

Survey Paper on Data Mining in Mobile Devices

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Abstract: The necessity of the mobile devices like smart phones and tabs is increasing very fast, with the advent of new technologies and the new innovations in area of communications. Even though this type of devices share a common ground exhibiting their work, but they run on different stations which makes coordination with server application. Data mining for mobile devices using web services can be made use of its best in mobile friendly environment. It improves interoperability between clients and server applications from the different platforms they execute on. Mobile user wants useful information in a short time. So that user will be able to extract relevant data. Data mining for mobile devices is very efficient process to classify data. In this paper, different types of architecture and some common tools for mobile data mining for the proposed methodology is explained. Mobile data mining is the process of extracting specific knowledge from data collected from mobile users through the different data mining techniques. As per the latest technology the status of mobile phone adoption being very high in technologically developed nations, with the expansion of mobile devices with new capabilities. With such modern mobile devices, areas that mobile users visit, time of communications, description of surrounding locations of mobile users can be collected, stored and distributed to a central location, in which it have the great potential application in area such as wholesale, retail, marketing, and banking. As the life of mobile users are mined, common patterns and knowledge such as the ordered collection of locations that they choose to visit, groups of people that they like to meet, and timing where they generally active can be collected. This supports marketing, retail and banking systems through the use of knowledge of behaviour of the mobile users. However, challenges related privacy and security are still a main constrain before the mobile user data mining can be implemented.

Keywords: Data mining, mobile devices, web services Extensible Markup Language, XML.

I. INTRODUCTION

Analysis of data used for mobile is a complex process that often involves remote resources (computers, software, databases, files, etc.) and people (analysts, professionals, end users). Recently, mobile data mining techniques are used to extract useful data sets. Advancement in this research area arises from the use of mobile computing technology [1] for supporting new data analysis techniques and new ways to discover knowledge from every place in which people operate. The availability of client programs on mobile devices that can invoke the remote execution of data mining tasks and show the mining results is a significant added value for nomadic users and organisations who want know about the overall status or prices of goods in stock market and data stored in repositories far away from the site where users are working, allowing them to generate knowledge regardless of their physical location. Aim of proposed work is to improve the mobile data mining techniques so that data retrieval for mobile devices will be faster in efficient mobility management using proper web services. The goal of mobile data mining is to provide advanced techniques for the analysis and monitoring of critical data from mobile devices.

Ashutosh K. Dubey, Ganesh Raj Kushwaha and Jay Prakash ,[2] analyzed different aspects of data mining techniques and their behaviour in mobile devices. They also recommended the innovative ways for data mining services which is more suitable for mobile devices. They

proposed a novel CSUA [3] (Create, Select, Update and Alter) based data mining approach for mobile computing environments. In the recent years several types of new software tools are used for mobile data mining purpose. Those tools are designed for specific mining areas. They differ in their mode of operation and area of specialisation. MobiMine[4] is an example of data mining environment designed for intelligent monitoring of stock market from mobile devices. MobiMine is based on 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.

MobileMiner,[5] is an another data mining tool using for mobile data analysis and business strategy development. Built on the state-of-the-art data mining techniques, MobileMiner presents a real case study on how to link data mining techniques into a business solution. In a large mobile communication company like China Mobile Communication Corporation, there are many analytical tasks where data mining can help to assuage the business

interests of the company. Besides, that a system cannot cover everything. MobileMiner begins with customer relation management, the most important component of mobile communication business. In this demo, we focus on two tasks, mobile user segmentation and community discovery from user calling networks. Rapidminer[6] is a software platform developed by the company of the same name that provides an integrated environment for machine learning, data mining, text mining, predictive analytics and business analytics. It is used for business and industrial applications as well as for research, education, training, rapid prototyping, and application development and supports all steps of the data mining process. Rapid Miner uses a client/server model with the server offered as Software as a Service or on cloud infrastructures.

