

**An Emperical Study On Price-Sensitivity Of Recemender System For
Next Gen E-Commerce Platforms**

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ABSTRACT

The Recommender System is an information system capable of providing appropriate products to meet a user's needs. The main task of Recommender System is to efficiently filter products and to classify user preferences in order to provide them with appropriate products. As a result, the use of Recommender System has changed rapidly from information collection to automated marketing tools. The main objective of marketing tools is to have a positive impact on purchasing decisions of consumers. Users can gain product knowledge and purchase the most suitable product through this process. In many ways, Recommender System can boost E-Commerce sales, such as transforming browsers into customers.

Despite early research, very little research has been done on the question of including price in an Recommender System design. The lack of research can be explained by noting that including price in Recommender System development is a challenging task as it requires modeling the price sensitivity of consumers, which varies from customers to categories of products. The price included in the Recommender System improves the accuracy of recommendations, but it must be properly modeled to improve business performance as well. In an online setting, this study experimented with a price-sensitive Recommender System and compared it to a conventional one by different settings. This research validates the impact of price-sensitive Recommender System in strengthening the marketing strategy for next-generation E-commerce platforms and to boost their sales.

Keywords: Recommender System, Price sensitivity, E-Commerce, Price sensitive Recommender System,

INTRODUCTION

Electronic Commerce (EC)

E-commerce (EC) can be defined as the process of purchasing, selling, transferring or exchanging goods, services and/or information through computer networks, including the Internet. It provides many new business models and opportunities, and also has an impact on customer purchasing behaviour.

Recommender Systems (RS)

A recommender system (RS) can be defined as an information system for providing user-interesting product information based on the preferences of users. In addition to sorting data, its main task is to find the user's preferences and thus provide the item that the user would really like to see. Specifically, information overload and search complexity can be minimized with the help of the Recommender System. In addition, the relationship between users and sellers can be strengthened, the quality of the service improved and the profits increased as a result. An Recommender System can therefore increase sales and also better manage customer relationships leading to higher loyalty.

Price Sensitive Recommender System (PSRS)

It is worth noting that price sensitivity varies between customers and products. Different customers may have different price sensitivity for the same product category, and for different products the same customer may have different price sensitivity. As per the Recommender System literature, including price in an Recommender System may seem an obvious way of improving accuracy on average. A Recommender System which includes price is called as Price sensitive Recommender system (PSRS). If a PSRS can increase the accuracy in all price categories, it is considered better than a regular Recommender System (without price). If using a PSRS only increases accuracy in some price categories and decreases accuracy in other price categories, the company may prefer not to risk a decrease in profitability and then choose a regular Recommender System.

With the booming of Internet technology, E-commerce (EC) has grown rapidly with millions of E-Commerce sites operating around the world. However, the question remains how to provide the right products to consumers and maintain

user commitment. The recommender system (RS) is one of the most indispensable methods for dealing with these issues. The Recommender System is an information system capable of providing appropriate products to meet a user's needs. Recommender systems automate web-based customization, allowing individual customization for each client.

E-commerce sites use recommendation systems to suggest goods to their customers. Digital retailers like Amazon and Netflix use them extensively. By using Recommender System, Amazon.com overcame the crisis caused by the Internet bubble burst in 2000 and quickly became the world's largest E-Commerce site. Recommender System was born as tools for retrieving information, but for business purposes they quickly became interesting. In many ways, Recommender System can boost E-Commerce sales, such as transforming browsers into customers, increasing cross-selling and creating loyalty.

Although there is much evidence that using Recommender System can have a positive effect on the purchasing behavior of a customer, product price information is not included in the Recommender System design. Despite early research, very little research has been done on the issue of including price in an Recommender System model. The lack of research can be explained by noting that including price in Recommender System development is a challenging task as it requires modeling the price sensitivity of consumers, which varies from customers to categories of products.

The implementation of price-sensitive recommendation engines would be very necessary for companies. A price sensitive Recommender System should recommend the most relevant products to the customer at the right price. Recommending low-cost products to consumers who prefer to spend more money on that commodity reduces business performance. But at the other hand, it reduces the effectiveness of the recommendation to recommend high-priced items to users who like to spend little money.

