Mining Parallel Patterns from Mobile Users

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ABSTRACT

Mobile technology is a widely adopted technology and is used for mobile users to stay connected. Mobile data mining is an extension of data mining for the purpose of developing innovative ways to extract useful knowledge out from mobile users to the decision makers. Our proposed method, parallel pattern, provides a method for finding out similar decisions by mobile users. Parallel patterns are divided into physical parallel pattern and logical parallel pattern. Physical parallel pattern finds the similarities of physical movement decisions among mobile users. Logical parallel pattern finds the logical similarities of logical theme movements among mobile users. In physical parallel pattern, mobile users can only occupy one physical location at any one time while in logical parallel pattern, mobile users can occupy more than one logical theme at any one time and each static node can have more than one logical theme at any one time. Our performance evaluation shows that the method for mobile parallel pattern mining suits for the real world problem in both the physical and logical parallel pattern mobile mining paradigm.

Keywords: frequency pattern; knowledge discovery; mobile data mining; mobile knowledge extraction; parallel pattern

INTRODUCTION

Mobile technologies have benefited the society by connecting people without the barrier of physical distance. Mobile technologies have been widely adopted and are still on track of further adoption in terms of more services in single mobile equipment. Mobile technology is heading toward a bright future and research into this area is needed to create innovations in both the business side of the technology and technical side of the technology. Innovations in particular will provide new ideas that enable users to get jobs done or be entertained by using mobile technology without the barrier of physical distance in a way that is cost efficient and socially acceptable performance. Since mobile technologies have been widely adopted, there is an opportunity to find out the behaviour patterns of mobile users by observing their physical and logical movements (Goh & Taniar, 2004a; Wang et al., 2003).
Data mining (Agrawal & Srikant, 1994; Agrawal & Srikant, 1995; Eirinaki & Vazirgiannis, 2003; Han et al., 2000; Han et al., 1998; Han et al., 1999) is an area of research that focuses on the problem of how to retrieve useful knowledge out from a set of raw data collected from many sources. The volume of source data is often huge, and contains a lot of irrelevant variables or datasets. The art of data mining is to create an efficient method, which later can be translated into algorithm, which the method is smart enough to discard irrelevant dataset and provide a clear analysis of the source data.

Mobile data mining (Goh & Taniar, 2004a; Goh & Taniar, 2004b; Wang et al., 2003; Lim et al., 2003) is an extension of the data mining research field, which specifically combines the goal of both data mining along with the new environment and challenges posed in the mobile environment. Instead of looking at just market basket analysis (Agrawal & Srikant, 1994), which is a common area of analysis for classical data mining, mobile data mining looks into the patterns of the mobile users. The patterns of the mobile users (Goh & Taniar, 2004a) present a behavioural description of the mobile users.

This paper proposes a method for mining useful knowledge out from mobile users by using parallel pattern technique. Parallel patterns are movement decisions of mobile users that are of similar directions. It could be described in both physical and logical way. The aim of this method is to provide a highly accurate knowledge that is relevant to decision makers who are interested in finding out the behaviour of mobile users. This could range from physical movement decisions and logical taste selection decisions.

The paper is organised in the following manner. The next section provides the background knowledge necessary in understanding the concept of parallel pattern. These include the underlying concepts of how the mobile environment works and operates, how the mobile users can be identified in different ways and what are their advantages and drawbacks. The third section provides an account of related work surrounding the area of mobile data mining. This includes the frequency pattern and density pattern. The fourth section describes the proposed parallel pattern in detail. The parallel pattern section is subdivided into physical parallel pattern and logical parallel pattern. The fifth section provides the algorithm for the parallel pattern mining techniques. The sixth section provides performance evaluation for both physical and logical parallel pattern. Finally, the last section concludes.

BACKGROUND

The mobile environment will usually consist of static nodes and mobile nodes (Goh & Taniar, 2004a). A static node is a generic term to describe equipment in the mobile coverage area that the physical location of the mobile equipment generally does not change, or only changes a little. A mobile node is also a generic term to describe all equipment in the mobile coverage area in which the physical location of the entity moves from one place to another from time to time. An example of static node is the wireless network point and an example of mobile node is the wireless Personal Digital Assistant (PDA).

Figure 1 shows the representation of the mobile environment (Goh & Taniar, 2004a). It can be observed that each circle represents a mobile node, or mobile user. Each triangle represents a static node. Each arrow represents the direction of