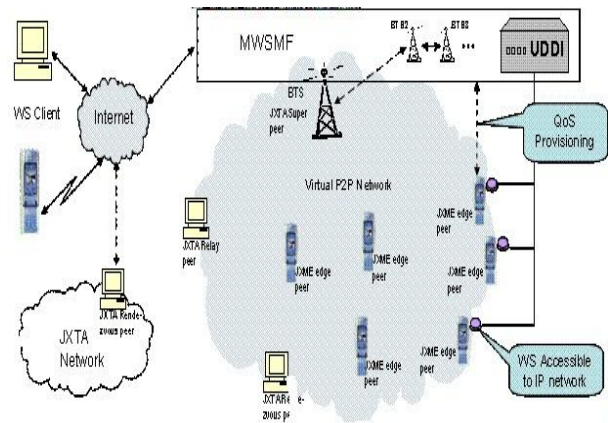


Figure 2. PDM Frame work

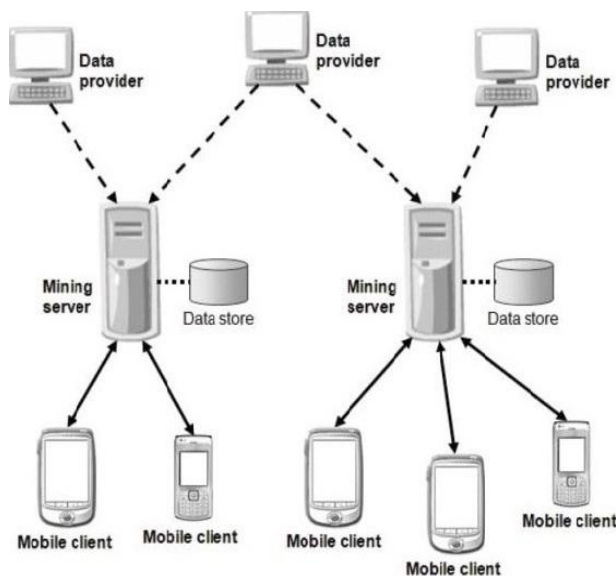


Figure 1 Mobile Data Mining Architecture

II. MOBILE DATA MINING ARCHITECTURE

The Service Oriented Architecture (SOA) model is widely exploited in modern scientific and business oriented scenarios to implement distributed systems in which applications and components interact each other independently from platforms and languages. Currently Web Services are the most important implementation of the SOA model. Their popularity is mainly due to the adoption of universally accepted Internet technologies such as XML and HTTP. The use of Web Services fosters the integration of distributed applications, processes, and data, optimizing the deployment of systems and improving their efficiency. In particular, integration represents an important competitive factor in Business to Business (B2B) scenarios [7], where information systems can be very heterogeneous and complex. Recently, a growing interest on the use of Web Services in mobile environments has been registered. Mobile Web Services make it possible to integrate mobile devices with server applications running on different platforms, allowing users to access and compose a variety of distributed services from their personal devices. Figure1.shows mobile data mining architecture.

III. POCKET DATA MINING ARCHITECTURE [PDM]

It is a type of mobile data mining frame work. Figure 2 illustrates the PDM frame work. As the per the figure, the data stream mining process executes onboard the users' smart cell phones [8]. Figure 3 shows Pocket Data Mining Architecture. The data streams in the specific model are frequently updated to cope with the concept drift of the streaming environments. The work of stream mining is carried out using an Agent Miner [9], denoted as AM. AMs are distributed at the starting of initiating the mining job. Few of these miners could be stationary and few others could be mobile. Stationary agents are assigned by the task scheduler to mine the streaming data to the mobile device without making any hops. Meanwhile, the mobile agents could switch to one or more nodes in order to perform the specific mining task. The selection using stationary or mobile agent depends on the nature of the work and the number of prime nodes involved in the processing. Typically, Agent miner is the data stream classification techniques. Mobile agents are an excellent paradigm for implementing distributed applications, particularly in the context of partially connected computers. But the use of other techniques is also possible according to the required task.

