings may be enhanced. Despite the success of filtering techniques, they exhibit cold-start, sparsity and scalability problem. This paper proposes an adaptive recommendation system that combines item- and content-based filtering techniques to increase the accuracy and performance of RSs.

A. Adaptive Recommendation System

Here, designed system uses an adaptive recommendation system which is making automatic predictions about the interests of a user by gathering preferences from many users. The aim of this system is to recommend new items to the user or forecast the utility of a certain item, based on user's previous likings and on the opinions of other like-minded users. Adaptive Recommendation system dominates content based collaborative filtering, Item based and knowledge based recommender, as the relative accuracy of the recommender is comparatively high.

The Adaptive system has following objectives:

The main objective of the proposed work is providing accurate recommendations to users.

1. To present the new adaptive algorithm to improve the Scalability, Accuracy, Memory consumption.

2.Present an approach that provides the recommendation to users even they are new in system by removing the cold-start problem from existing algorithm.

3.Present a system to improve the speed and accuracy of recommendation system in big data application.

Following techniques are used for Adaptive system

1.A content based recommendation Algorithm is used that works on the user preferences that is likes and dislikes given by any user to items or products and the user profile. Here it will only consider likes given by the user.

2. A knowledge based recommendation algorithm is used that works on the set of requirements of the user and the product description. Products feature and category compare with the user's interest and category respectively. Output will be a set of products.

3. An item based recommendation algorithm is used that works on the user's preferences that is likes and dislikes given by all users to items or products. Output will be a set of products preferred by all user's.

4. An adaptive Recommendation algorithm is used which combines Content based collaborative filtering, Item based and knowledge based recommender, that increase accuracy of the recommender.

5. Agglomerative Hierarchical Clustering (AHC) Algorithm is used to generate the cluster and to calculate results.

B. Architecture

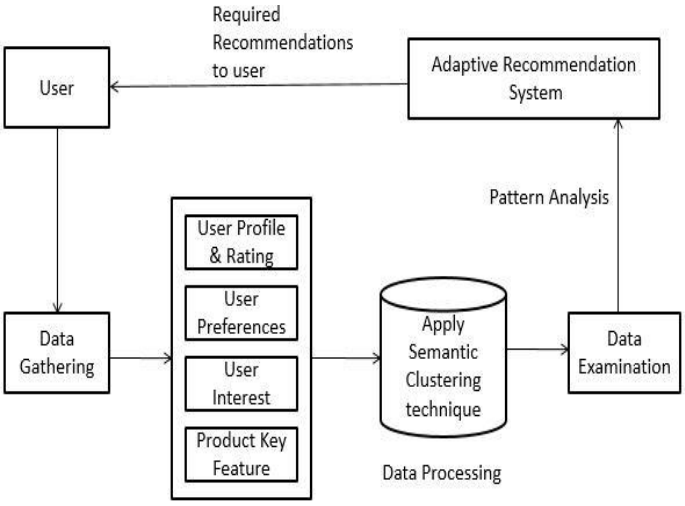

Fig 1: Architecture of Adaptive recommendation system for semantic cluster in big data

The proposed architecture consists of two modules.

1. Admin Module

Admin can login and manage the categories of products. The admin user can add/update product information, images and description. Also, the admin has right to approve the order requested by visitor, generate invoices and pass to dispatch team. Admin module has the option to add/update advertisements. Also, admin can provide the product details, advertise details and order details to visitor through web services.

Cluster Generation (Compute Description Similarity and Functionality Similarity):

A. Description similarity: Description similarity is computed by a Jaccard similarity coefficient (JSC) which is a statistical measure of similarity between sample sets.

B. Functionality similarity: Functionality similarity is also computed by a Jaccard similarity coefficient (JSC), similarly as description similarity.

2. Visitor Module

In the proposed system visitor module is the second module. First, visitor can register and login to the web portal. Visitor user can view product list by categories. Also, the visitor module has the option to view details of product and purchase the product and notify by mail. The visitor can give a rating to the product and he can give a prediction about that product.

Service Recommendation using (Adaptive Collaborative Filtering Techniques)

The recommendation system builds a database (user-item matrix) of preferences for items by user. It then matches users with preferences by calculating similarities between their profiles to make recommendations. Such users build a group called a neighborhood. A user gets recommendations to those items that he has not rated before, but that was already positively rated by users in his neighborhood. Recommendation that is produced can be either prediction or recommendation. Prediction is a numerical value, Rij, expressing the predicted score of item j for the user i, while recommendation is a list of top N items that the user will like the most. The adaptive system combines content based collaborative filtering, Item based and knowledge based recommender,

In content-based collaborative filtering technique, a recommendation is made based on the user profiles using features extracted from the content of the items evaluated in the past. Items that are mostly related to the positively rated items are recommended to the user.

Item-based approach computes for each user-item correlation with all other items and aggregates for each user the ratings for item that are already highly correlated.

