Chapter 10
Location–Based Advertising Using Location– Aware Data Mining

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ABSTRACT

This chapter describes how mobile advertisements are critical for both mobile users and businesses as people spend more time on mobile devices than on PCs. However, how to send relevant advertisements and avoid unnecessary ones to specific mobile users is always a challenge. For example, a concert-goer may like to visit restaurants or parks before the concert and may not like the advertisements of grocery stores or farmers' markets. This research tries to overcome the challenge by using the methods of location-aware data mining. Furthermore, privacy is always a great concern for location-based advertising (LBA) users because their location information has to be shared in order to receive the services. This chapter also takes the concern into serious consideration, so the user privacy will not be compromised. Preliminary experiment results show the proposed methods are effective and user-privacy is rigorously preserved.

INTRODUCTION

Advertisements are a double-edged sword. They are a lifeline for businesses and a great service for many people, but at the same time the customers may receive a negative impression of the businesses if they are not used appropriately. For example, concert goers would appreciate the advertisements of restaurants or souvenir stores, which will make more profit because of the advertisements. On the other

hand, the same people may not appreciate the advertisements of farmers' markets or hardware stores. However, sending the advertisements based on the people's locations may not solve the problems completely. Another example is the advertisements of rental cars and hotels, but not the ones of grocery stores or car dealers, will be sent to the mobile users when they show up at an airport. Nevertheless, the users may be airport workers like flight attendants or they go to the airports to pick up someone. Most of the mobile advertising methods are based on one or two features of human travel behavior such as the current locations or popular destinations. This research tries to send more relevant advertisements to mobile users based on the current and past travel patterns of the users and others. It is based on several, not just one or two, features of travelers' behavior and expect to receive better results. At the same time, one major concern for this research or most location-based services (LBSs) is user privacy preservation. Most LBSs require the users' current locations and many users are reluctant to share their locations and identities. The proposed method not only successfully produces accurate advertisements, but also rigorously protects users' privacy.

This research is to send more relevant advertisements to mobile users and protect the users' privacy at the same time. It works as follows. The mobile user keeps sending his/her locations to the server. Based on the previous stored data and the locations it receives, the server sends appropriate advertisements back to the user. For example, when the user visits a landmark or a store, two incremental mining methods, incremental location-aware association-rule and sequential-pattern mining, start kicking in. The association-rule mining is used to find related advertisements. For example, if the user stops by a rest stop, then advertisements of motels will be displayed. After visiting the site, the sequential-pattern mining is used to discover the next sites. For example, after checking into a motel, advertisements of restaurants will be shown. At the same time, user privacy is rigorously enforced by sending dummy locations along with the user locations to the server, so the server is not able to tell the correct user locations among the locations it receives. The server then tries to send related advertisements back to the client (user). This research is useful and popular and involved a couple of subjects such as mobile computing, security and privacy, location-based services, data mining, augmented reality, and human behavior recognition. The proposed research gives researchers a new way of thinking about tackling the location-based and user-privacy problems.

Chapter Organization

The rest of this article is organized as follows. Section 2 gives the background information of this chapter including three themes: (i) association rule mining, (ii) sequential pattern mining, and (iii) LBS (location-based service) privacy preservation. Section 3 introduces the proposed system and Section 4 gives details of the proposed method. Experiment results are shown in Section 5. The last section summarizes this research.

BACKGROUND AND RELATED LITERATURE

Three themes related to this research, (i) association rule mining, (ii) sequential pattern mining, and (iii) privacy preservation of location-based services, are discussed in this section. The data mining methods

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