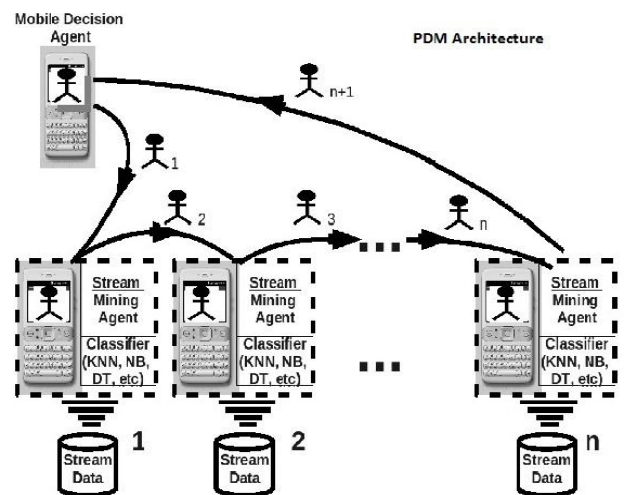


Figure 3 Pocket Data Mining Architecture

IV. DATA MINING

Data mining is an analytic process designed to explore data in search of consistent patterns and/or systematic relationships between variables, and then to validate the findings by applying the detected patterns to new subsets of data. The ultimate goal of data mining is prediction and predictive data mining is the most common type of data mining and one that has the most direct business applications. While large-scale information technology has been evolving separate transaction and analytical systems, data mining provides the link between the two. Data mining software analyzes relationships and patterns in stored transaction data based on open-ended user queries.

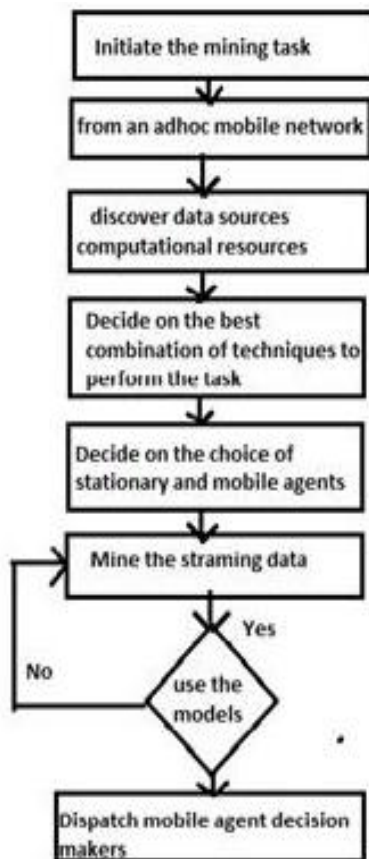


Figure 4Flow chart of the collaborative Data mining Process

V. MOBILE COMPUTING

Recent advances in computer hardware technology have made possible the production of small computers, like notebooks and devices like palmtops, which are very light to carry for users. These portable computer can also equipped with wireless communication devices that enable user to access global data services from any location. A considerable amount of research has been conducted in mobile database system areas with the aim of enabling mobile (portable) computers to efficiently access a large number of shared databases on stationary / mobile data services. Mobile computing is a basic concept used for this purpose. Mobile computing is technology that allows free

flow of data through a computer, here there is a no need for it to be connected to a fixed physical link.

VI. 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. The mobile data mining field may include several application scenarios in which a mobile device can play the role of data producer, data analyzer, client of remote data miners, or a combination of them. In an architecture of PDM framework developed by Frederic Stahl, Mohamed Medhat Gaber ,Max Bramer and Philip S. Yu [11] , the data stream mining process runs onboard the users’ smart mobile phones.

