

Designing and developing an effective recommendation system for eCommerce stores

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Abstract

Based on the continuing fundamental changes of eCommerce the last years, the customers need tailored e-stores to support them in doing their purchases online. Different services have been developed to fulfill this requirement. The most widespread are the personalization and recommendation systems that improve customer's shopping experience. The scope of this paper is to identify the necessary requirements of a recommendation system, to examine the supported functionalities of the proposed system and to present its architecture.

Introduction

How can someone create a usable eCommerce store? How to recommend products that the customer wants? When does the customer buy? How to ensure that the customer will keep doing business with the store? What is the most important content to customize/personalize? What types of data are needed to stimulate transactions and predict lifetime value? What store features make the customer revisit, repurchase or recommend the e-store or specific products?

These are only few of the questions that we try to answer in this paper. A lot of discussion has been made on the significance and importance of eCommerce. eCommerce is more than just handling purchase transactions and funds transfer over the Internet. It also includes the tasks that support the buying and selling goods and services, and interactions among those tasks. More specifically, eCommerce embodies the entire business process from promotion, advertisement, marketing, through to sales, ordering, distribution, customer support, turnover and market share, interaction with external partners (customers and suppliers) and within the company (processes and organisation), etc [9]. However, the majority of eCommerce sites (e-stores) fail to fulfill customer's needs, desires and requests. The real secret of success in eCommerce today involves with building and sustaining an effective relationship with the customers [1].

The goal is too simple. The store should give to the potential customers a compelling reason to buy products or services. Rationally, there are differences between the electronic store and the physical store. An electronic store is not necessarily a substitute for the physical store. In most cases, it works as a complement for the physical store and aims to gain consumers confidence. Obviously, there is no easy answer to the way someone can maintain or even increase customers' e-loyalty [10]. However, the first key is to understand what the customer wants [8]. The second key is to build a close personal relationship. This is not too different from the relationship that a store has in real world, since web sites relationships work in the same way.

Based on the above, the e-store should provide the appropriate tools ensuring the creation of lasting relationships between the web site and the customers. This means that the store should use customers' data to develop and maintain an intelligent interaction. So, when the customer gives information, the store should respond with more personalized services, products, and information [2], [3].

Personalization and recommendation systems are only two of the tools that may improve the customer's shopping experience by offering advanced services and functionalities [4], [5]. The aim is to ask customers to reveal themselves. The e-store uses this information, builds and maintains customer's profiles about their particular needs, interests, preferences, etc. Then, the web site is personalized to them, so that every time they come back it shows the products that fit most to their profile. This functionality gives customers a friendly feeling every time they go back, increases their loyalty and trust about the e-store and of course improves their satisfaction [6], [7].

In this paper we address the issue of offering recommendation services to the customers and the way they are implemented within the framework of our research project. More specifically, we examine how we can actively associate a product or products to customers of the store. We explain how the recommendation system can suggest other products when a customer is examining one. We refer to all the possible services (e.g. online catalogue, banners, offers, cross-selling and up-selling tactics, etc.) that the store can provide in order to offer successful recommendations. Also, the importance of featuring items on the home page of the store that the manager particularly wants to sell or to bring people's attention to them is being under consideration.

This work is organized as follows; the next section figures out the recommendation requirements under the perspective of both customer and e-store; section 3 presents the supported functionalities of the recommendation system; section 4 describes in brief the

recommendation system architecture; section 5 concludes with some general thoughts and suggestions regarding developments in this area.

Requirements

The customers expect to be able to make their purchases from the e-store in an easy and effective way. Consequently, the requirements of the recommendation system can be viewed from the perspective of the customer and the perspective of the store.

From the customer's point of view, the recommendation system should ensure:

- Easy browsing through the products of the online catalogue.
- Useful assistance during the whole shopping process.
- Efficient recommendations about new products, product discounts, special offers, coupons, sweepstakes, etc.
- Saving customers time and minimizing irritation.
- Respecting the customer's individuality.
- Letting customers specify and modify their own profiles.
- All second-time visitors receive content personalized to meet their needs and that this content is embedded with relevant product recommendations.

