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REVIEW ARTICLE

Product Recommendations and Improvement in Smart Inventory System through Customer Relationship Management Processes Using Internet of Things and Big Data Analytics

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ABSTRACT

Big data collection and storage can be expensive due to the vast quantities of information involved, cloud computing can be used. Internet of things provides a tool for collecting the relevant data from the big data. Big data analytics provides solutions to enable decision-making in the business. Identification of customers groups that respond differently from other groups is competitive. The modeling of consumer preferences is one of the major activities for an organization. Big data analytics techniques are used for mining the customer relationship management (CRM) data. Big data analytics techniques help for predicting a future customer. In this paper, Apriori Algorithm is used to optimize the CRM.

Key words: Apriori, association rules, big data analytics, big data, customer relationship management, internet of things

INTRODUCTION

The internet of things (IoT) refers to devices that collect and transmit data through the internet. The opportunities posed by the IoT are expansive, and they have the potential, just like big data, to revolutionize the way businesses and governments operate, and the way people live. Big data are enabling organizations to collect and analyze data in new ways, helping to transform business. Big data analytics solutions over insights into how this data can be interpreted, enabling decision makers in business and government alike to reach meaningful conclusions and decisions that support business success. Collecting and storing big data are only the beginning. It is the application of analytics solutions that allow business to harness the benefits of big data. To create an accurate picture of big data and IoT adoption in our economic modeling and analysis, we use a measure of adoption that takes into account the intensity with which businesses are using big data analytics solutions in each industry. To achieve this, we weight the proportion of businesses in each industry that has implemented big data analytics solutions, with an intensity rating based on the average number of solutions they have implemented. On average, the majority of firms have implemented between one and three big data analytics solutions. The telecoms industry has the highest current rates of big data analytics adoption and IoT adoption at 67% and 61%, respectively. However, by 2020, businesses in the retail banking industry are expected to be the leaders in terms of big data. With big data analytics, the manufacturing industry is expected to experience the greatest economic benefits from the use of the IoT.

RELATED WORK

Bashir and Gill[1] proposed an IoT big data analytics framework to overcome the challenges of storing and analyzing large amount of data originating from smart buildings. Lee *et al*.[2] proposed an IoT-based cyber-physical system that supports information analysis and knowledge acquisition methods to improve productivity in various industries. Rathore *et al*.[3] propose a smart city management system based on IoT that exploits big data and analytics. Ahlgren *et al*.[4] discuss the significance of using IoT to deliver services for improving the lives of citizens, including transportation, air quality,

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and energy efficiency. Sezer *et al*.[5] proposed an augmented framework that integrates semantic web technologies, big data, and IoT. Wang *et al*.[6] discussed the challenges and opportunities resulting from IoT and big data for the maritime cluster. Wang *et al*.[6] discussed the challenges and opportunities resulting from IoT and big data for the maritime cluster. Jara *et al*.[7] conducted a survey to highlight the existing solutions and challenges to big data that are posed by cyber-physical systems. Ding *et al*.[8] proposed a general statistical database cluster mechanism for big data analysis in the IoT paradigm. Ahmad *et al*.[9] analyzed human behavior using big data and analytics in the social IoT paradigm Arora *et al*.[10] utilized big data and analytics techniques to classify network-enabled devices.

RELATIONSHIP BETWEEN IOT AND BIG DATA ANALYTICS

The IoT is essentially an extension of big data, linking smart objects to the internet that are then able to share information and complete tasks. This growing number of smart, connected products can present opportunities to businesses by providing insights that can enhance productivity and increase revenue. The more objects that are connected, the more powerful the IoT becomes. The IoT can change the way in which businesses compete. Big data and the IoT can result in opportunities, and increase the incentives, for business creation [Figure 1].

