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E Commerce Recommendation for limited resource products

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Abstract: *With the development of E-Commerce, it's harder and harder for consumers to find the product they want, and the recommendation systems are applied more and more widely. A recommendation system includes user model, the recommended model and recommendation algorithm. The improvement considered in this paper mainly refer to the recommendation algorithm. Limited resource, data valid time and cold start problems are not well considered in existing E-Commerce recommendation system. According to the problems described above, an algorithm based on limited resource and a solution to cold start problem are proposed.*

Keywords: *Recommendation System.*

I. INTRODUCTION

Now a days everyone likes to shop online. The recommendations of the product is important for customers to purchase the most recommended product. Customers depend on the recommendation to search the products that is good quality wise, the product that is purchased more by other customers that the recommendations save the time of the customers by filtering the product.

The recommendation system should be customer friendly so that the system displays the products that are of customer's interest instead of displaying other products of other customer's interest. This paper concentrates the above issue. The paper also concentrates on other issue. The other issue is the products of customer's interest is recommended to that customer and not displayed to other customers if the quantity of the products is limited.

II. HEALTH CARE AND INNOVATION IN HEALTH CARE

Present System

Difficulty for the consumers to find the products they want in existing recommendation systems. Limited resource situation, data valid time and cold start problems have not been well considered in existing Ecommerce recommendation system.

The customers are recommended with the products that the customer may not be interested. The recommendation may be like the products that are mostly viewed by others or the products may be mostly purchased by others. But the present logged in customer may not be interested in such kind of products. Proper recommendation of products to customers who are interested in that products is not taken care in the existing system.

The situation can also be like the products that are of customers interest may be purchased by some other customers. This situation occurs while resources are limited.

In the limited resource situation the customer may be interested to purchase a particular product but due to some reasons like financial problem he/she may delay the purchase. If some other customers purchase the product the customer with the interest on the product will not be able to purchase the product. So the limited resource situation is not handled in the existing system.

Another issues is the newly registered customer may get recommendations according to the interest and purchase/ browse history of other customers. In such case the new customer may be confused with unwanted recommendations. The registered customer's area of interest is not considered in the existing recommendation system. The issue described above is called cold start problem.

The customer having a transaction history should be recommended with the products that are purchased in common with the other customers with same area of interest. This problem is called data valid time which is not taken care in the present recommendation system.

Limitations

- Lack of consumer satisfaction
- No Personalized Recommendation
- Unable to solve cold start problems
- Limited resource situation not properly handled
- Data valid time not handled properly
- Less Efficient

Proposed System

Proposed system is an effective E-Commerce recommendation system that can give out effective recommendations for customers which can be approved by customers as far as possible. Customers can get benefits, at the same time, the trading volume can be enhanced. Proposed system finds the solution for the existing recommendation problems such as;

The proposed system handles the data valid time by finding the neighbor customers to the customer who requires the recommendation. The neighbor customers are the customers who have more number of products purchased in common. This solution comes into picture only when the customer who requires the recommendation has transaction history.

If the customer is a newly registered customer with no transaction history or if the customer has no neighbor customer with the products purchased in common it is a cold start problem. The cold start problem is handled in the propose system with the help of area of interest field. The area of interest field should be entered buy the customers while they are registering to the online shopping portal.

The limited resource situation is handled in the present system by displaying the limited resources to the customers who are interested in that particular product. The limited resource product is not displayed to other customers whose area of interest is not the limited resource product.

- Limited resource situation
- Data valid time
- Cold start problems

III. REQUIREMENTS

Software requirements

- Frame work: DOTNET
- IDE: Visual Studio 2010
- Front end: ASP.NET 4.0

- Programming Language: C#.NET
- Back End – MS SQL Server

Hardware Requirements

- RAM: 1GB+
- Processor: Pentium 4+
- Processor Speed: 2ghz+
- Hard Disk: 20GB+

IV. METHODOLOGY

Recommendation Process:

On the basis of collaborative filtering principle, the recommendation process of consumer's attractions can be divided into three steps;

- The representation of user information. The purchasing history of attractions by consumer need to be analyzed and modeled.
- The generation of neighbor users (consumers). The similarity of consumers can be computed according to the buying history data and the collaborative filtering algorithm. A neighbor consumer list can be calculated on the basis of known similarities.
- The generation of attraction recommendations. Top-N attractions will recommended to the consumer according to the buying history of his neighbors.

According to above steps, user's basic information and past purchasing history can be used to calculate the user list of neighbors.

