



A Review on Cloud and Data Mining Assisted Customer Relationship Management

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Abstract: *Customer Relationship Management(CRM) is a basic requirement for any organization for retaining and attracting the valuable customers. In Corporate world, “Customer Retention” strategy in CRM is the greatest issue. Many CRM softwares are now available readily in the market. The demand is changing dynamically in the market in the current scenario. Softwares are now-a-days developed by many of the industries to handle the demand and keeping up the growth. Business Process Management(BPM) systems enable to automate the process. Datamining tools help to retrieve the hidden customer information from huge databases of CRM. CRM deployed on Cloud, enables reducing the capital expenditure. It also provides services which are on demand and on always. It will be available anywhere at anytime as well as on any of the devices and also IT- Technology independent. Our research focuses on Cloud Based Integration of CRM systems with Data Mining(DM) techniques for all types of Enterprises(small and medium) that provides a centralized point to Enterprises and users. Here a person can select CRM or integrated CRM-DM systems in a cloud.*

Keywords— *Customer Relationship Management(CRM), Business Process Management(BPM), Data Mining Technique(DM), Cloud Computing, Small & Medium Enterprises(SME)*

I. CUSTOMER RELATIONSHIP MANAGEMENT

A CRM (Customer Relationship Management) can be defined in several ways. It may be considered as a tool which helps any company to construct, manage and maintain the customer relationship. It can be viewed as a concept that enables a long-term relationship between the customer and company [1]. In marketing the building and maintenance of customer relationship plays a key role [2]. CRM systems are now-a-days gaining their value as they improve the value of customer life time [3]. Any company’s success or failure depends on how well they have understood their customers as well as the provision of value added services [4]. The customer data helps in maximizing profit, business progress as well as in strategic planning [5-7]. CRM can also be categorized into two types: Strategic or operational [8]. The information about the customer in detail is provided by the strategic CRM. It finds and builds the knowledge about customer. It helps the company to find out customer’s view on the company as well as its products. The operational CRM in turn helps in collecting the data related with their customer and to evaluate them in order to identify potential customers. It also enables the company to maintain them. CRM can be viewed in another perspective also: i.e. the CRM can be considered as a software which can be defined as a tool implemented inside an organization. It differs on its various features such as size, functioning principle and its requirements. This software, fits within the company’s system perfectly matters, how it helps in identification, management, and maintenance of customer relationship as well as the database for delivering customized product or services. This process as a result provides a complete satisfaction and also loyal behavior from the company’s customers [9-12].

II. CLOUD COMPUTING

Cloud computing is a newly arrived concept in the IT enabled services and also in the companies likelihood [13-15]. In the IT and software field it is on great demand now-a-days. It can be divided into 3 categories which is shown in figure 1.

The first one is Software as a Service(SaaS): It is a software solution which is distributed through Internet and can be used within a web-browser. After the usage of the software the updates are done automatically. In this the key features such as facilities by administration, collaboration in a better manner, access by global, compatibility provided internal, automatic updates and easily developing management are to be considered. Most of them are related to SME’s. Dropbox and Google Docs are the examples for popular SaaS.

Secondly Platform as a Service(PaaS): It is a solution by any of the developer and can be created through API’s (Application Programming Interface). The entire configuration can be constructed remotely and PaaS features enable the deployment of all applications. By this way all the things needed for supporting the entire life cycle of developing and dispatching web applications and services are provided. Examples: Azure by Microsoft, Force by Salesforce and Google App Engine by Google.

The third type: Infrastructure as a Service (IaaS): This falls in the lowest layer of service provided by the cloud. It can also be viewed as a terminal PC which is at the company's disposal 24/7. This can be accessed remotely through various API's as well as with any of the proprietary software tool. This type can be considered as the flexible one but it is difficult to manage. Economically it is high. EC2 by Amazon and Windows Live Skydrive by Microsoft fall in this category [16-17].