BIG DATA ANALYTICS METHODS

Big data analytics describes the software solutions that are used to handle big data. These solutions can include data mining, advanced analytics, data visualization, and in-database analytics. The information collected through big data analytics can provide businesses with insights that enable them to make smarter and faster business decisions. It can reveal client preferences, market trends, and inadequacies in supply chain processes. When the data are analyzed to reveal these insights, the business user can then seek to capitalize on the resulting opportunities [Figure 2].

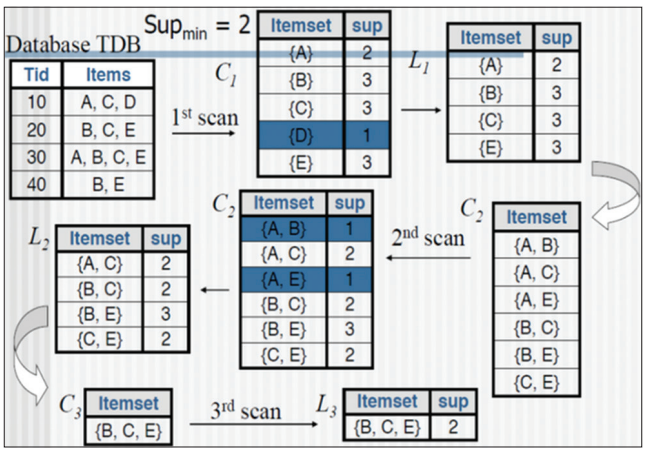
ASSOCIATION RULES FOR CUSTOMER BEHAVIOR

Customer relationship management (CRM) begins with a customer identification. The customer identification phase involves targeting the people who are most likely to become customers or most profitable to the company. Customer attraction phase following customer identification. After identifying the segments of possible customers, organizations can direct effort and resources into attracting the target customer segments. Direct marketing is a promotion process which motivates customers to place orders through various controls. CRM third phase is the customer retention. Customer satisfaction, which refers to the comparison of customers' expectations with their view of being satisfied, is the essential condition for retaining customers. Next phase is the customer development. This phase deals with the customer profitability. Association rules are used to evaluate the patterns of customer behavior of different time periods for each customer cluster. The proposed system uses the Apriori Algorithm to mine customer behavior patterns. An online query system is built to facilitate the timely search of change patterns. By searching for change patterns, market analysts can rapidly acquire the required information through visualization and can devise appropriate marketing strategies by searching for possible changes in customer behavior over time.

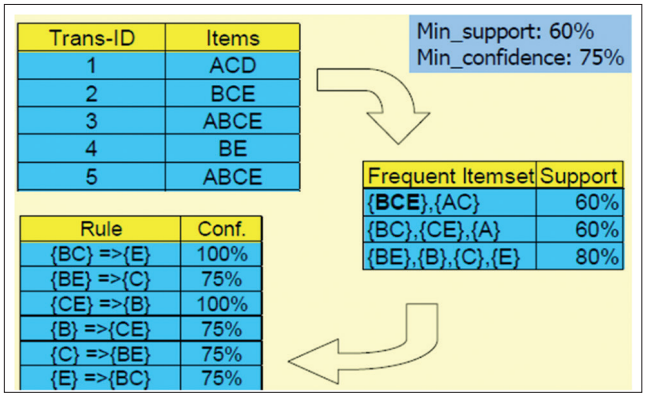
Apriori

Apriori Algorithm is a standard algorithm in data mining. It is used for mining frequent itemsets and appropriate association rules. It is created to operate on a database containing a lot of transactions, for instance, items bought by customers in a store.

