

## Chapter 6

# Improving Recommendation Accuracy and Diversity via Multiple Social Factors and Social Circles

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### **ABSTRACT**

*Recommender systems have been widely employed to suggest personalized online information to simplify users' information discovery process. With the popularity of online social networks, analysis and mining of social factors and social circles have been utilized to support more effective recommendations, but have not been fully investigated. In this chapter, the authors propose a novel recommendation model with the consideration of more comprehensive social factors and topics. To further enhance recommendation accuracy, four social factors are simultaneously injected into the recommendation model based on probabilistic matrix factorization. Meanwhile, the authors explore several new methods to measure these social factors. Moreover, they infer explicit and implicit social circles to enhance the performance of recommendation diversity. Finally, the authors conduct a series of experiments on publicly available data. Experimental results show the proposed model achieves significantly improved performance over the existing models in which social information have not been fully considered.*

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## **INTRODUCTION**

With the development of Web 2.0 technologies and the popularity of online social networks, Web/Internet has become a huge platform for information sharing. That more and more people like to share daily experiences in social networks leads to the explosive growth of data on the WWW. When users are able to define their information requirements precisely, search engine is a powerful tool to help them to select online information, e.g., Google, Yahoo, etc. However, in many cases, users have difficulty in precisely describing what information they want, the keyword-based search engine is not efficient to fully meet the need of user information discovery. Under the background of this, personalized recommender system, a more intelligent tool, is needed to offer users new ways to engage with the topics, events, and items that matter to them.

Recommender systems can be divided into several different types based on data source. Content-based RS work by learning the item content for the ranking problem. Recent content-based approaches rank candidate items based on how well they match the topic interest of the user as their preference (Balabanović & Shoham, 1997; Phelan, McCarthy, & Smyth, 2009; Stefanidis, Pitoura, & Vassiliadis, 2011). The accuracy of recommendations depends on the completeness and comprehensiveness of item content. Collaborative Filtering methods make recommendations by exploring user-item interaction information to find correlations between users or items (Koren, 2010; Liu, Chen, Xiong, Ding, & Chen, 2012; Peng, Zeng, Zhao, & Wang, 2010; Sarwar, Karypis, Konstan, & Riedl, 2001), but these methods are unable to make full use of user profiles and item content.

Now, social network has become an integral part of our daily lives. The massive social data contributed by social network users contains rich social knowledge. Researchers have proposed several social trust based RS to improve recommendation accuracy in recent years (Chen, Zeng, Zheng, & Chen, 2013; Jamali & Ester, 2010; Ma, King, & Lyu, 2009; Ma, Zhou, Liu, Lyu, & King, 2011). In fact, a user may trust different friends in different categories. With the notion of this, social circle based RS have recently been investigated (Feng & Qian, 2013; Yang, Steck, & Liu, 2012). Yang, Steck, and Liu (2012) introduced the concept of “inferred trust circle” for recommendation in social networks, taking interpersonal trust influence into account. They focused on inferring category-specific social trust circles. Yang, Liang, and Zhao (2017) developed a set of matrix-factorization (MF) and nearest-neighbor (NN)-based recommender systems (RSs) that explore user social network and group affiliation information for social voting recommendation. However, some of the social network users prefer choosing products closely related to their individual preference, rarely considering interpersonal influence. Feng and Qian (2013) proposed a recommendation model to cater users’ individualities, especially for experienced

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