

Chapter 123

Recommender Systems: An Overview

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ABSTRACT

With the explosive growth of goods and services available on the Web through e-commerce, it is increasingly difficult for consumers to find the right products or services. Recommender systems provide consumers with personalized recommendations of goods or services and thus help them find relevant goods or services in the information overload. Since they were introduced a decade ago, recommendation technologies have made significant progress. This article presents a brief overview of recommender systems as an effective and powerful personalization tool in the e-commerce environment. Current major recommendation approaches are described and reviewed within a single unifying recommendation model and future directions are also discussed. Recommender systems and technologies will continue to have an essential role in future e-commerce and e-business.

INTRODUCTION

Electronic business (e-business) conducts many activities of a traditional business process by using information and communication technologies. E-business is usually done through the Internet and intranets. As a part of e-business, electronic commerce (e-commerce) handles the process of buying and selling goods and services between business and consumers (B2C e-commerce). E-commerce

evolved to deal with all types of business interactions (e.g. B2B e-commerce and C2C e-commerce). E-commerce typically uses the World Wide Web (the Web) on the Internet and has grown exponentially. With the explosive growth of goods and services available on the Web through e-commerce, it is increasingly difficult for consumers to find and purchase the right products or services.

Recommender Systems are systems that provide consumers with personalized recommendations of goods or services and thus help consumers find relevant goods or services in the information overload

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(Resnick & Varian, 1997). Since its first introduction in the mid-1990s, a variety of recommender systems have been developed and used in a variety of e-commerce application domains including Amazon.com, BarnesandNoble.com, Netflix.com, mystrands.com and Yahoo.com (Konstan, Miller, Maltz, Herlocker, Gordon & Riedl, 1997; Sarwar, Karypis, Konstan & Riedl, 2000; Schafer, Konstan & Riedl, 2001). Over the last decade, recommender systems have been proven useful by sales increase and consumer retention, and are considered as an effective personalization tool in the E-commerce environment (Sarwar, Karypis, Konstan & Riedl, 2000; Schafer, Konstan & Riedl, 2001; Adomavicius & Tuzhilin, 2005; Goy, Ardissono & Petrone, 2007).

The concept of recommender systems is relatively new (just over ten years old) and interdisciplinary, based on various technologies. However, recommender technologies have made significant progress. In this article, we present a brief overview of the field of recommender systems in the context of e-commerce. First, we characterize the personalized recommendation problem and present a unifying model of recommender systems. We then examine current major approaches to personalized recommendations within this unifying model. We conclude with emerging and future research trends and additional readings in the area of recommender systems.

BACKGROUND

The first major recommender systems emerged in the mid-1990s (Resnick & Varian, 1997). Since then, a variety of recommender systems have been developed and used in a range of e-commerce environments, and research has continued to improve them. Basically, a typical recommender system provides consumers with *personalized* recommendations of goods or services in order to help consumers find relevant goods or services. The recommendations are based on the past and

present profiles of consumers with respect to the goods or services.

Figure 1 depicts a model of recommender systems. The personalized recommendation problem is described as follows: *Given a target consumer, produce personalized recommendations of goods or services for the target consumer.* To solve this recommendation problem, a recommender system generally uses three types of data – data about the consumers (called *C_data*), data about the items such as goods and services (called *I_data*) and data about the feedback (such as rating, evaluation, purchase or interest) relation between consumers and items (called *F_data*):

- *C_data* contains a set of all consumers and optionally some additional information about all consumers.
- *I_data* contains a set of all items and optionally some additional information about all items.
- *F_data* contains information about feedback (such as rating, evaluation, purchase or interest) of the consumers on the items (that can be viewed and represented as a partial function that maps a pair of consumer and item into a feedback value).

Thus, a recommender system can be modeled as follows: *Given a target consumer, a recommender system suggests a list of new items that are most relevant to the target consumer by using C_data, I_data and F_data.*

The consumer data and the item data are constructed for all existing consumers and items. The feedback relation data is constructed over time. It can be obtained explicitly from the consumers' participation (*explicit feedback*) or inferred implicitly from the consumers' behaviors (*implicit feedback*).

In order to find items relevant to the target consumer, recommender systems are based on the notion of *similarity* between consumers or between items. A number of similarity metrics

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