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Recommender Systems for E-commerce: Novel Parameters and Issues

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Abstract: ***E-commerce is a powerful weapon which has helped many companies to boost their sales. Recommender system also known as recommenders are tools that provide important suggestions to users or customers in order to take good decisions while shopping online. The Recommendation systems use old knowledge and some statistical methods to provide these suggestions. In this paper we have provided an overview on the recommender systems like graph based, Context based and 3D-recommender system and focused on techniques that consider social networking data as a backbone to provide valuable suggestions to the user.***

Keywords: Recommender system, graph based, Context based, 3 dimensions based, Social networking.

I. Introduction

Business Marketing has taken a new face. Good Internet speeds, Low computer costs and bandwidth cost have given an opportunity to people to use computer. And, the E-Commerce has helped people to buy good of their choice from anywhere in the world. It has been noticed that the number of transactions carried out by eBay on cyber Mondays and on black Friday crossed a million [1]. There may be hundreds of E-Commerce sites on internet[5], but a customer always expects or prefers one to one marketing strategy. I.e. unlike normal shopping where a sales assistant help us in buying the best item, an E-commerce website should also be able to recommend the best product to the customer. Recommender Systems are software tools and techniques which uses data mining as a backbone to provide suggestions to users while shopping on the web. The recom-mendations are based on the user's priority and other constraints. These recommend-dations are offered to user as ranked list of items. Broadly, these techniques are part of personalization on a site, because they help the site adapt itself to each customer. Recommender systems automate personalization on the Web, enabling individual personalization for each customer. Recommendation system uses historical data available with e-commerce sites. This information can be classified into two types: Implicit information and explicit information.

Implicit information includes purchase history, clicks. Bookmarks, logs etc...And explicit information includes user's reviews on various products. Though there are many techniques for rec-ommendations, the most commonly used techn-iques are Collaborative filtering and content based filtering.

A. Collaborative filtering technique

Collaborative filtering technique takes both user's past behavior and similar decisions made by other users. For example when searching for a product, the e-commerce website recommends other items you may purchase along with items you are going to buy. In simple, a collaborative filtering focuses on a customer's behavior based on other customer's behavior. The effectiveness of collaborative filtering is based on user rating. But, the problem with collaborative filtering is that, user rate only limited number of products. This fact will make it difficult in finding many similar users. This problem is considered as Data sparsity. It is also difficult to design model based on the little rating information. This problem is known as cold start.

B. Content based filtering

Content based filtering categorizes items according to their similar characteristics. This is most popular technique especially in the case of mobile phones. For examples mobile phones with similar charact -eristics are recommended along with the mobile phones what are viewed by a user. In simple, only product information is used[8].

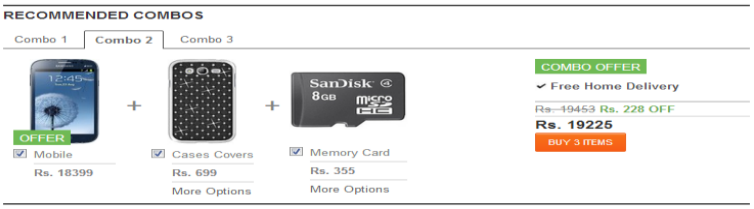

Fig 1: Example of Collaborative filtering technique

Fig 2: Example of content based filtering

Whatever may be the recommender system, the basic inputs to recommender systems are user factors (name, gender, Address, DOB) item factors (product, brand, price) and Transactional data and User's explicit rating and Implicit feedback observed from there navigational behavior

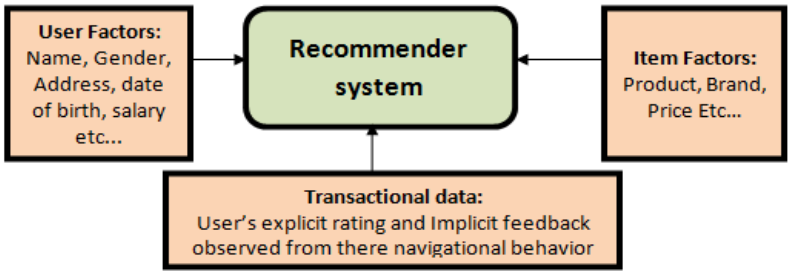

Fig 3: Basic Inputs to a recommender system

II. Recommendation Systems

There are many recommender systems introduced by many researchers but graph based, context based, and 3 dimensional based systems are new systems which are based on latest technologies like mobile technology and 3D viewing.

