International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 6 Issue: 5 121 - 127

Time Based Collaborative Recommendation System by using Data Mining Techniques

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Abstract: Recommendation of appropriate product to the specific user is becoming the key to ensuring the continued success of E-commerce. Today, many E-commerce systems adopt various recommendation techniques, e.g., Collaborative Filtering (abbreviated as CF)-based technique and Structural Balance Theory-based Recommendation (i.e., SBT-Rec) technique to realize product item recommendation. Overall, the present CF recommendation and as per suggested SBT can perform very well, if the target user owns similar friends (user-based CF) and Structural Balance Theory-based Recommendation (i.e., SBT-Rec) for we first look for the target user's dissimilar "enemy" (i.e., antonym of "friend"), and furthermore, we look for the "possible friends" of E-commerce target user, according to "enemy's enemy is a friend" rule of Structural Balance Theory or the product items purchased and preferred by target user own one or more similar product items (item-based CF). Here both the systems depends on friends and enemies if we are not getting friends or enemies then. So to improve Recommender system we propose a time-aware profile based collaborative Recommendation algorithm. In this algorithm, we will consider only recently submitted ratings and positive reviews to evaluate products quality. Along with this, we propose a novel recommender system in which user will give his requirement about any product as input, and depending on that input we will recommend most appropriate products according to the customer's requirement and ratings given by other customers. Only recent ratings will be considered by the system. Our proposed system will meet personalized product item recommendation requirements in E-commerce and time-aware rating consideration to evaluate current product quality.

Keywords— *E-commerce, Time based collaborative recommendation, Product recommendation, Similar friend, Dissimilar enemy, Big rating data, Structural Balance Theory.*

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1. INTRODUCTION

The popularity of Network, E-commerce has gained fast development and accumulated a huge number of faithful online users all over the world [1]. Through E-commerce, users can browse, compare and select the product items that they like in a more convenient manner, which brings the great facility to the E-commerce users [2]. Today, many E-commerce companies (e.g., Amazon, eBay, BestBuy) have provided various product items to their massive online users. Generally, in each E-commerce company, there are a variety of product items that are ready to be compared, selected, and purchased by target users. Therefore, from the perspective of E-commerce companies, accurately predicting target users' preference and further recommending appropriate product items to him/her is becoming the key to ensuring the continued success of E-commerce companies [3-5]. In view of this, many recommendation approaches are brought forth, e.g., the well-known Opinion Mining is for decision making both on the individual and organizational level is always accompanied by the search of other's opinion on the same. With the tremendous establishment of opinion-rich resources like reviews, forum discussions, blogs, micro-blogs, Twitter etc provide a rich anthology of sentiments. This user-generated content can serve as a benefaction to market if the semantic orientations are deliberated. Opinion mining and sentiment analysis are the formalizations for studying and construing opinions and sentiments. The digital ecosystem has itself paved way for use of the huge volume of opinionated data recorded. Also Collaborative Filtering (i.e., CF)-based recommendation [6]. Concretely, through observing the big rating data in user-product purchase network, system can determine the similar friends

of the targetuser or the similar product items of target user' preferred product items, and further put forward CF recommendation methods [7, 8], such as item-based one, user-based one, or a hybrid one. In case if similar friends are not available, CF will not provide satisfied recommendations. To improve this system, their is use of SBT technique. In this technique, integration of both the recommendation methods i.e. item-based CF and user-based CF will improve the recommendation system. No doubt this system will improve the recommendation system but in case if the user is new in a particular product category not having rating data. In that case, SBT system could not find out the enemies and as there are no enemies the system will not be able to find out similar friends. To overcome this problem uses a mixed approach in which system will use SBT in presence of rating data as well as for recommender system. And SBT algorithm is a very time-consuming method. To improve Recommender system uses a time-aware profile based collaborative Recommendation algorithm. In this algorithm, consider only recently submitted ratings and positive reviews to evaluate products quality. Along with this use a novel recommender system in which user will give his requirement about any product as input, and depending on that input, system recommends most appropriate products according to the customer's requirement and ratings given by other customers. [9] Only recent ratings will be considered by the system. This system will meet personalized product item recommendation requirements in E-commerce and time-aware rating consideration to evaluate current product quality.

It is worthwhile to highlight several aspects of the system hereThe system will present a new website of e-commerce from the viewpoint of time-based collaborative recommendation, which incorporates both collaborative user-service relationship as well as structural balance theory features for recommendation process.