LITERATURE REVIEW

Recommender System was first developed as tools to help the retrieval of information. A lot of research has been done to study certain things that are as relevant from a business perspective. Since Schafer et al. challenged scholars to

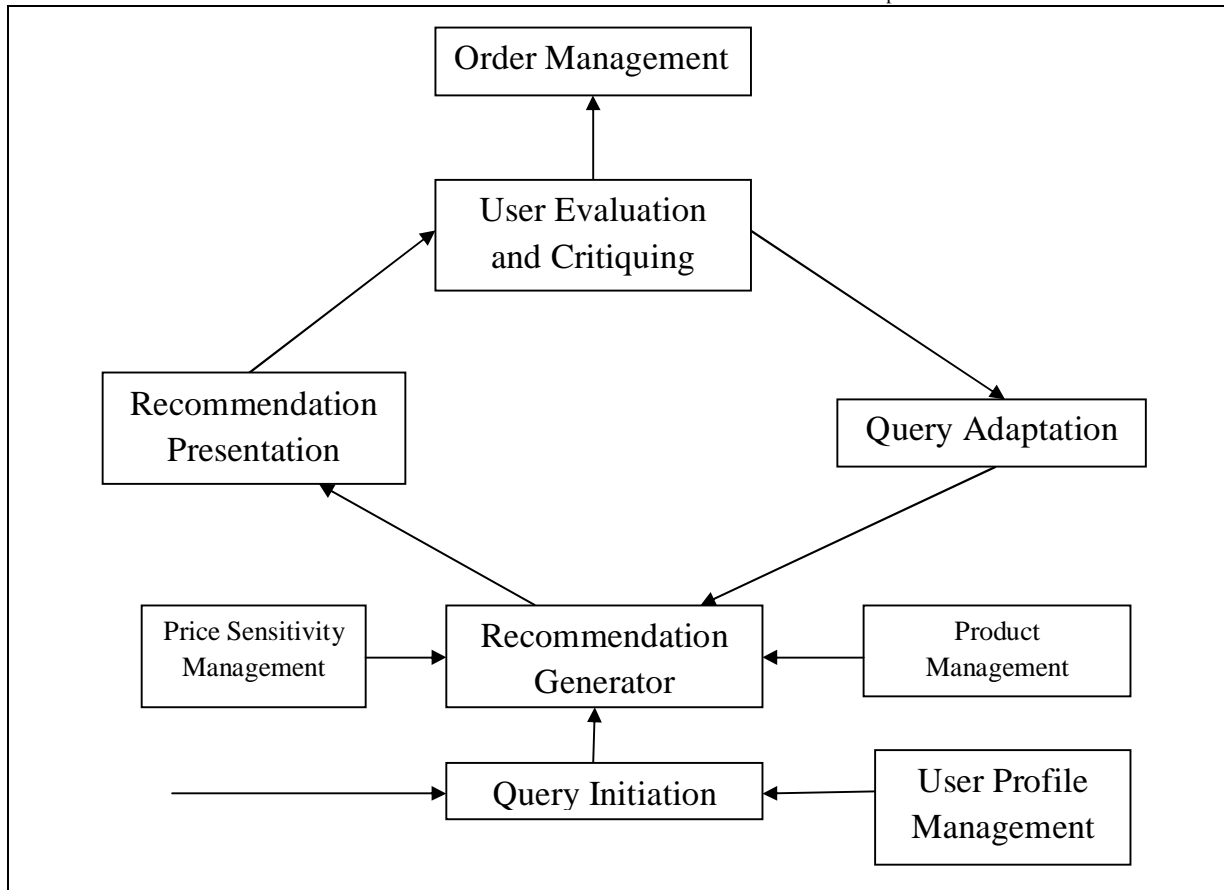
develop an Recommender System to optimize both consumer efficiency and business value at the same time; there has been a lot of research on this viewpoint. Pu et al. found that ease of use and perceived usefulness is critical for purposes of use, whereas trust and choice confidence are crucial to purchase intention. Bharati and Chaudhury studied how the relevance, accuracy, completeness, and timeliness of recommendations significantly affect the decision-making and satisfaction of users. Schafer et al. concluded that by turning browsers into customers, increasing cross-selling opportunities, and creating customer loyalty, recommending systems help increase sales. Pathak et al. found that sales were positively affected by the strength of the recommendations. Gorgoglione et al. demonstrated the effect of recommendations on the purchasing behavior of customers and the sales of business.

Schafer et al. claimed that the Recommender System could provide an indicator of the customer's price sensitivity for a particular product. Bergemann and Ozmen believed that the task of determining the price of each product was external to the recommender system and provided some insight into how this task could be done when using (or not) a Recommender System.

METHODOLOGY

System Design

A critique-based interactive Recommender System aggregated with price sensitivity factor (PSRS) is proposed to take into account the characteristics of any product on an E commerce website. This PSR system's modules are described as below with a block diagram.