A. Graph based

In graph based approach the customer and the product information is represented in the form of graphs and relation. These graphs are links are plotted between customers to customers, customers to products and products to products. Three analysis methods are commonly used – direct retrieval, association mining and high degree association retrieval [2].

1) Direct retrieval: In this method, recommendations are generated based on the customer's previous purchase history and similar customers buying history. For content based recommendation, products that are similar to the target customer's previous purchases are retrieved as recommendations. And for collaborative approach similarities can be traced through customer layer links or through interlayer links from the target customer's previous purchase. The products that are linked to similar customers are retrieved as the collaborative recommendations for the target customer.

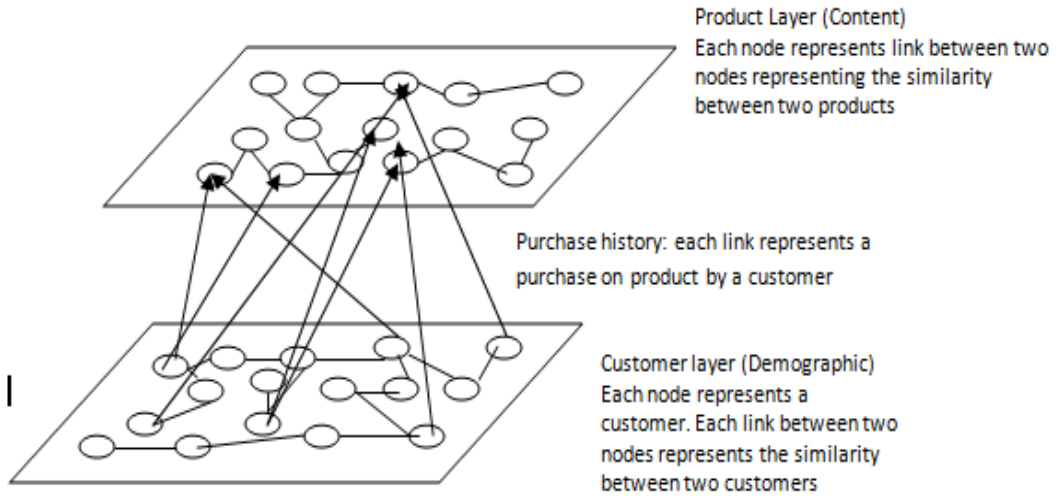

Fig 4: Graph based model

2) Association mining: For each product, we retrieve a number of similar products ranked by similarity weights. These items form an association set that is used for association mining. To find out which association is meaningful we use statistical measure like 'support' which means the relative occurrence of association rule within the entire database transition. In the case of collaborative recommendation, association rules are generated by treating the purchase history as a transition. As a result, we obtain M sets of products where M is the total number of customers who have purchased products. Here we use measures like support and lift value to predict which products are likely to be purchased by a customer given his/her purchase history [2].

3) High degree association retrieval: This technique is mainly helpful for sparse data. The ratio between number of products purchased by customers and the number of products available makes the data sparse. Instead of using dimension reduction, transitive neighborhoods may be used. A recommendation is generated based on the association strength between a customer and product.

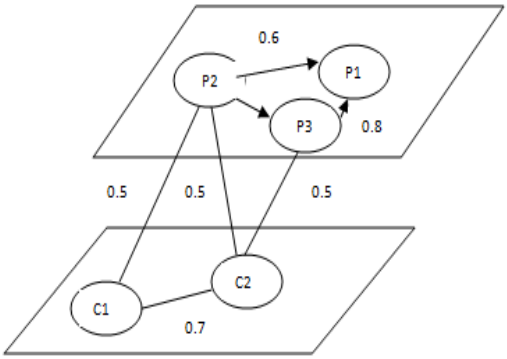

Fig 5: High degree association retrieval

In this method novel techniques like high degree association are used. For example, consider single degree retrieval, in figure 5, c1-p1 specifies customer c1 purchased a product p1. This can be extended to three levels as c1-c2-p2-p1, (or) c1-p2-p3-p1 (or) c1-c2-p3-p1.The delicate weighing schema for the summation can be explored to improve the accuracy of this preference estimate. The result obtained from adding association is, in fact a combination of content-based and collaborative approach [2].

