Chapter XVI
Mobile User Data Mining and Its Applications

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ABSTRACT

Mobile user data mining is the process of extracting interesting knowledge from data collected from mobile users through various data mining methodologies. As technology progresses, and the current status of mobile phone adoption being very high in developed nations, along with improvements on mobile phones with new capabilities, it represents a strategic place for mobile user data mining. With such advanced mobile devices, locations that mobile users visit, time of communications, parties of communications, description of surrounding locations of mobile users can be gathered, stored and delivered by the mobile user to a central location, in which it have the great potential application in industries such as marketing, retail and banking. This chapter provides a general introduction on mobile user data mining followed by their potential application. As the life of mobile users are mined, general patterns and knowledge such as the sequence of locations they tend to visit, groups of people that they tends to meet, and timing where they generally active can be gathered. This supports marketing, retail and banking systems through the use of knowledge of behavior of mobile users. However, challenges such as privacy and security are still a main issue before mobile user data mining can be implemented.

INTRODUCTION

With the increasing penetration rate of mobile technologies among the marketplace (Goh & Taniar, 2004b; Lim, Wang, Ong, & Hwang, 2003), businesses have adopted various types of mobile products, such as personal digital assistants, mobile phones, and wireless laptop computers, in order to help improve the efficiency of one's daily life. The increasing adoption of such equipment allows the opportunity for the collection of data about their usage and

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movement that can then be further analyzed (Goh & Taniar, 2004b, 2004d).

The analysis of such data collected from mobile devices and mobile users for determination of patterns is called *mobile user data mining* (Goh & Taniar, 2004a, 2004b, 2004c, 2004d, 2005). In the mobile environment, there are devices offering service to mobile equipments. These are often known as static devices (Goh & Taniar, 2004b, 2004d), as they stay static and provide services for the mobile devices. These mobile equipment operate in a network where data can be readily transferred and services can be readily rendered (Goh & Taniar, 2004c).

Data mining can be performed in various domains such as the time series domain (Han, Dong, & Yin, 1998, 1999; Han, Pei, & Yin, 2000), Web domain (Christophides, Karvounarakis, & Plexousakis, 2003; Dourish, 2004; Eirinaki & Vazirgaiannis, 2003; Kastaniotis, Zacharis, Panayiotopoulos, & Douligeris, 2004; Kim, Kim, & Kim, 2004), market-basket analysis domain (Agrawal & Srikant, 1994, 1995), geographical information system domain (Koperski & Han, 1995), performance improvement domain (Han et al., 2000; Li, Tang, & Cercone, 2004; Miyahara et al., 2004; Thiruvady & Webb, 2004; Yip, Wu, Ng, & Chan, 2004), security domain (Oliveira, Zaiane, & Saygin, 2004), and mobile domain (Goh & Taniar, 2004a, 2004b, 2004c, 2004d, 2005; Wang, Lim, & Hwang, 2003). The existing methods of data mining include association rules (Agrawal & Srikant, 1994) and sequential patterns (Agrawal & Srikant, 1995). The existing methods of mobile user data mining include frequency patterns (Goh & Taniar, 2004b), location-dependent mobile user data mining (Goh & Taniar, 2004d), and parallel patterns (Goh & Taniar, 2004c).

The aim of this chapter is to provide an insight on the background of mobile user data mining and potential application areas of mobile user data mining in different industries. The potential application is viewed from the aspects of the banking industry, marketing industry, and retail industry. As the mobile user data mining methods are getting more developed, they could be implemented one day in areas where interactions are required with highly mobile customers.

This chapter is organized as follows. The next section provides a background on mobile user data mining. We then highlight the benefits of adopting mobile user data mining and provide detail about how banking, marketing, and the retail industry could benefit from mobile user data mining. Next we provide an overview of future challenges such as security and privacy, and finally summarize the chapter.

MOBILE USER DATA MINING

Mobile environment (Goh & Taniar, 2004a, 2004d) refers to an environment where free movements of human beings are possible. The mobile environment is an area where a human being carries devices that can be handheld (mobile devices), and seeks information and services from service providers (static devices) that is within the coverage of that area or available through subscription. Mobile environment therefore can also be referred to as the mobile network environment (Goh & Taniar, 2004d).

In the mobile environment, many devices are being used. The static devices are nodes in the mobile that never moves around, but are stationed in the mobile environment just to provide services such as data, network, and processing to their clients, which are mobile devices (Goh & Taniar, 2004b, 2004c, 2004d). These mobile devices are wirelessly connected together to a server. The mobile devices can come in many forms. Some of the existing forms include mobile phones, personal digital assistants, and laptop computers. Mobile de-

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