Chapter 15
A Mobile Service Recommendation System Using Multi-Criteria Ratings

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ABSTRACT

With the rapid advancement of wireless technologies and mobile devices, mobile services offer great convenience and huge opportunities for service creation. However, information overload make service recommendation become a crucial issue in mobile services. Although traditional single-criteria recommendation systems have been successful in a number of personalization applications, obviously individual criterion cannot satisfy consumers' demands. Relying on multi-criteria ratings, this paper presents a novel recommendation system using the multi-agent technology. In this system, the ratings with respect to the three criteria are aggregated into an overall service ranking list by a rank aggregation algorithm. Furthermore, all of the services are classified into several clusters to reduce information overload further. Finally, Based on multi-criteria rank aggregation, the prototype of a recommendation system is implemented. Successful applications of this recommendation system have demonstrated the efficiency of the proposed approach.

INTRODUCTION

Due to successful practice of E-Commerce as well as the maturity of wireless techniques and popular mobile devices, mobile services bring dramatic and fundamental changes to the world.

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The mobile services have attracted much attention in the electronic market (i.e., M-Commerce) during recent years (Smith, 2006). As B3G/4G communication systems (Onoe, Nakamura, & Higuchi, 2007) evolve and mobile devices (e.g., hand-held PC, PDA and mobile phone) become more widespread, the mobile revolution will impact numerous facets of our daily lives. It will

make possible to collect important data in real time so as to assist decision makers, exerting the great influence on communications between businesses and their customers.

In mobile services, proactive service recommendation is a key issue to facilitate user's transaction. Even though much research has been devoted into recommendation systems in web services, those systems are not available for mobile services. There is a great demand for real-time mobile services, but information overload bring a negative influence on it. Muder, Poot, Verwij, Janssen, and Bijlsma (2006) observed that "Whatever people perceive as information overload affects decision-making, quality of work, happiness, job satisfaction, and leads to frustration, stress, and loss of time". Comparing with wired network, wireless communication is truly affected by the information overload. In this paper, services are classified into several clusters based on their similarities in order to overcome this information overload problem.

It has been demonstrated that the Top-*k* ranking list is able to reduce information overload and improved precision. In particular, a Top-*k* ranking list for recommendation of web services has proved successful (Zhang & Dong, 2000; Agichtein, Brill, & Dumais, 2006). But most of them use single-criteria rating. That is, the services are ranked only on the merit of one attribute. For example, all the candidate restaurants in (Yang & Wang, 2009) are sorted by the location distance that is calculated by Global Positioning System (GPS). Andersen, Borgs, and Chayes (2008) presented a trust-based recommendation system. Furthermore, the famous PageRank algorithm takes the importance of pages as the criterion (Page, Brin, Motwani, & Winograd, 1998). Although single-criterion rating systems have proved successful in a variety of applications, McNee found that recommender systems move towards a more user-oriented applications, and the users are not truly satisfied with only one criterion rating of services (McNee, Riedl, & Konstan, 2000). Therefore, multi-criteria ratings are adopted in the field of Recommender Systems. It poses the challenging question of which criterions are more advantageous for precision. Unfortunately, lots of researchers have focused on the attributes of services and context awareness of the user. Few studies have examined the association relations between services. The association relations reflect the users' service usage habits and interests. This information could be extracted from the data on user historic services or service sequences in terms of associate rules. This paper presents an approach to calculating a Top-*k* ranking list based on association rules among service data and to aggregating this ranking with other ranking lists of the attributes of the service.

The proposed multi-criteria rank aggregation recommendation system makes the following contributions. Firstly, the use of service classification is able to reduce information overload. Secondly, the proposed system takes advantage of association rules to extract the relationship among the services, and thereby produces a ranking list. Finally, several Top-*k* ranking lists against different criteria are aggregated into a final Top-*k* ranking list using the rank aggregation method.

This paper presents related work on the recommendation systems and discusses the proposed recommendation system, which includes the system architecture and two subsystems in the subsections. In addition, the algorithm for this system is described in detail. Next, a prototype system is implemented with an illustrative example and then a conclusion is given.

REVIEW OF LITERATURE

Recommender System

As an independent research area, the recommender system was first presented by Resnick and Varian in 1997. They defined it as "people provide recommendations as inputs, which the system then