VII. MOBILE WEB SERVICES

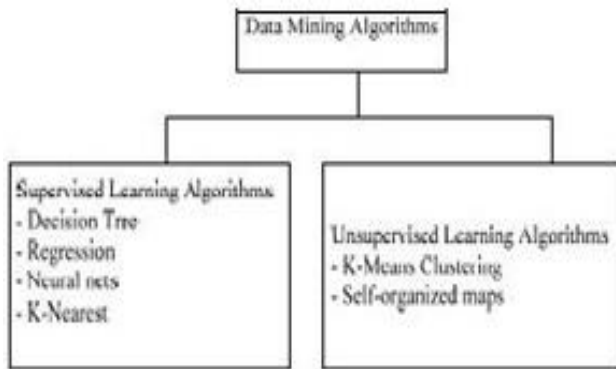
Currently Web Services are the most important part of modern scientific world. Their popularity is mainly due to the adoption of universally accepted Internet technologies such as XML and HTTP. The use of Web Services fosters the integration of distributed applications, processes, and data, optimizing the deployment of systems and improving their efficiency. Recently, a growing interest on the use of Web Services in mobile environments has been registered. Mobile Web Services make it possible to integrate mobile devices with server applications running on different platforms, allowing users to access and compose a variety of distributed services from their personal devices .The aim of a mobile site design is to make simple and elegant for user interaction.

The users of mobile devices are using different specification of mobile devices like their screen size, method of data inputting to mobile device etc. They are using different types of screen sizes with different application. At the same time we will have to design a mobile website for all type of users who can easily view and interact through mobile interface. So we need to consider all type of users while designing a mobile web site. This may be a fully featured combination this makes a critical difference in how much content mobile visitors are able to consume in one go and how much of it can be rendered by the developer. This means that mobile Web production efforts are more that complex as debugging and testing user experience become much than a quick sanity check in microsoft Internet Explorer (IE), Google Chrome, and Mozilla Firefox[11].

VIII. ALGORITHMAM USED FOR MOBILE DATA MINING

The users may think that only by loading the computer software; data mining will happen. Before moving forward with data mining many issues must be treated such as data

pre-processing. There is often a misconception that data mining is a data warehousing, SQL queries and reporting, software agents and online analytical processing (OLAP). The answer is; these are not data mining. Data mining in fact increases computing power, improves data collection and management and it has statistical and learning algorithms. It is clear that decisions are not made by data mining; the people have to decide with their knowledge and experience. The main properties of data mining algorithms are robustness, scalability and efficiency. Data mining is now used in bioinformatics, education, genetics, medicine, and electrical power. The major aims of data mining are to verify the hypothesis prepared by the end user and to find out new patterns. Classification, Clustering, Regression model and Association rule Learning are the important fields of data mining. K. Meena and M. Durairaj [10] introduced a algorithm for datamining. The data mining algorithm used for user moving patterns in a Mobile computing environment. It improves the overall performance of a mobile system.



IX. APPLICATIONS OF MOBILE DATAMINING

Data mining is emerging as an upcoming topic in the area of mobile computing environments. In this we have elaborately discussed about a distributed architecture in which mobile devices in co-operation with a peer-to-peer style to perform a data mining process, tackling the problem of energy capacity shortage by distributing the energy consumption among the available devices. An energy-aware (EA) scheduling strategy assigns data mining tasks over a network of mobile devices optimizing energy usage. The main design principle is to find a task allocation that prolongs the network residual life by balancing the energy load among the devices. The wide availability and growing computing power of mobile devices has opened the way for data analysis and mining in mobile scenarios. Mobile applications exploiting data mining techniques have appeared on the market in recent years. Examples include smart phone-based systems for body-health monitoring, vehicle control, and wireless security systems. An important aspect that must be addressed is that of ensuring energy efficiency, as most mobile devices have battery power which would last only a few hours. Data mining tasks in mobile environments should be allocated and scheduled so as to minimize the energy consumption of low-capacity mobile devices.

CONCLUSION

Mobile data mining is still in an immature phase; however it represent a very promising area for users and professionals that need to analyze data where users, resource and applications are mobile. The combined use of a data mining approach with mobile programming technologies could be used for the implementation of mobile knowledge discovery applications. Data mining of databases from mobile devices would be implemented which will allow remote user to execute data mining tasks from mobile devices.

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