B. Context-aware Recommender Systems

Location-based Advertisement Recommender for Mobile Users (LARMU) is introduced by Kyoung-jae Kim [3]. Collaborative filtering uses a matrix which contains information about user, item satisfaction level, location, time and need type as shown in figure. Here location is placed at the top and time is specified by visiting day and visiting time and needs type have been classified as hedonic and utilitarian.

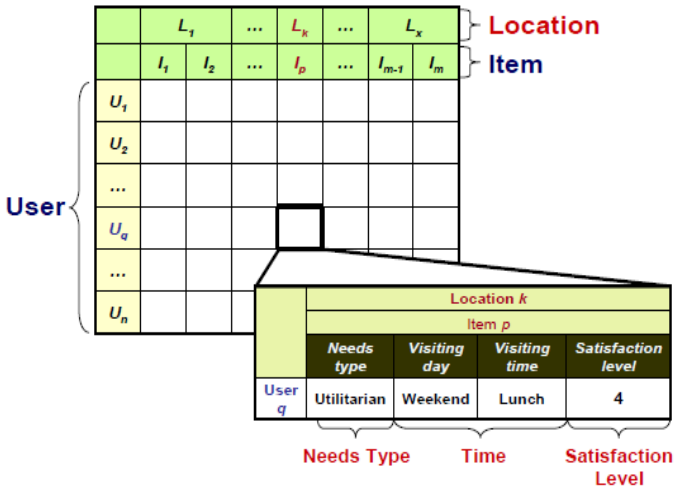

Fig 5: Parameter and matrix representation

In the first step, the information about the target user is input to LARMU. This includes the identification code of the target user, his or her location (visiting area), and current date and time and need type. The, LARMU is designed to estimate the user's needs type by using the information on the target user, and the background (location and time). After collecting and estimating all the required information on the target user, LARMU searches for candidate items for recommendation. At this time, it filters items in the areas that are located in the areas far from the target user's current position.

After the first step, CF is performed to find similar neighbors to the target user, and to calculate the expected satisfaction level for the items that are outside the experience of the target user. In LARMU, other additional information, such as day, time, and needs type should also be considered when calculating similarity and the expected satisfaction level. Thus, it adopted 'weighted Pearson correlation' when calculating similarity between users. Therefore, the similarity between users can be improved by considering multi-dimensional factors, including day, time and needs type. Thus, more sophisticated recommendation results may be generated for mobile users. The architecture of LARMU is as follows

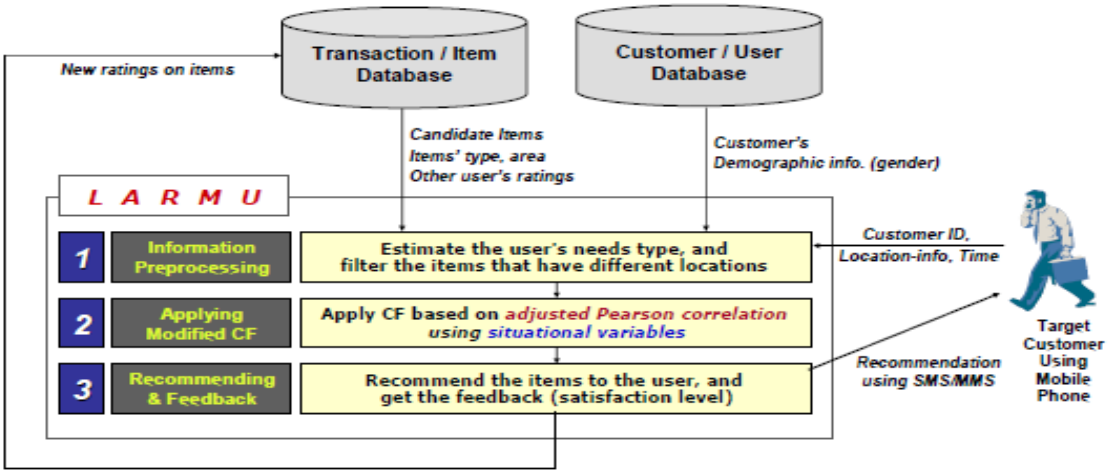

Fig 6: Process of LARMU

In the last step, the optimal recommendation results produced by LARMU are provided to the target user. Then, the user will show the different types of responses. These are stored as a new source of data, and will be used to refine the next recommendation. The results can be transferred using SMS or MMS. If the system uses MMS, it may include more detailed information for the recommended places, such as a simple map, photos, bar codes for promotion, and long messages, although SMS can only send 80 alphabetical characters [9].