Example



Generating rules example



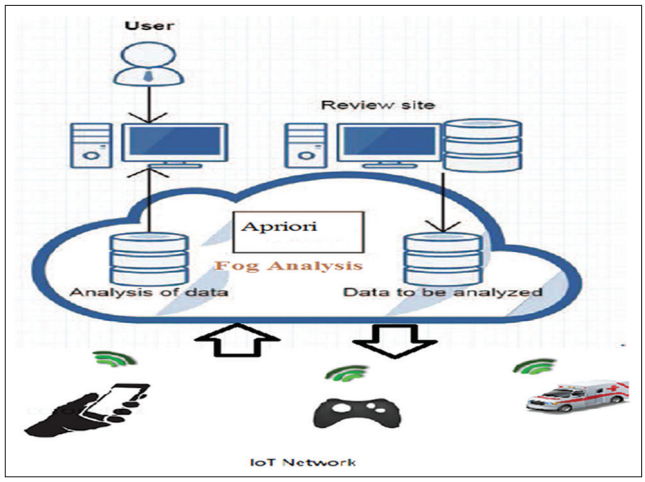


Figure 3: Proposed system

PROPOSED SYSTEM

Big data can help businesses, both large and small, to maintain their competitive advantage. optimize the CRM by the apriori algorithm Generate strong association rules from the frequent item sets. Apriori Algorithm is mining frequent item sets for Boolean associations' rules. K-item sets (item sets with k items) are used to explore (k+1)- item sets from transactional databases for Boolean association rules. Generate strong association rules from the frequent item sets. If an item set is frequent, then all of its subsets must also be frequent. The algorithm uses prior knowledge of frequent items [Figure 3].

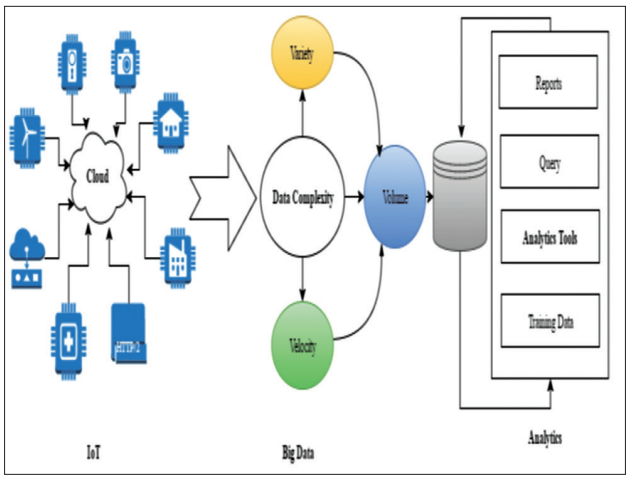


Figure 1: Relationship between internet of things and big data analytics

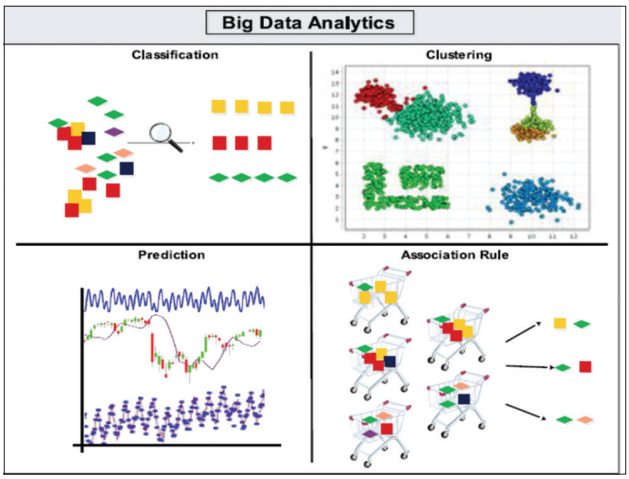


Figure 2: Big data analytics techniques

CONCLUSION

The IoT is an extension of big data, linking smart objects to the internet. Big data enable businesses to make the most of both historic and real-time data that are generated through supply chains, production processes, and customer behaviors. The two technologies, i.e., IOT and big data can be used together. Big data analytics describes the solutions that are used to handle big data. The proposed system uses the association rules, i.e., big data analytics techniques. The proposed system uses the Apriori Algorithm to optimize the CRM. The future scope is the deeper analysis of CRM.

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