A knowledge based recommendation works on the set of requirements of user and the product description. Products feature and category are compare with the user's interest and category respectively

C. Implementation steps

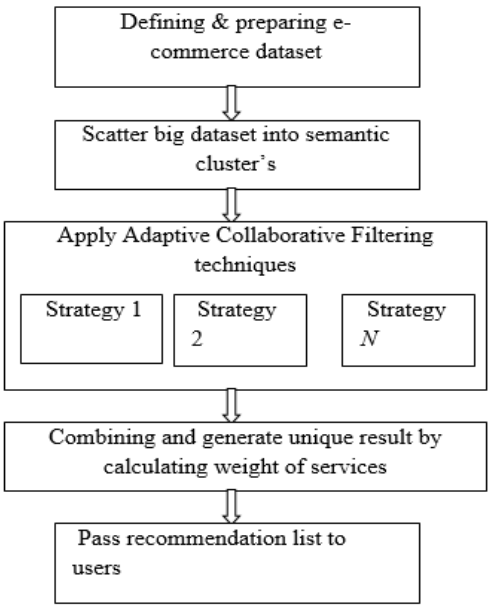

Fig.2 Implementation steps

Step 1: In the Defining & preparing e-commerce Dataset. This data is used as input to the system.
Step 2: The scattered data collected in the first step is grouped In semantic clusters.
Step 3: Adaptive collaborative filtering is applied, which Combines content based collaborative filtering, Item based and knowledge based recommender,
Step 4: Result is combined and unique result is generated By calculating weight of services.
Step 5: Recommendation list is passed to the user in step 5.

D. SCOPE OF THE WORK

This Design Specification is to be used by Software Engineering and Software Quality Engineering as a definition of the design to be used to implement an adaptive Recommendation System for semantic clusters in big data. Recommender System is used to generate meaningful recommendations to a collection of users for items or products according to their area of interest. Using the proposed algorithm.i.e. Adaptive algorithm system provides recommendations to customer by removing limitations of existing system (cold start, accuracy, scalability etc.). Improve the speed of recommendation on big data application and reduce the human efforts of doing analysis process while searching products online by providing recommendations online.

2.RESULT EVALUATION

In order to calculate accuracy, Mean Absolute Error (MAE) is calculated as shown in the following equation

$$\mathrm{MAE} = \frac{\sum_{i=1}^{n} \left| r_{a,t} - P(u_a, s_t) \right|}{n}$$

Where, n is the total no. of items or products or services. In case of an item based collaborative filtering, r (a, t) is the actual rating given by the user to the product. P (ua, st) is the predicted ratings. In case of an adaptive recommendation system, r (a, t) is the total no of items who has been rated as well as preferred by the user and P (ua ,st) is the predicted ratings. Low MAE values represent high accuracy. For the simplicity predicted values are calculated as follows:

$$P_{u_a,s_t} = \bar{r}_{s_t} + \frac{\sum_{s_j \in N(s_t)} \left(r_{u_a,s_j} - \bar{r}_{s_j} \right) \times R\_sim'\left(s_t, s_j\right)}{\sum_{s_j \in N(s_t)} R\_sim'\left(s_t, s_j\right)}$$

Comparative analysis:

Calculated MAE values are represented in the table. From the table, it is clear that the proposed system is having low mean absolute error it means the proposed system.i.e. hybrid recommendation system is more accurate as compared to existing systems.

Cluster size	MAE (Adaptive Recommendation)	MAE (Item-Based Recommendation)
C1(384)	0.00520	0.0234
C2(433)	0.00230	0.0184
C3(1212)	0.0008	0.0033
C4(629)	0.004	0.486

Graphical representation of the result is as shown in the following figure. Red bars rep-resent item based system and green bars represent the proposed system. X-axis represents the cluster size n Y-axis represents the accuracy

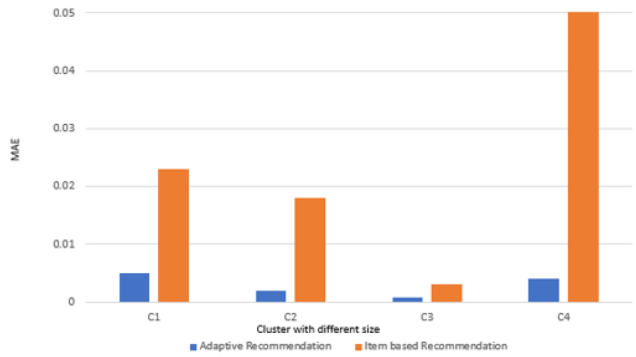

Fig 3. Comparative Results

3. CONCLUSION AND FUTURE WORK

The Adaptive Recommendation System approach for big Data application is proposed to generate meaningful Recommendations to a collection of users for items or products that might interest them. The proposed approach overcomes the limitations of existing systems like data sparsity, Scalability, Accuracy, cold-start problem. Provides recommendations to the customers by improving the accuracy of recommendation in big data application.

For future research, other collaborative filtering techniques can be combined to provide even more accurate results. Semantic analysis may be done on the description text of service that is with respect to service similarity. So, the accuracy of the system can be enhanced with respect to time.

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