Generation of Neighbors

- Neighbor users generated mainly based on the similarity between each user.
- The system can calculate the neighbors list including the top N consumers which similarity is higher than the given threshold. Where T1, T2 ... are transactions of S1, S2 respectively.
- There are mainly three ways to measure the similarity between customers, including Cosine method, Correlation similarity method and Adjusted Cosine method.
- The list A1, A2... are the list of products.
- Zero in the table defines the product not purchased by the customer Ti.
- One in the table defines the product is purchased by the customer Ti.

TABLE I. Purchasing History of the customer

Customers	Attractions				
	A ₁	A ₂	A ₃	A ₄	A ₅
T ₁	1	0	1	1	1
T ₂	0	1	1	1	1
T ₃	1	0	1	1	0
T ₄	0	1	1	0	1
T ₅	0	1	0	1	0

The Cosine rule to find similarity of purchasing between customers is:

$$\text{Sim} (T_i, T_j) = \frac{\text{Number of products purchased in common}}{\text{Total number of distinct products purchased by both customers.}}$$

The neighbor customers for the above given table is found by applying the rule given:

$$\text{Sim} (T_1, T_2) = 3/5 = 0.6$$

$$\text{Sim} (T_1, T_3) = 3/5 = 0.6$$

$$\text{Sim} (T_1, T_4) = 2/5 = 0.4$$

$$\text{Sim} (T_1, T_5) = 1/5 = 0.2$$

If the value of the threshold is set to 0.5 then the similarity with T1, T2 and T1, T3 is greater than threshold. So the neighbor customers of T1 are T2 and T3.

Generation of Recommendations

Recommendations of attractions are computed by the purchasing times of neighbors. According to the calculation above, we know that the neighbors of customer T1 are T2 and T3, so we can list all the purchasing history of all the attractions so as to summary the most popular ones. As listed in Table 2, we can find that the maximal purchasing times of neighbors are attraction A3 and attraction A4.

TABLE II.
Purchasing history of neighbor customers

Customers	Attractions				
	A_1	A_2	A_3	A_4	A_5
T_1	1	0	1	1	1
T_2	0	1	1	1	1
T_3	1	0	1	1	0
Total	2	1	3	3	2

The number of times a particular product is purchased is add and the recommendation system displays the product in the decreasing order of the total number of times the products are purchased by the logged in customer and his/her neighbor customers.

When new customers enter the system, there is usually insufficient information to produce recommendation for them, because there is no purchasing history of the new consumers. The usual solution of the cold start problem is similarity calculation between each user by profile information, such as user area of interest, sex, department, semester, etc.

Cold Start Problem (Random Algorithm)

1. Obtain the location of user and get the registration time of target user.
2. Statistics users in same location who registered within 1 year and their purchasing history.
3. Calculate the trading volume of each product in the statistical results.

Trading volume is calculated using the following formulae;

Volume = transaction containing that product/total number of transactions

4. Sorted by trading volume and get top 10 products as recommendation result.

A well recommendation to new customer can enhance the trust and loyalty of new customers. So the well algorithm which can solve cold start problem has to be applied to E commerce websites.

In cold start situation that is if the customer is not having any transaction history of is a new customer then the area called Area of interest is used to recommend the products. The customers with the same area of interest is considered as neighbor customers then the number of times the interested products are purchased is found. The products are displayed in the descending order of the number of times the products are purchased by the other customers who have same area of interest as new customer.

Limited resource situation is handled in all the cases like cold start situation and while handling data valid time in which the customer has transaction history. To handle limited resource situation a predefined threshold would be given for example 5. If the product count is less than 5 then that product is only visible for the customers whose area of interest is that product. The product displayed only for those customer for whom the product should be recommended after the calculation of neighbor customer.

The product is not displayed or visible for other customers for whom the product is not the area of interest and the product quantity is also limited that is less than 5 in this example. If the product quantity is not limited that is greater than 5 in this example the product is visible to each and every customer.

V. FUTURE WORK

- We can consider the user's area of interest, age, gender, location, marital status etc.
- Then we consider similar users of same interest and their transactions.
- Calculate the trading volume of each product
- Store it in array list, then sort and reverse

Retrieve top 10 products as recommendation result.

VI. DISCUSSION

The paper has the discussion on the problems in the existing recommendation system. The paper gives the methodology for the solution of the problems in the existing system. The methodology discussed in the paper is customer oriented recommendation system methodology. Customer oriented because the methodology focuses on the customer's area of interest, the transaction history of the customer to recommend the wanted products for the customer instead of recommending unwanted products to the customers. The problem of recommending the limited resource products is handled in the methodology as well.

VII. CONCLUSION

The methodology described above helps the recommendation system to recommend the products in a customer oriented manner. The cold start issue, data valid time are taken care by this methodology. The limited resource situation is handled in the methodology described above.

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