The system will use an efficient iterative procedure, TimeBased Collaborative Filtering which utilizes the Opinion Mining, Collaborative Filtering, and SBT algorithm, to solve the product recommendation problem.

2. RELATED WORK:

Product item recommendation has been a hot research topic in E-commerce domain. Through analyzing the existing big user-product rating data, we can recognize user interest and preference precisely and further recommend appropriate product items to the target user, so as to improve the on line product sales significantly. Many people have investigated this recommendation problem and put forward various solutions.

In time-aware recommendation is introduced, where time is considered as an important factor for predicting product quality. However, work only discusses the objective quality prediction, without considering the subjective preferences of different users. Matrix factorization technique is introduced in to realize the recommendation purpose; however, if the user-product rating matrix is very sparse, the recommendation effect is not as good as expected (e.g., over fitting problem).

In [6], a CF-based recommendation approach (named CF+QoS) is proposed, which recommends product items to the target user by considering the product items liked by user target's similar friends. However, when user target does not have any similar friend, the recommendation accuracy of CF+QoS is low. In [9], a bidirectional recommendation approach named WSRec is put forward, which integrates user-based CF and item-based CF together, for high-quality recommendation results. While the recommendation quality of WSRec is low, when user target does not have similar friends and user target's preferred product items do not have similar product items simultaneously.

In a Monte Carlo algorithm named MCCP is brought forth to measure different users' personalized preferences towards different product items. According to MCCP, user target's similar friends can be found by trust propagation; and afterwards, the missing product item quality could be predicted based on the obtained similar friends. Generally, MCCP can work very well if user target has similar friends. However, as introduced previously in this paper, we only focus on the specific recommendation situations when user target does not have similar friends; therefore, prediction accuracy and recall of MCCP are not as good as expected, which has been validated by the experiments.

In our previous work [4], a recommendation approach SBT-SR is put forward, for dealing with the specific recommendation scenarios where user target has no similar friends and the product items liked by user target do not have similar product items. While SBT-SR approach haves two parts. First, only "enemy's enemy is a friend" rule is recruited in SBT-SR. Second, SBT-SR only adopts user-based CF recommendation, while neglects item-based CF recommendation as well as their integration. Therefore, the recommendation effect of SBT-SR is not as satisfactory as expected. In view of the shortcomings of above approaches, we put forward a novel product item recommendation approach SBT-Rec. Through "enemy's enemy is a friend" and "enemy's friend is an enemy" rules in Structural Balance Theory, SBT-Rec can make full use of the valuable structural balance information hidden in user-product

purchase network, and further make precise product item recommendation. Moreover, SBT-Rec integrates both user-based CF recommendation and item-based CF recommendation; therefore, the recommendation recall could be improved.

In our base paper, SBT-Recommendation technique is proposed. According to author, integration of both the recommendation methods i.e. item based CF and user based CF will improve the recommendation system. No doubt the proposed system will improve the recommendation system but in case if the user is new in particular product category not having rating data. In that case SBT system could not find out the enemies and as there are no enemies the system will not be able to find out similar friends. To overcome this problem we propose a mix approach in which we will use SBT in presence of rating data as well as for recommender system. Along with this we propose a novel recommender system in which user will give his requirement about any product as input, and depending on that input we will recommend most appropriate products according to the customer's requirement and ratings given by other customers. Only recent ratings will be considered by the system. Our proposed system will meet personalized product item recommendation requirements in Ecommerce and time-aware rating consideration to evaluate current product quality.

3. SYSTEM IMPLEMENTATION AND WORKING:

With the rapid development of internet technology we are surrounded by a flood of information, it gets difficult for users to choose the information they need. Recommendation system comes into being in this context. And it has been widely both in academia and industry [10]. In recent years, with the rapid development of web 2.0, E-commerce sites are more and more popular. Obviously, the traditional algorithms are no longer applicable to recommend in social networks so many researchers began to study personalized recommendation with a rich source of review and rating information, such as user friendship and user trust. To establish a trust prediction model predict the spread trust in the E-commerce network by using the recommendation system. With the increasing popularity of e-commerce, product recommendation has attracted a lot of attention recently in the research communities of information retrieval

There are various algorithms that are using for recommendation such as Collaborative filtering, Opinion Mining, and Structural Balance Theory in many popular e-commerce sites that follow recommendation systems such as Flipkart, Amazon, eBay. Currently, there is not any such a service available which will provide a time-based recommendation to review the particular product. To overcome these issues the system provides a time-based recommendation. This works on the user rating, review, comments, similarities, enemies' enemy friend, and user interest.