On the other point of view, the store's view, the system should provide:

- Promotion of the products.
- Creation of customers' profiles. This means that the system should capture customer behavioral information from login procedure, completed purchases, response to questionnaires, etc. The data should be updated at predefined time intervals.
- Generation of consumers' demographics.
- Management of navigation data.
- Analysis of sales data.
- Gathering of statistical data.
- "Remembering" and analyzing everything the store needs to "know" about the customer.
- Encouragement to the customers to "leave something of themselves behind" by different and "invisible" methods.
- Incensement of second purchases.

All the customer's information is gathered into a specific database called *customer profile database*. A customer profile is where the customer gives his preferences and where the system notes important things that have learned about him/her. For example, name, phone number, address, what credit card the customer uses, what kind of products the customer prefers, etc. This database is updated and queried constantly. Also, the customer's transaction information is stored into another database called *transaction database*. The system combines the data and generates appropriate and relevant recommendations. Figure 1 shows the specific information that the customer supplies the system databases.

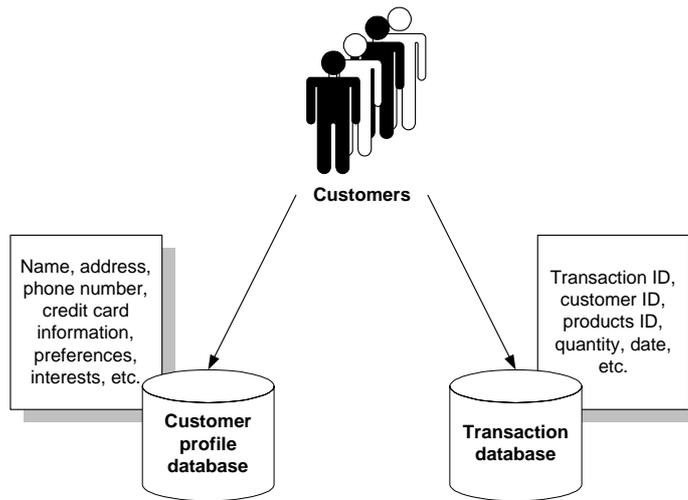


Figure 1: Gathering customers' information.

Supported functionalities

The ability to suggest to customers making additional purchases is a powerful eCommerce sales tool. The user should be able to find products in the e-store by different ways. Figure 2 shows a state diagram describing the behavior of a customer in order to select products from the e-store. Indeed, the state diagram is a pattern since it describes an entire range of different sequences (many sequence for every customer). Following the explanation of every state is presented.

The diagram has one initial and one final state:

- ❑ *Start*: a solid circle shows the initial state when the customer starts the procedure in order to find and select a desirable product.
- ❑ *Select*: the final state is shown by a bull's eye, which is labeled as select. When the customer reaches this state means that he/she has selected the desirable products.

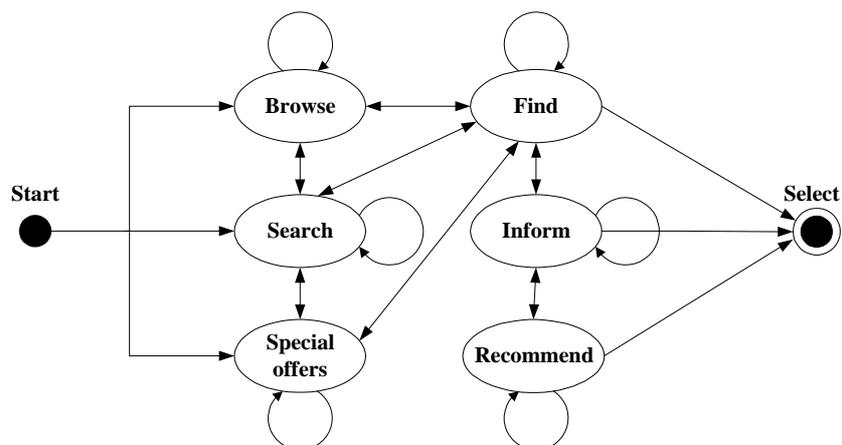


Figure 2: State diagram for the selection of products.

