Recommender Systems for E-commerce: In Perspective of Business Strategies

Shahab Saquib Sohail* Jamshed Siddiqui** Rashid Ali***

Abstract

The rapid growth of emerging technologies and Internet has moved the world towards an e-world where most of the things are digitized and available on a mouse click. Most of the commercial transactions are performed on Internet with the help of on-line shopping. The huge amount of data puts an extra overload to the user in performing on-line task. Recommender Systems are being used widely to reduce this extra overload and recommend the scrutinized product to the customers. Several data mining techniques are frequently being used for recommendation technology to enhance the online business, amongst which Collaborative filtering, Association rules and web mining are on top . In this paper we try to give an overview of these recommendation techniques with suitable examples and illustrative diagrams, and change of trends in recommender systems. Also the SWOT analysis is discussed for these technologies that give an idea about the respective effects of these systems on business strategies. Various diagrammatic representations are illustrated. And finally we conclude that there is a need of an extra effort to overcome the limitations in existing technology also the aspects of these technology to be used as a business strategy are discussed.

Keywords: Data Mining, E-commerce, Online Business, Product Recommendation, SWOT Analysis, Web Mining.

Introduction

The rapid growth of emerging technologies and Internet has moved the world towards an e-world where most of the things are digitized and available on a mouse click. Most of the commercial transactions are performed on Internet with the help of on-line shopping that makes e-commerce to become more popular. E-commerce is very much popular nowadays. Customers are buying more and more products on the Web and business organizations are selling more and more products on the Web. Whenever a user wants to buy a product on the Web, he visits an online store and looks for item of his interest. There are many popular e-commerce sites like ebay.com and amazon.com. Such online stores sell many items. For a single item, there are many brands and models available. The opportunity for the customer to select from a large number of products increases the burden of information processing before he decides which products meet his needs [1, 2]. If the customer is not sure about product of his choice, he may face the problem of information overload. He may come across a situation, where he may be unable to decide which product to buy. Whenever, a user visits a site and selects a product to buy, the sites recommend him some more products to buy. Product Recommender systems attempt to predict products in which a user might be interested, given some information about the product's and the user's profiles. Most existing recommender systems use collaborative filtering or content-based methods or hybrid methods that combine both techniques.

Web mining is the application of data mining techniques to extract knowledge from the Web data [8]. Data mining refers to extracting unseen, hidden, novel and useful informative knowledge from a large amount of data. Web mining can be broadly divided into three distinct categories according to the kinds of data to be mined namely Web content mining, Web structure mining and Web usage mining.

These techniques are widely being used by the various online marketing portals such as www.amazon.com. By the virtue of the recommender systems available in the market, the customers save their time of visiting several numbers of shops for purchasing a single item. Also the variety in the quality of products and the differences in the rate to the corresponding items can easily be monitored just by browsing the recommended items on the web. This is one of the unique characteristic of the product recommendation

^{*}Research Scholor, Dept. of Computer Science, AMU, Aligarh.

^{**}Research Scholor, Dept. of Computer Science, AMU, Aligarh.

^{***}Research Scholor, Dept. of Computer Science, AMU, Aligarh.

technique that replaces the need of the marketing executive to advertise the products door to door and shop to shop.

Overview of Product Recommendation Techniques

In this section we give brief description for the approaches available for product recommendation techniques and the details are elaborated in the next section.

Association Rules

Association rule technique is one of the traditional data mining techniques and proved to be very effective in recommendation technology [4]. In this technique we try to find the association between set of purchased items. It searches for interesting relationship among items in a given data set.

Rule support and confidence are two measures of rule of interestingness.

Common Recommender System

The collaborative filtering is considered to be the most commonly used recommender system and may be referred as common recommender system. A good number of successful recommendation techniques on the web use collaborative filtering. The basis of collaborative filtering (C.F) is the user's opinion. There are three main parts of a recommender system, as classified in [4].

- 1. Representation of data
- 2. Neighborhood formation
- 3. Recommendation generation.

In spite of the success of C.F there exist some major issues with it such as 'sparseness' and 'scalability'.

Web Mining

Web mining is defined on the basis of different approaches. There are two approaches; first one is "process-centric view" and the second one is "datacentric view". Web mining is defined as "sequence of task" on the basis of "process-centric view". The datacentric view defines web mining in terms of the types of web data being used.

Data Mining Techniques For Product Recommendations

Collaborative Filtering

It is believed that the collaborative filtering is the most successful technology for being used as a

recommendation system till early decade of the new millennium [5, 6]. The products are recommended based on the opinions of other customers. This opinion includes the trends of a particular customer on several products and several customers on a particular product. These systems try to find the neighbor of an item. Neighbors are the customers that either rated different product in a same way as the target customer or they seem to show their affinity for a particular product same as the target. Though (Collaborative Filtering) C.F is a successful recommender system and widely being used, but still there are few major issues with this.

Collaborative filtering identifies previous customers whose interests were similar to those of a given customer and recommends products to the given customer that was liked by previous customers. But, application of collaborative filtering to e-commerce has exposed some well-known limitations such as sparseness and scalability [3, 4, 9].