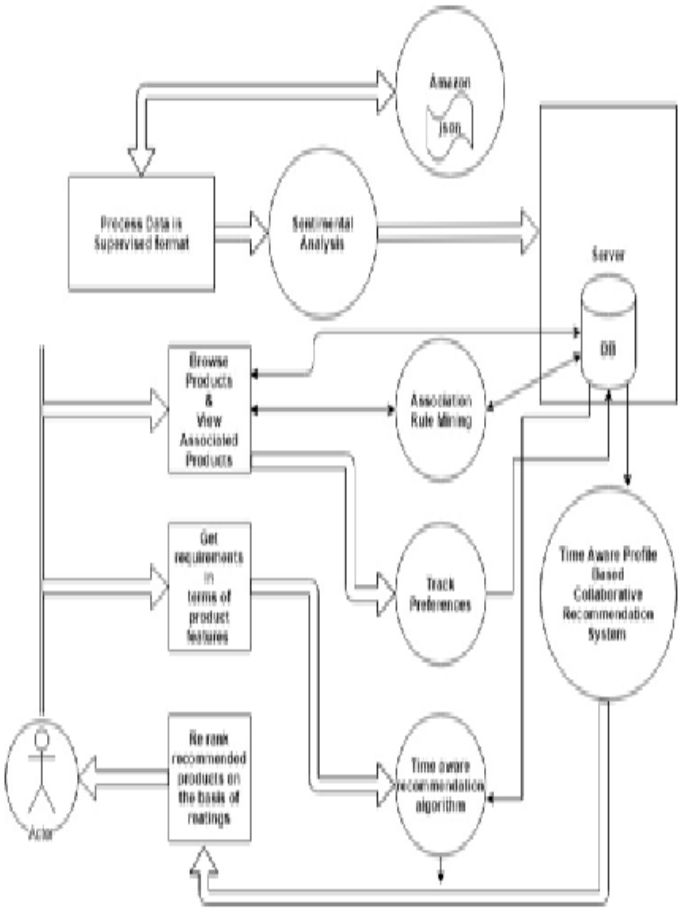


Figure 3.1: System Design

System Architecture

The figure below shows the system architecture for "Time Based Collaborative Recommendation System". The system uses reviews, ratings, and profiles of users. The time-based recommendation model recommends the service based on user profiles as per the user having similar profiles i.e. friends and enemies enemy is friend rule as describe SBT, reviews that are positive or negative depends on sentiment and ratings given to the particular product.

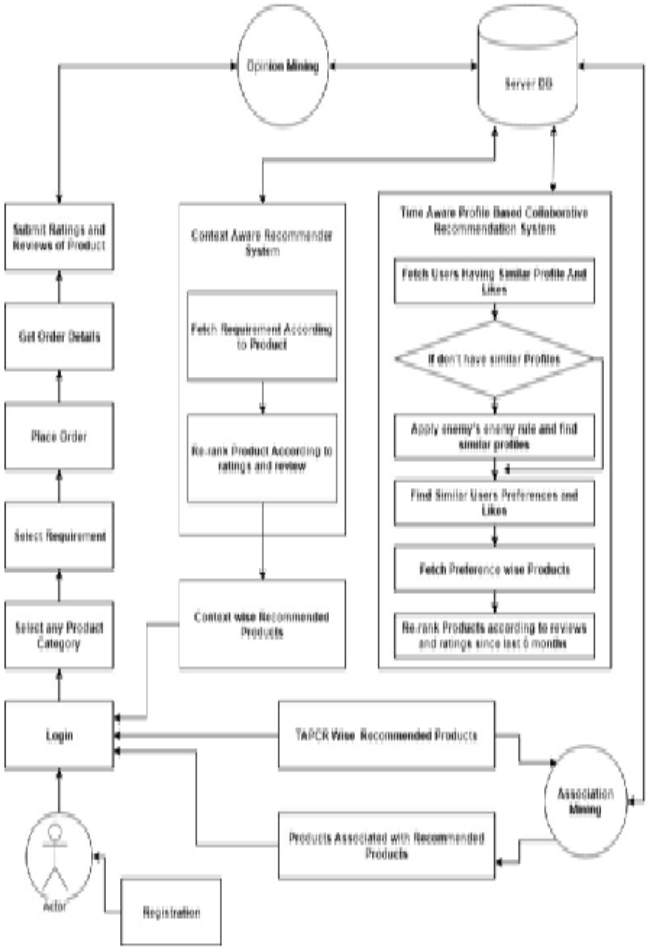


Figure 3.2: System architecture of "Time Based Collaborative Recommendation System

In this user provides the recommendation with the help of sentimental analysis. The systemused to recommend the user based on user recent use of particular kind of product. The system provides the last recent reviews about the particular product which will helpful for the e-commerce website as well as to the users.

