

# Recommender Systems in E-Commerce

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## INTRODUCTION

Electronic commerce (EC) is, at first sight, an electronic means to exchange large amounts of product information between users and sites. This information must be clearly written since any users who accesses the site must understand it. Given the large amounts of information available at the site, interaction with an e-market site becomes an effort. It is also time-consuming, and the user feels disoriented as products and clients are always on the increase. One solution to make online shopping easier is to endow the EC site with a recommender system. Recommender systems are implanted in EC sites to suggest services and provide consumers with the information they need in order to decide about possible purchases. These tools act as a specialized salesperson for the customer, and they are usually enhanced with customization capabilities; thus they adapt themselves to the users, basing themselves on the analysis of their preferences and interests. Recommenders rely mainly on user interfaces, marketing techniques, and large amounts of information about other customers and products; all this is done, of course, in an effort to propose the right item to the right customer. Besides, recommenders are fundamental elements in sustaining usability and site confidence (Egger, 2001); that's the reason why e-market sites give them an important role in their design (Spiekermann & Paraschiv, 2002).

If a recommender system is to be perceived as useful by its users, it must address several problems, such as the lack of user knowledge in a specific domain, information overload, and a minimization of the cost of interaction.

EC recommenders are gradually becoming powerful tools for EC business (Gil & García, 2003) making use of complex mechanisms mainly in order

to support the user's decision process by allowing the analogical reasoning by the human being, and avoiding the disorientation process that occurs when one has large amounts of information to analyse and compare. This article describes some fundamental aspects in building real recommenders for EC.

We will first set up the scenario by exposing the importance of recommender systems in EC, as well as the stages involved in a recommender-assisted purchase. Next, we will describe the main issues along three main axes: first, how recommender systems require a careful elicitation of user requirements; after that, the development and tuning of the recommendation algorithms; and, finally, the design and usability testing of the user interfaces. Lastly, we will show some future trends in recommenders and a conclusion.

## BACKGROUND

E-commerce sites try to mimic the buying and selling protocols of the real world. At these virtual shops, we find metaphors of real trade, such as catalogues of products, shopping carts, shop windows, and even "salespersons" that help us along the process (see <http://www.vervots.com>).

There exist quite a number of models proposed to describe the real world customer-buying process applied to electronic trade; among these, we might propose the Bettman model (Bettman, 1979), the Howard-Sheth model (Howard & Sheth, 1994) or the AIDCA (Attention Interest Desire Conviction Action) model (Shimazu, 2002). The theory of purchase decision involves many complex aspects, among which one might include the psychological ones, those of marketing, social environment, and so forth. The behaviour of the buyer (Schiffman & Kanuk, 1997) includes besides a wide spectrum of experi-

ences associated with the use and consumption of products and services: attitudes, lifestyles, sense of ownership, satisfaction, pleasure inside groups, entertainment, and so forth.

Therefore, the fundamental goal today in EC is that of providing the virtual shops with all of the capabilities of physical trade, thus becoming a natural extension of the traditional processes of buying and selling. One must provide these applications with dynamism, social and adaptive capacities in order to emulate traditional trade. The recommender system can supply the user with information related to the particular kind of shopping technique he or she is using. The most important phases that support the user's decision can be resumed as follows:

- **Requirement of Identification:** It permits the entry of every user into the system in an individual way, thus making it possible for the recommender to make use of a customized behaviour.
- **Product Brokering:** The user, thus properly identified, interacts with the site in search of certain products and/or services; the searching process is facilitated by recommender systems, which relieves the user from information overload and helps each concrete user to locate the desired product.
- **Merchant Brokering:** This type of buying mechanism comes into play when users want to acquire a certain product already known to them; at this moment, they look for the best offer for this precise item. The recommender systems make use of a comparison process, carry out the extraction of necessary information from different virtual shops, and work towards the goals established by the buyer (best price, best condition, etc.).
- **Negotiation:** This aspect reflects the customized interaction between the buyer and the site in the process of pre-acquisition, as well as the maintenance of these relations in post-sale process. This process is performed in the transaction between the user and the site, and it depends on the purchasing needs of the user and on the sales policy of the site. The user must perceive negotiation as a transparent process. In order to benefit and activate the relationship with the site, one must facilitate

fidelity policies. Also, one should avoid pervasive recommendation or cross-sell, which the user could see as obtrusive and abusive methods. This will consolidate the success of the virtual shop.

- **Confidence and Evaluation:** Recommender Systems work with relevant information about the user. A significant part of this phase of approximation to the user is related to the safety in the transactions and the privacy of the information that the user hands over to the company. Besides, post-sale service is critical in virtual shops, both in the more straightforward sense (an item is not acceptable) and in the sense of confirming the results of a given recommendation. This reinforces the confidence of the user in the site and integrates them in a natural way in the sales protocol. Confidence on a recommendation system relies on three fundamental premises (Hayes, Massa, Avesani, & Cunningham, 2002). Confidence in the recommender, assuming that it has sufficient information on our tastes and needs, also accepts that the recommender has knowledge on other possible alternatives.

There exists a large number of recommenders over the Internet. These systems have succeeded in domains as diverse as movies, news articles, Web pages, or wines; especially well-known examples are the ones that we find in Amazon.com or BarnesAndNoble.com.

## MAIN ISSUES IN RECOMMENDATION

The user's interaction with the recommender system can be seen as two different but related processes. There is a first stage in which the system builds a knowledge base about the user (Input Stage we could say) and then a second stage in which a recommendation is made, at the same time taking notice of the user's preferences (Output Stage). Normally, systems offer a set of possible products that try, perhaps without previous knowledge about the particular user, to extract some sort of first-approximation ratings. When the user makes further visits, both the data extracted from a first contact and the information garnered from any purchases

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