C. 3-D Ecommerce

This is a new recommender system proposed by Guibing Guo and Mohamed Elgendi [4]. In this paper the post purchase rating as well as pre purchase rating is considered. Post purchase is given explicitly given by the user. And the pre purchase rating is gathered by electroencephalogram (EEG) signals. The pre purchase ratings are calculated from the averaged relative power of the collected EEG signals. I.e. The wireless EEG device collects data from 14 data collection electrodes and sends in an encrypted format to computer.

The relative power in two non overlapping frequency bands (10-20Hz, and 20-30Hz). Are calculated by using formula:

$$F1=P(10\text{-}20HZ)/p(3\text{-}40HZ) \text{ And}$$
$$F2=P(20\text{-}30HZ)/p(3\text{-}40HZ)$$

Where, 1>F1>0 and 1>F2>0. F1 represents positive emotions while F2 represents negative emotions. Now the averaged features are mapped to as pre purchase ratings, with values varying from 0 to 1

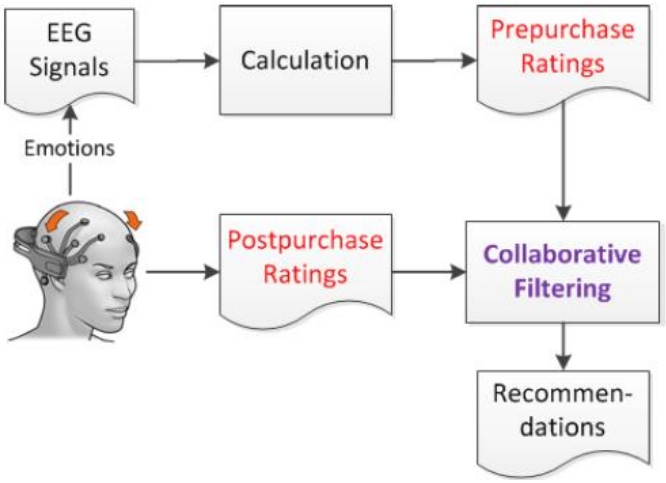

Fig 7: Process of 3D Ecommerce

In this method more recommendations are generated by using both pre purchase rating and pre purchase rating. Post purchase rating is explicitly specified by the user. Whereas, the pre purchase rating is specified by using EEG signals produced automatically by using by a wireless EEG headset. Here, the EEG signals generated are mapped into pre purchase rating. This means we can determine the percentage of likeness of a certain product during the 3D experience. Now both the pre purchase and post purchase ratings are combined to model and provide recommendations.

III. Impact of Social Networking Sites on E-Commerce

This above recommender system uses data generated by the E-commerce company. But there is plenty of external data available with social networking sites and other sources

- Social networking is becoming a powerful tool for e-commerce. A person always believes another person only when he knows him well. This concept is used to post a person's review on a product on social networks.
- E-commerce companies are posting ads on social sites and creating pages on social sites to increase their presence.
- Dynamic offer generation is a used to generate offers based on the customers profile imported from social sites.
- Auto logins from social sites allow e-commerce sites to get permission to post on customer's timeline. Auto logins allow faster checkouts since most of the data like address, name, phone numbers of the customer can be imported from his social network profiles.
- A customer should be able to share a product details on his social networking sites very easily.

IV. Future Work

In this paper we have reviewed on three latest techniques Graph based, Context based and three dimensions based techniques. The future work is based on the fact to use social networking sites like facebook, pinterest, twitter etc...to import knowledge about customers . Recommending a product to a customer should not be based on simple collaborative filtering approach or content based approach. The collaborative filtering should be able to use friend's data to recommend a product along with other unknown customer's interest. The recommender system should also consider the social data about the customer, like date of birth; his friends purchase history, relationships etc... For example we may recommend a beautiful gift with discount to customer on some once birthday or marriage anniversary.

V. Conclusion

"A machine can replace hundred men. But no machine can replace the whole activities of common man." A recommender system may provide many recommendations to a customer. But nothing can replace a shop boy who can recommend a product to a customer. This paper has discussed about latest recommender like Graph based, Context based and three dimensions based techniques. The main aim of the paper is to highlight the practical usage of recommender systems. The future of recommender system would be diversified by taking external data from social networking sites etc...And the recommender systems will be online and offline.

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