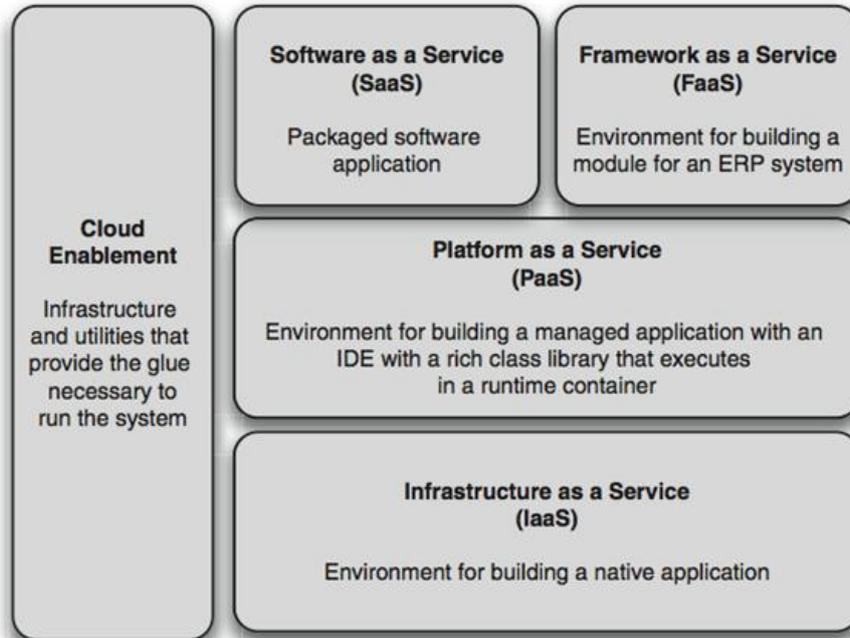


Figure 1: Cloud Computing Categories Data Mining:

Extraction or mining the knowledge from the available huge amount of data is referred as data mining. This can also be referred as knowledge discovery from database(KDD). The objective of data mining technique is to find pattern which was not known previously. This is the most essential step in KDD [18-19]. Data mining involves various steps such as: Selection which involves choosing the appropriate data related to the task being analysed from the available Preprocessing: this step comprises of noise removal and inconsistent data elimination as well as multiple data sources combination. Transformation: the preprocessed data should be converted into a suitable form for performing data mining. Data mining: the suitable pattern in the data can be selected. Interpretation/ Evaluation: the redundancy and inappropriate patterns can be removed and the patterns are interpreted into knowledge. Then the patterns are converted into terms which can be human understandable. There are many challenges in data mining such as scalability, data quality and complexity, heterogeneous data, ownership and distribution and privacy in presentation. There exist many pros and cons related with data mining. The pros can be such as data mining helps in digging data in the process of banking, marketing, detective agencies and government sectors [20-21]. But privacy and security issues are the existing cons of data mining [22].

III. LITERATURE REVIEW

Ahmed Bahgat et al. [23] proposed that Data mining techniques can assist in radiology centers to improve customer services. The objective of clustering the customers is to determine the unsatisfied needs, promote services as well as to create new services. Their proposed system comprises of three functional layers namely preprocessing, clustering followed by post processing. They constructed three data sets from the data collected for a period of four months for 6700 transactions and then dividing the whole data into 90%, 85% and 80% for the purpose of training and 10%, 15% and 20% for testing respectively. They used three K-means models with k values as 10, 15 and 18 cluster. Each data set is used to calibrate and test the model. They found that the model with 15 clusters is the best one. The clustering results were also reported to a medical specialist. They found that some results are reasonable.

Yong Wang et al. [24] presented a research on the Bank's CRM based on data mining technology. They analyzed the functions of the bank's CRM, and constructed a decision tree to categorize the kind of the bank's customers with the help of ID3 algorithm. The decision tree can adapt to the management classification of the bank's customers through judgment, analysis and adjustment. They predicted some conclusions with the help of the decision tree as: 1. Bank's development depends on the credit quality of the customers 2. The customers are mainly classified based on their income 3. The monthly income is not absolute although it is important for a customer to become a high-value one. 4. The education background and credit record through POS terminal of a customer can be regarded as an important reference factor for a customer to become a high-value customer.

A marketing decision model proposed by Yu-Min Chiang et al. [25] utilized the demographic and geographic variables as input of three individual classifiers - BP network, decision tree, and Mahalanobis distance - to predict a new customer's value. They predicted the new customer's value by various combinational methods. They initially applied the

three individual classifiers. They combined the result obtained above to form a multiple classifier system. The parallel combination methods adopted in the research include majority vote, BPN, and SOM network. They implemented empirical analysis to compare the results got in both the methods. They concluded that the result of multiple classifier system combined by BP has the best prediction accuracy.