Price sensitive Recommender System (PSRS)

1. User Profile Management (UPM): The user profile includes three types of information: basic personal data, such as user name, age, birthday, occupation, preferential price and interactive user history.
2. Price sensitivity management (PSM): This module sets two price categories “low-price” and “High Price” by relatively varying the magnitude of the price categories, referring the price threshold.
3. Query Initialization (QI): This module generates a price-sensitive request that is customized. It receives the user's query and integrates the information from the UPM module and the PSM module into the user profile (e.g., age, price preference).
4. Product/ Price Management (PM): This module contains information about the product, including details of the product, price of the product, constraints of product categories and critique-able attributes.
5. Recommendation Generation (RG): In this section, all the Recommender System methods are implemented. The input of this module can come from the QI during the critiquing cycle for a first time query or from the Query Adaptation (QA), and may be the personalized query or the

- critiquing query... The functions of this module include filtering out unsuitable products; calculating product similarity; comparing the price and providing high price sensitivity for recommended candidate products.
6. Recommendation Presentation (RP): This module provides users with the candidate products which can be arranged according to the price sensitivity of the consumer.
 7. User Evaluation and Critiquing (UE&C): Users will respond with opinions and comments when the candidate products are introduced to users, and if users are not happy with the proposed product, users can critique it in an adjusted direction.
 8. Query Adaptation (QA): This module accepts the UE&C critique comment and changes the request accordingly.
 9. Order Management (OM): If the user is pleased with the product, the user places the item in the shopping cart. This module handles the ordering process and also includes the UPM purchase item stored as purchase history information and the critique process is completed.

Recommendation Process

The process for a price-sensitive recommender system is defined as follows:

1. When users are interested in buying any products, they send their request to the QI module, which is combined with the long-term preferential information obtained from the PM module. If the users are clients for the first time, they must provide basic personal information, including name, birthday, nativity, etc. If the users have previously visited, their long-term preferences are their personal information and history information in the user profile. The QI module can incorporate these types of information into the user specifications.
2. After the QI aggregates all this data, the aggregated query is sent to the RG module, and a suitable product category is obtained and displayed in the RP module by sorting and compiling with Product Management and Price Sensitivity Management modules
3. Upon receiving the recommended product list, users can assess whether the product meets their requirements.
 - (i). If the answer is no, the user may start critique-ing the product by setting the Product / Price adjustment attribute. The critique request is sent to the QM module and the original user request is adjusted and sent back to the PM and PSM for a new run of the recommendation critique cycle.
 - (ii). If the user is satisfied with this product, the product is sent to the shopping cart and the order process starts in the OM module; the product

information is then sent to the UPM module to modify the user profile, where the information can be used in the future when the user has a new purchase intention.

EXPERIMENT AND RESULTS

A PSRS-based prototype system was developed to test its performance. Fifty six customers participated in the online strategy adopted to identify the outcomes.

This experiment contains two modes, the proposed Price Sensitive Recommendation (PSRS) mode and the control mode, which is an E-Commerce mode with all the general E-Commerce functions, to estimate the relative advantage of the Price sensitive Recommender mode. Each participant was asked to identify a product that was expected and to apply both methods to obtain the exact products. The level of satisfaction of participants of these two types, established by Linag and Jiang and Benbasat, is shown in Table 2 below.

The result of the experiment shows that the mean PSRS satisfaction level in 5 factors, Information search, usability, Personalized service, system value, and perceived Price Sensitivity, all of which were higher than the general E-Commerce value. The results show that the satisfaction levels in PSRS were significantly better in all 5 factors than the general E-Commerce by applying the paired t-test.

Table 2.

Mean of the satisfaction level of General EC and PSRS modes

Factor	Item	General EC		PSRS	
Information Search	Find the desired item	3.49	3.55	5.32	5.56
	Filtered undesirable	3.52		5.48	
	Identified the right category	3.64		5.87	
Usability	User friendly	3.39	3.39	5.86	5.79
	Easy to use	3.46		5.75	
	Perfectly formatted	3.42		5.92	
	Clear presentation	3.27		5.64	
Perceived Price sensitivity	Price	3.39	3.46	5.58	5.57
	Price importance	3.42		5.49	
	Price search	3.57		5.63	
Personalized service	User attentive	3.82	3.75	5.65	5.65
	Interest Capturing	3.74		5.59	
	Service Adaptiveness	3.68		5.72	
System Value	Efficient	3.81	3.79	5.76	5.80
	Useful	3.76		5.84	

A Likert 7-point scale was applied (1: totally disagree, 7: totally agree)

CONCLUSION

It is evident from the results of the experiment that the participants were substantially more pleased with the new PSRS architecture variables in all respects (Information search, usability, Personalized service, system value, and perceived Price Sensitivity) compared to the general E-Commerce platform. The experiment's findings show that the manner in which price is set affects business performance.

From a business point of view, it is critical that the price included in the recommendation engine increases the average accuracy. If a PSRS improves accuracy when recommending low-cost products and reduces accuracy when recommending expensive products, the business may risk reducing its profitability. The use of the price in the recommendation engine therefore makes it counterproductive. This research also shows that prices can be set so that the business performance as a whole increases. This research analysis helps to compare a PSRS with well-established marketing models in order to increase customer price sensitivity and make even more effective use of this knowledge to include prices in all Recommender Systems.

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