From figure 2 we can distinguish several ways for the customer of the e-store to look through the available products. The most obvious method is to browse inside the store and when he/she finds the product simply clicks on it in order to select it. In most cases, the store is structured in *departments* that are available in the main page of the store. When the customer chooses the department then he/she looks at the products that it contains. Another option is to use the search functionality (it can be in the form of simple or advanced search) to find a particular product in the online catalogue. Also, the customer can choose products from the special offers section. The above different ways to spot products are depicted in the following states:

- ❑ *Browse*: enables the customer to navigate inside the store.
- ❑ *Search*: allows the customer to find particular products of the store by using appropriate keywords.
- ❑ *Special offers*: gives the opportunity to the customer to locate products that may have a discount.

When the customer finds the product then he/she has reached in the state find. There he/she can be informed about the product (state inform) or access several recommendations (state recommend). Finally, the customer can also jump to a specific item through promotional links, such as those that are supplied by the cross-selling or up-selling options.

- ❑ *Find*: the customer has located the desirable product.
- ❑ *Inform*: presents in detail all the features of the product including name, price, other characteristics (like number, weight, height, material, etc.), photograph, etc.
- ❑ *Recommend*: the users can also jump to a specific item through promotional links, such as those that are supplied by the cross-selling or up-selling options.

Specifically, the recommendations that the system makes can be:

- ❑ *Cross-selling*: suggests products related to the one(s) the user is currently viewing. In many cases, these are complementary products. For example, selling a music CD with a book or batteries with toys.
- ❑ *Up-selling*: suggest products perhaps more expensive or advanced to the one(s) the user has chosen. The customer will be informed about products available in the next price level, which he/she does not know or he/she has forgotten. This tactic depends on the type of products.
- ❑ *Other customers' opinions*: suggests additional products that the customer may like, based on what other customers believe about them since they have already purchased them.
- ❑ *Historical data*: analyzing the historical purchase data (stored on transaction database), the store is able to offer customers an extremely targeted range of choices that possibly fit their profile.

Before adopting either technique it is absolutely vital to ensure that it will benefit the customer and do not interfere with his/her ability to complete his/her current purchase. Indeed, it is clear that what online shoppers want most is convenience as they are looking for an easy way to get what they want. Therefore, the recommendation system should be fast, efficient and reliable.

Architecture

As mentioned before, the system saves data about customers' shopping habits, in order to make effective suggestions. This kind of technology offering sales recommendations when the visitor is examining a product, as well as offering the visitor a way of saying "What do you recommend to me?".

The proposed system recommendation technology is based on examining the real-world buying habits of its customers. The problem for implementing this kind of technology is that it needs a lot of orders for creating an enviable base of data on which to run the queries. Another problem is that in many cases some recommendations are often based on assumptions made a priori. Also, statistical information that has not been gathered directly from the customer may lead to inaccurate and misleading recommendations. Finally, people do not usually like the fact that the system collects information about them. So, they avoid supplying the system with personal information.

Figure 3 depicts the architecture of the proposed recommendation system. Both customer profile database and transaction database supply recommendation processor with the appropriate information. The recommendation processor aggregates all the orders ever placed for each individual product of the online catalogue. The results are ordered and written to the recommendation database.

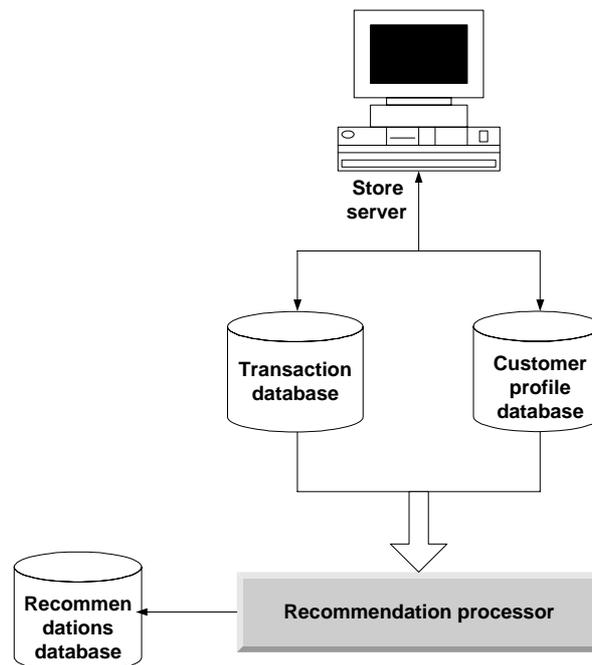


Figure 3: Recommendation system architecture.

