DATA MINING IN MOBILE ENVIRONMENT-AN OVERVIEW

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Abstract- Mobile data mining is a very promising area for users and professionals where users, resource and applications are mobile. On the basis of researcher's experience, it can be suggested that the combined use of a service oriented approach with mobile programming technologies makes easier implementation of mobile knowledge discovery applications. Data mining services play an important role in the field of Communication industry. Data mining is also called knowledge discovery in several database including mobile databases. In this paper, consumptive behavior based on data mining technology is discussed and analyzed. Different aspects of data mining techniques and their behavior is discussed and analyzed in mobile environment. Due to recent advances in computer hardware technology, a vast number of mobile clients are accessing various information systems via wireless communication from anywhere at any time. At present, the wireless services do not support the personalization and localization for mobile clients. If wireless internet service provider (WISP) has the ability to explore the user behaviour, and support Location-based Services (LBS), it will increase the client's loyalties and satisfaction. In this paper, the use of data mining technologies to trace out the mobile clients' behaviours and the sequences of service requests is studied.

Keywords- Data Mining, Mobile Data Mining.

I. INTRODUCTION

Analysis of data is a complex process that often involves remote resources (computers, software, databases, files, etc.) and people (analysts, professionals, end users).Recently, distributed data mining techniques are used to analyze dispersed data sets. An advancement in this research area comes from the use of mobile computing technology for supporting new data analysis techniques and new ways to discover knowledge from every place in which people operate. This paper discusses study of data mining from mobile devices through the use of web services. By implementing mobile web services we allow remote users to execute data mining tasks from a mobile phone. A prototype based on a J2MEclient will be used by describing the data selection task, the server invocation mechanisms, and the result presentation on a mobile device.

II. DATA MINING

Data mining is the new technology of discovering the meaningful information from the data repository which is widely used in almost all domains which includes finance, insurance, process control, quality supervising, engineering and scientific data analysis etc. Recently, mining of databases has attracted a growing amount of attention in database communities due to its wide applicability in retail industries in improving marketing strategies. Analysis of past transaction data can provide very valuable information on customer behavior and business decisions. The amount of data stored grows twice as fast as the speed of the fastest processor available to analyze it.

2.1 Mobile Data Mining

The goal of mobile data mining is to provide advanced techniques for the analysis and monitoring of critical data from mobile devices. Mobile data mining has to face with the typical issues of a distributed data mining environment, with in addition technological constraints such as low bandwidth networks, reduced storage space, limited battery power, slower processors, and small screens to visualize the results [1].The mobile data mining field may include several application scenarios in which mobile device can play the role of data producer, data analyzer, client of remote dataminers, or a combination of them. More specifically, we can envision three basic scenarios for mobile data mining:

1. The mobile device is used as terminal for ubiquitous access to a remote server that provides some data mining services. In this scenario, the server analyzes data stored in a local or distributed database and sends the results of the datamining task to the mobile device for its visualization.
2.Data generated in a mobile context are gathered through a mobile device and sent in a stream to a remote server to be stored into a local database. Data can be periodically analyzed by using specific data mining algorithms and the results used for making decisions about a given purpose.
3. Mobile devices are used to perform data mining analysis. Due to the limited computing power and storage space of mobile devices, it is not realistic to perform the whole data mining task on a small device. However, some steps of a data mining task (i.e. data selection and preprocessing) could be run on small devices.

MobiMine [2] is an example of data mining environment designed for intelligent monitoring of stock market from mobile devices. MobiMine is based on a client-server architecture. The clients running on mobile devices such as PDAs monitor a stream of financial data coming through a server. The server collects the stock market data from different web sources in a database and processes it on a regular basis using several data mining techniques. The clients query the database for the latest information about quotes and other information. A proxy is used for communication among clients and the database. Thus, when a user has to query the database, she/he sends the query to the proxy which connects to the database, retrieves the results and sends them to the client. To efficiently communicate data mining models over wireless links with limited bandwidth, MobiMine uses a Fourier based approach to represent the decision trees, which saves both memory on mobile device and network bandwidth.