Working

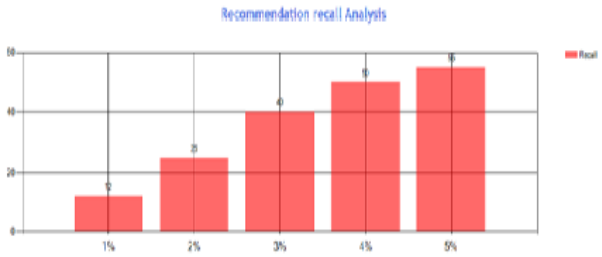
1. At first, the user will register himself on the website, the system will recommend the various services on the basis of the user's profile and also on the basis of his/her profile similarities. If no matching profile will be found then the system will recommend the most popular products to the user.
2. After using any service by user he/she will rate/comment to the product about the experience. If the comment and rating are positive/negative it will be store in the database.
3. The user rating will be stored in user's preferences, interpersonal rating, personal product rating.
4. The system will recommend the user various products on the basis of his profile as well as his/her profile similarities.
5. Then the user will buy particular product/products. The user will be able to recommend the product and also users rating and comments will store to the database for preference learning.
6. The user can also manage to view product details and also able to search new products that might not recommend.

Recommendation Activities:

The systems recommendation is done on the basis of similar profile, opinion, liking means ratings. Match profile with existing users and if find applies friend's friend rule otherwise enemy's enemy is a friend. Also, the user has a similar type of product ratings that kind of products is recommended and on the basis of the opinion that might be positive or negative so from that only positive review product will recommend on the basis of the time when the user puts his review.

- Profile wise recommendation
- Opinion wise recommendation
- Review wise recommendation

Evaluation of system:



Recommendation recall Analysis

Rating Density in percent	Recall Percentage
1%	12
2%	25
3%	40
4%	50
5%	55

4. APPLICATION SYSTEM

The applications of Time Based Collaborative Recommendation System mainly include three fields which are user's profile similarities, user reviews, and user rating.

1. User's profile similarities are used to recommend products to similar profile users. As in real life people find similarities, any similarity found will help for recommendation and decision making.
2. Users rating will helpful for recommending the product on the basis ratings given by the particular user to the particular product.

3. Application of the recommendation system is mainly to recommend the product according to the review of the product on the basis of the ratings provided by the customer.
4. The comments given by the customer are useful for the product to improve the product quality.

5. ADVANTAGES

1. The system will help the user to for finding out the best products based on the ratings as well as comments.
2. The system will recommend the services on the basis of the user profile, likings etc. so the user will have the preferences of products which are used by another user's.
3. The system will provide the facility to the customer that products are recommended on the basis of the time period of ratings less than seven months.
4. On the basis of user's rating, profile & requirements, the system will recommend products.

6. CONCLUSION AND FUTURE SCOPE

Conclusion

Products ratings in E-Commerce with a wide verity of recommendation systems, ratings are one of the major issues know from various users about the product and then targeted user decide for further action and just proposing so there will consider only recently submitted ratings and positive reviews to evaluate products quality. Only recent ratings will be considered by the system. Our system will meet personalized product item recommendation requirements in E-commerce and time-aware rating consideration to evaluate current product quality. This work presented a new approach of product recommendation from the viewpoint of user profiles, by using user's similar, different profiles and the rating given by them for products, which incorporates collaborative filtering as well as opinion mining and structural balance theory.

Future scope

This work can be used in the market for commercial use in e-commerce sites where product recommendation required, with the help of this system recommendations occur through various levels and analyze the service performance using product ratings and product comments. This system is enabling to suggest/help customers to buy the appropriate product as per his requirement, ratings & reviews. In future, will enhance the algorithm to find out the statistical trustworthiness of vendors by tracking their behaviors like order delivery, quality, product life, customer satisfaction for the product etc. In this project focusing on the single user, in future, will focus on similar users' group wise recommendation algorithm.

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