The first stage in the recommendation process is to take a snapshot of the orders currently being in the system and passing them to the recommendation processor. The processor also has a snapshot of the current online products' catalogue of the eCommerce store. Then the recommendation process starts in order to apply the cross-selling tactic:

1. Firstly, it looks the transaction database for orders containing the selecting product.
2. Once all the orders are processed the system has sorted the products according to their popularity.
3. Therefore, it has estimated the most common other product that is bought by customers together with the selecting product.
4. At the end of this process, the system has dynamically created the recommendations containing data based on the real-world ordering habits of its customers.

To maximize data gathering opportunities, the system collects data at every customer touch point, online and offline.

Online customer touch points include:

- ❑ Registration. The store can offer the opportunity to register as part of the purchase process. In this case, the advantages are clear to the user because the registration will make future purchases much easier. The store asks some basic information about the customer (e.g. name, address, phone number, fax, interests, preferences, etc.), including the e-mail address and the password.
- ❑ Transactions. It may refer to purchase or request of data.
- ❑ Sign-ups. For instance newsletters, email notifications, samples, coupons, partner offers, etc.
- ❑ Customer profiles or user preferences.
- ❑ Customer surveys (research related and entertaining content surveys).
- ❑ Customer service.
- ❑ Web log files: pages viewed, categories searched, links clicked, etc.
- ❑ Entering and exiting URLs (URL linking to site, and link/entered URL to leave site).
- ❑ Banners.
- ❑ Sweepstakes and other promotions requiring customer data.

Offline customer touch points include:

- ❑ Customer service by phone, entered in database.
- ❑ In-store transactions.
- ❑ Various surveys.
- ❑ Paper submissions (e.g. sweepstake or promotion entries).

The most important data collection point is the initial registration. In most cases this registration process is more important than a first transaction, in that the act of registering indicates that a customer wants to start a conversation or a relationship and that he/she is giving store permission to begin this process.

If the right data is collected that can make the first and subsequent conversations exceed the visitor's expectations. Ensuring that the store allow customers to update and modify their own profiles will not only keep the customer information up to date but will also engender more trust because the customer know what information is kept online.

One of the second most effective ways to gather data is when the system does not ask the customer for any information at all. Many successful web sites use cookies and unique identifiers to make collecting customer-specific data invisible to the customer.

Moreover, it is important that the front page of the e-store contains items that the store particularly wants to sell or bring people's attention to. This page is constantly changing, to keep people coming back. A good design can provide an option (in the administrative page) that allows the store to set whether a product is to be a featured product or not.

Finally, figure 4 presents the implemented recommendation system as a component of a business-to-consumer (b2c) eCommerce application where the focus is given in the different ways to select products (presented in the state diagram of figure 2).



Figure 4: Example of application for the selection of a product.

Conclusion

We started off this paper by examining how important is a recommendation component that can be used to define how the e-store suggests other items when the customer is shopping around for items. We then saw how we can build such a system, its architecture and the way it stores in the databases and then analyzes transaction data and customers' habits and preferences in order to generate successful and accurate recommendations.

All the above indicate the importance of recommendation systems for eCommerce stores. Of course the company's marketing department should support this attempt for achieving better results. Also, the continuous evaluation of the provided recommendations is absolutely necessary. The question that arises in this point is "When a recommendation system is successful?" A short answer could be that "it is successful when the customer buys every product that the recommender suggests". But this is not true since customers do not always buy a product although they may need it. For this reason there is a lot of work need to be done to define all the parameters that characterize and evaluate the performance of a recommendation system. This is one part of our future work.

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