Another example of mobile data mining system is proposed in [3]. Such a system considers a single logical database that is split into a number of fragments. Each fragment is stored on one or more computers connected by a communication network either wirely or wirelessly. Each site is capable of processing user requests that require access to local or remote data. Users can access corporate data from their mobile devices. Depending on the particular requirements of mobile applications, in some cases the user of a mobile device may log on to a corporate database server and work with data there. In other cases the user may download data and work with it on a mobile device or upload data captured at the remote site to the corporate database. The system defines a distributed algorithm for global association rule mining, which does not need to ship all of local data to one site, thereby not causing excessive network communication cost. Another promising application of mobile data mining is the analysis of streams of data generated from mobile devices. Some possible scenarios are patient health monitoring, environment surveillance, and sensor networks.

The VEhicle DAta Streammining (VEDAS) system [4] is an example of mobile environment for monitoring and mining vehicle data streams in real time. The system is designed to monitor vehicles using on board PDA based systems connected through wireless networks. VEDAS continuously analyzes the data generated by the sensors located on most modern vehicles, identifies the emerging patterns and reports them to a remote control center over a low bandwidth wireless network connection. The overall objectives of VEDAS support drivers by characterizing their status, and helping the fleet managers by quickly detecting security threats and vehicle problems.

III. WEB SERVICES IN MOBILE ENVIRONMENTS

Web services are an Internet based implementation of the SOA model. Basically, web services are software services that can be described, discovered, and invoked by using XML formalisms and standard Internet protocols such as HTTP[5]. The use of XML as basic language permits to share data independently from underlying platforms and programming languages. At the same time, the use of standard Internet protocols allows to exploit software and hardware infra structures those are already available for Internet applications such as the Web. Web Services differs in many respects from classical distributed architecture based on remote components such as RMI, CORBA and DCOM. Webservices use a platform independent formalism for message exchange and classical architectures use low level binary communications. Thus data encoding completely depends on specific technologies. Another important difference is that web services are thought for coarse grained services, while classical architectures are mainly designed to support fine grained components. In other terms ,web services expose their functionalities at a higher level of abstraction while remote components expose low level operations that are mainly related to implementation aspects.

The market of mobile devices such as smart phones and PDAs is expanding very fast, with new technologies and functionalities appearing every day. Even if such devices share a common set of functionalities, they run on many different platforms, which makes integration with server applications problematic. As in standard wired scenarios, Web services can be exploited in mobile environments to improve interoperability between clients and server applications independently from the different platforms they execute on. Basically, there are three architecture models for implementing Web Services in mobile environments [6]:

1. a wireless portal network;
2. a wireless extended Internet;
3. a Peer to Peer (P2P) network;

In a wireless portal network there is a gateway between the mobile client and the Web Service provider. The gateway receives the client requests and takes care of issuing corresponding SOAP requests and returning responses in a specific format supported by the mobile device. In the wireless extended Internet architecture, mobile clients interact directly with the Web service provider. In this case mobile clients are true Web services clients and can send or receive SOAP messages. In a P2P network, mobile devices can act both as Web service clients and providers. This capability of acting both as consumer and provider can be particularly useful in systems such as adhoc networks. It is not currently implemented in real systems, but it represents the more general model that can offer very interesting opportunities for mobile services in a near future. In most application scenarios, mobile devices act only as Web service consumers.

In these cases, the choice between the wireless portal network and the wireless extended Internet architecture mainly depends on the level of performance required by the application. The wireless extended Internet configuration requires mobile devices with XML/SOAP processing capabilities. This introduces additional processing load on the device and some traffic overhead for transporting SOAP messages over the wireless network. While the additional processing load could be negligible inmost devices, the traffic overhead can affect response time in presence of wireless connections with limited bandwidth. On the other hand, wireless portal network architecture requires the intermediation of a gateway that acts as proxy between client requests and service providers. This allows user to use a set of optimizations (e.g., data compression, binary encodings)for reducing the amount of data transferred over the wireless link, but these methods generally depend on the specific structure of data used by the application [6-7]. So its applicability is limited. Following either the wireless portal network or the wireless extended Internet architecture, some researchers studied how to improve functionalities and performance of Web Services in mobile environments.