As collaborative filtering requires explicit non-binary user ratings for similar products, the number of ratings already obtained is very small compared to the number of ratings that need to be predicted. Therefore, collaborative filtering based recommendations cannot accurately identify the products. It is evident that quality of recommendation plays very important role in identifying the customer's purchasing future behavior.

If we do not use a good and reliable recommendation technique, there can be two major types of characteristics errors. One of the errors is "false negative". This is the error in which those items are missed to recommend which are likened by the customers. The second error is "false positive". There is a situation in which those products are recommended which customers do not like, and this is the worst condition as it irritates the customers and discourages them for any further purchasing. Another problem associated with C.F is scalability. As discussed in the previous sections that collaborative filtering uses neighbor algorithm that requires computations. And the computation increases proportionally to the number of customers and products both. In [4] Sarwar et al. divided the recommendation process in three tasks as discussed in Overview section. The first task is "Representation" in which data is represented. They showed two approaches for representation; aggregate and center based respectively. Then the respective algorithm is used for neighborhood formation and can be reduced to low dimension from high dimension. Finally recommendation generation is performed by observing most frequent item and applying appropriate association rule.

Web Mining

A Taxonomy for Web Mining i)

Web mining technique is defined as the application of data mining technique to discover and extract information from web automatically [11]. Mobasher et al. in [10] categorize the web in two different categories, namely web content mining and web usage mining. A similar taxonomy is represented in Fig 1.

ii) Web Content Mining

It is the process of extracting useful information by analyzing the contents of the web. In [10], the author classified web content mining in database approach and agent based approach. The agent based approach were again divided in to three category, Intelligent search Agents, Information filtering and Personalized



Fig 1 Web Mining Taxonomy

Web Agents. They also divided database approach into multilevel database and Web Query Systems.

iii) Web Usage Mining

Web Usage Mining is useful in predicting the user's behavior when they interact with the web. The data which are mined while interacting with the web are considered to be secondary data [12].

Web usage mining is concerned with the behavior of the customer that how they visit and what are the trends of their shopping, what are the products they visit before purchasing an item and what are the items they purchase. If a customer purchases items A and B in the first week of consecutive months then it is probable that in next month that particular customer will purchase both the items. So these combinations are made with the help of web usage mining. Product taxonomy for web usage mining is shown in Fig 2.

If we consider the kind of data to be mined, we can categorize web mining in one more category, web structure mining.

iv) Web Structure Mining

Mining the web structure implies finding out the structure information of the web. It is considered as the process of extracting structure information of the web. If we draw graph for a typical web structure, it consists of web pages and hyperlinks as node and edges respectively.



Fig 2 Product Taxonomy for Web Usage Mining

Business Strategy and Recommendation Technique

The formulation of business strategies are considered as decision making techniques. Therefore it is very important to know the factors that affect decisions that we make. In [7] five factors have been discussed that is important in making decisions.

- 1. Opposite psychological needs
- 2. Motivational style
- 3. Dominants motivational style
- 4. Determining key styles
- 5. The four domain of experience

With the help of SWOT analysis we can easily assess the recommendation system as a basis for making business strategies for marketing and advertisement.

Before we focus on the SWOT analysis of recommendation technique, it should be kept in mind that initially e-commerce focused on the sales of goods; however, it has then expanded to deal with all the aspects of business interaction. The two major areas of interests include:

- 1. Business to Business e-commerce (B2B) concerns the management of business interactions between enterprises.
- 2. Business to Consumer e-commerce (B2C) deals with the interactions between enterprise and end customers.

The four factors of SWOT stand for Strength, Weakness, Opportunities and Threats respectively.

SWOT Analysis is a useful technique for understanding Strengths and identifying Opportunities that may exist, and finding out the Weaknesses and



Fig 3 SWOT Analysis for Product Recommendation.

Table 1 SWOT Analysis for Recommender Systems

SWOT Analysis parameter	Product Recommendation Technique's Features
Strength	Top online retailer in the world like Amazon.com use product recommendation techniques.
Weakness	False positive and false negative errors
Opportunity	Rapid growth in online shopping
Threat	Information overload over Internet

knowing the Threats we may face. It is used in a business context; a SWOT Analysis helps to carve a sustainable niche in market. When we use SWOT analysis in a personal context, it helps to develop career in a way that takes best advantages of the talents, abilities and opportunities. A diagrammatic representation of SWOT analysis for product recommendation is shown in Fig 3.

In the table 1, the four factors of SWOT analysis is discussed.

Conclusions

In the present scenario, product recommendation techniques are widely used by various on-line marketing portals. With an extra information overload over Internet, users need good and sound recommendation techniques. In this paper, we describe various recommendation techniques and briefly their advantages and limitations are elaborated. This gives a clear idea about the recommendation approaches and easy to understand the phenomena of recommendation, even for a native user. Also the SWOT analysis of the recommendation technique is perceived and elaborated. Finally we conclude that there is a need to make a lot of efforts to overcome the limitations of the existing techniques which will give benefit in decision making policies to the brand business giants. Also the advantages of recommendation technique are described in various sections.

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