Manu Chopra [26], has presented an analysis on data mining techniques for better customer relationship management. He insisted on the importance of the optimization methods in data mining process. He also illustrated a few predictive models with their working principle. He has discussed that data mining is best suitable for CRM application since it reduces cost as well as time. He also suggested that this type of studies and researches should be motivated.

Yurong, et al. [27], has given a complete definition of the CRM itself. The exact definition of CRM and also listed the benefits of CRM for the company. He has also presented the advantages and disadvantages of this tool.

Ramdani et al. [28] in his paper focused on how to develop a model that can be used to predict which small to medium-sized enterprises (SMEs) are more likely to become adopters of enterprise systems (ERP, CRM, SCM and e-procurement). He used also direct interviews to collect data from a random sample of SMEs located in the Northwest of England. This model can be used to assist software vendors not only to develop marketing strategies that can target potential adopters, but also to develop strategies to increase the adoption of ES among SMEs.

Monika et al. [29] presented a survey on the scope of cloud computing technology for the SME's in India. In that they have analysed how cost can be saved and the difficulty level can be reduced by adopting cloud computing service for ERP systems. They have interviewed IT people over 30 SME's in North India. They have concluded that cloud computing can be adopted compared to traditional ERP.

The merits of providing different service providers in cloud computing has been discussed by Golda et al. [30] along with the different techniques involved in that. They have proposed a model related with data storage such that they have used one service provider for data encryption and another one for storing the data. They have concluded that by this way, the unauthorized data access can be prevented.

HemaLatha et al. [31] has proposed a secure business model for CRM based on cloud computing in which the security issues with the cloud computing were discussed. They have also implemented separate encryption and decryption service for data storage. In their proposed system the data is stored on the internal storage itself. They have separated the storage and the encryption and decryption of user data and these services are not provided by the single user. They have implemented the BlowFish algorithm for encryption and safeguarding the data.

Jiaqi et al. [32] has proposed a survey on the benefits and drawbacks of cloud based and traditional ERP methods. They have presented a review on cloud-based enterprise applications. They analysed the merits and demerits of cloud-based ERP and traditional ERP. Based on their research, cloud-based ERP performs well within the feature categories of 'Direct Costs', 'Impact on Competitive Position and Organization', and 'Functionality & Usability'.

A survey based investigation on cloud computing for SME's has been done by Reza et al. [33] in which they have discussed the motivations, concerns and the requirements related with cloud computing. They have also clearly described about the architecture and services of cloud computing. They have conducted this survey over 300 SME's in UK. They have concluded that to attract SME's towards cloud, the security issued should be considered more during design.

Shubada et al. [34] has presented a web enabled and Android CRM tool for builders for cloud based sales and CRM application. They have proposed a mobile application with web enabled PC application for the sales persons including builders. They have used the simple object access protocol(SOAP). Using this model the manager can schedule his meetings, manage the clients, get the review of the meetings and send message and emails through Android application.

A CRM based cryptography service for ensuring security in cloud computing has been proposed by Prasad et al. [35] in which they have discussed on separating the encryption and decryption process from the data storage. They have implemented the user interface using CRM. They have utilized three cloud systems such that encryption and decryption is operated by one service provider and another operates on storage and the third cloud is the CRM application system. For security purpose they have also implemented the one time password authentication(OTP).

Saini et al. [36] has presented a study on the cloud computing and ERP systems. They have presented a review on how to develop low cost ERP solution to Indian industries. Their proposed model is concerned with implementing the solution through mobile with latest technologies. They have concluded that a low cost mobile ERP can be simulated with more security.

IV. CONCLUSION

In this paper a deep study has been done in the fields of CRM, Cloud computing and data mining. CRM plays a vital role in the development of any enterprise. It can be supported and handled efficiently with the help of cloud computing technology and data mining techniques. Also it is well known that CRM integrated with cloud computing and data mining reduces time as well as cost factor as a result of which profit of the concern can be increased inevitably. So it is concluded that CRM enabled with cloud and data mining is of great demand now-a-days and our proposed system aims at developing some models on this.

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