IV. RELATED WORK

Many researchers studied and worked on mobile data mining. Adaçal and Bener [6] proposed an architecture that includes the three standard Web Service roles (provider, consumer, and registry) and three new components a service broker, a workflow engine, and a mobile Web Service agent. The mobile Web Service agent acts as a gateway to Web Services for mobile devices and manages all communication among mobile devices and the service broker or the workflow engine. The agent, which is located inside the mobile network, receives the input parameters required for service execution from the mobile device and returns the executed service. It also selects services according to user preferences and context information such as location, air link capacity, or access network type.

Chu, You and Teng [8] proposed an architecture that divides the application components into two groups: local components, which are executed on the mobile device, and remote components, which are executed on the server side. The system is able to dynamically reconfigure application components for local or remote execution to optimize a utility function derived from the user preferences. This approach implements a smart client model, which is in contrast with that of *thin client* (which is only capable of rendering a user interface) generally implemented in wired scenarios.

Zahreddine and Mahmoud [9] proposed an approach for Web Service composition in which an agent performs the composition on behalf of the mobile user. In the proposed architecture, the client request is sent to a server that creates an agent on behalf of the user. The request is then translated into a workflow to be performed by the agent. The agent looks for services that are published in a UDDI registry, retrieving the locations of multiple services that suit the request requirements. The agent then creates a specific workflow to follow, which entails the agent travelling from one platform to another completing the tasks in the workflow.

V. ARCHITECTURE DESIGN OF CLIENT/SERVER MODEL IN MOBILE ENVIRONMENT

The traditional client/server paradigm fits well into the mobile search application. The carrier's network is the server which provides data and voice services to subscribers. User submits mobile queries to network. The mobile devices play an extensive role of collecting, analyzing ,and extracting context entities. Context profiles compiled at client side adapt to the mobile user's current situation. Figure 1 shows the paradigm of the client/server model. The user inputs (voice or data) and surrounding environment inputs (temperature, GPS reading, altitude, e.g.) are collected by the hardware logic or the applications such as the user calendar. The context-aware proxy further inspects inputs and extracts context entities from the inputs. Finally, the proxy compiles the context profile and sends it to the carrier server .The carrier server learns the user situation from the context profile in addition to data collected at the network. For example, the network context unit collects user information, i.e., location and query history. The intelligent manager carries out a few important functions such as identifying the ambiguous queries and expanding these queries with context profiles. Expanded query contains extra information which could facilitate search engines and improve the topic relevance of returned documents.

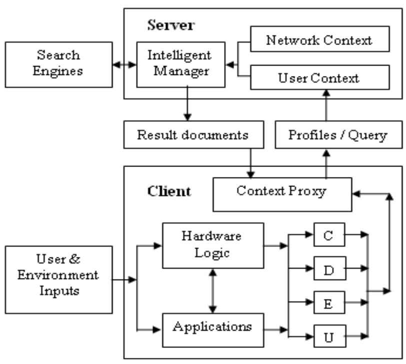

Fig. 1.General architecture of the system

E: environment profile C: cache profile
U: user profile D: device profile

VI. ANALYSIS

Now-a-days, quantity of mobile users is increasing. Therefore, there is need to use mobile data mining so that user can execute data mining anywhere. But it is not possible to mine the data on small devices. From the presence study, it has been observed that mobile datamining through web services with the help of client/server architecture can be used.

CONCLUSION

The technique of data mining of databases from mobile Environment (devices) through the use of Web Services is studied in the paper. From the overview of this paper, it is concluded that the remote user can execute data mining from mobile devices effectively.

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