Adaptive Classification of Web Mining Methods and Challenges of Customer Relationship Management Domain

Siavash Emtiyaz, MohammadReza Keyvanpour

Abstract — In recent years, World Wide Web has been extended from research society to the most dominant and general way for communication and broadcasting of information. Web mining is responsible to discover the hidden knowledge, rules and patterns from web. Customers always play a key role for the establishment or mean of crisis for any organization. Web mining is going to be involved in every organization for extracting extra information which is not visible for everyone. The most important application of web mining is in the domain of the e-commerce and economy that leads to the detection of most facts and effective factors in the customer relationship management and efficient services to the customers through the behavior and communicating with system. CRM uses data mining (one of the elements of CRM) techniques to interact with customers. It is also used for web mining in web domain.Our Analysis provides a roadmap to guide creation concerning the adaptive classification based on web/data mining methods to solve challenges of CRM. For this, we comparison and analyze the application of web mining process to solution challenges of CRM dimensions.

Index Terms— CRM Challenges, Customer Relationship Management, Web Mining, Data Mining.

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1 INTRODUCTION

THE e-commerce Rapid development Caused to business advancement in the Internet. The CRM became the main part of the work when e-commerce turned to customer-oriented from product-oriented and products and services were built and personalized according to customer's recommendations. It was done because the internet-based technologies are the best framework for implementation of CRM [1]. One of the goals of CRM is close relationship between customers and vendors, which is the simplest form of e-commerce. CRM uses data mining (one of the elements of CRM) techniques to interact with customers. It is also used for web mining in web domain. Web mining is one of the domains of Data mining. Web mining refers to the techniques that automatically retrieve, extract and evaluate information from documents and web services for knowledge discovery. This article proposes data mining methods in the commerce, understanding challenges and ways to manage customer communications with the related rules and classification provided in this area.

2 CRM CONCEPT

CRM is collection of steps to create, develop, maintain and optimize long-term and valuable relationships between Customers and organizations. Furthermore, it is

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part of the organization's strategy to identify customers, keep them satisfied and change them in to permanent customers. The main architecture includes several layers [3]. Fig (1)

Operational layer: In this layer some tools are provided for company sales and marketing personnel that can control, manage and improve their contacts with customers, accounting and sales information.

Technologies used in the operational layer are responsible for collecting customer data through their contact points such as connection centers, connection management systems, mails, faxes, sale persons, web and etc. Fig (2)

Data layer: As it is obvious in Figure (1) the collected data from operational part are stored in a repository that is large in size.

Analytical layer: This layer is one of the most important layers that are responsible to obtain, store, process, interpret and report data to the users which use customer's data. This layer provides capabilities for classification of customers to optimize the behavior of company, improve marketing activities and keeping customers. It is done by studying information in information storage. In terms of ICT and e-business development, customers' data are gathered more and more and day by day. Analytical layer capabilities can be used for better management of these data. Operational and analytical layers interact with each other. This means that data of operational layer go through to the analysis layer, then the data are analyzed and the results derived would have direct effect on the operational layer. By analyzing this section, Customers are classified and focusing on particular customers is provided for the organization.

This layer uses statistical analysis and predictive models for making decision, process improvement and other un-perceived benefits. Generally, they have been equipped by two types of technology: Online analytical processing, Data mining [3].

Online analytical processing is a process that uses one or more resources for collecting data. Data analysis and un-ification are done dynamically in different levels so they can help in finding, mapping and analyzing the custom-er's patterns based on their past data values.

Application Layer: When data are analyzed, and customers' profiles are created, this layer provides some statistics and analyzes the status of sales, marketing and support and it also measures the amount of satisfaction and loyalty of customers then the customers will be cate-gorized based on this method. For example, we can give responsibility to the system for monitoring all of custom-er's behaviors and when the amount of customers' pur-chases exceeds of a certain limit, makes the organization informed to do special works for them, Such as sending email or phone call automatically with the buyer.
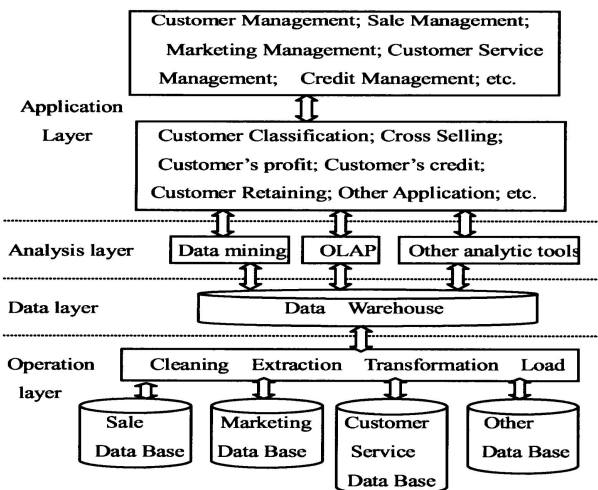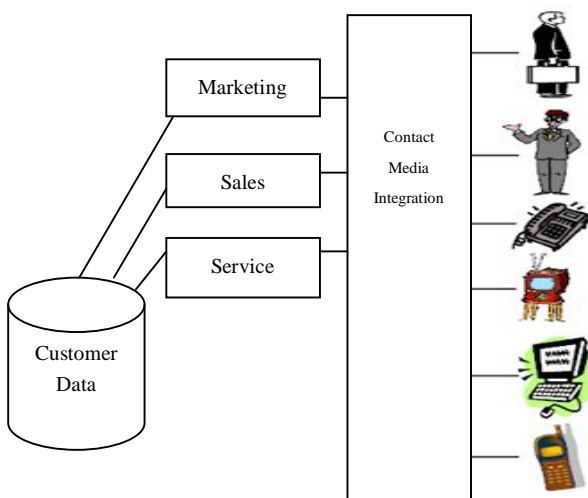

Fig 1: CRM Architecture [3]

Fig 2: Operation Layer CRM

3 CRM CHALLENGES

Organization before implementing a CRM should be aware of the potential and possible problems, in order to deal with them when it is necessary.

In organizational levels, business should create common activity between different parts that have contacts with customer and all sections related to the CRM in order to be more effective.

This established inter-group relationships with custom-ers, have effect on the role of employee within the organization also this issue can reduce emphasis on par-ticipation of the certain sections of the company. Usually this type of policy changes faced with the opposition in the early stages of performances.

One of the important points is that organizations should be maintaining the best employees of sales and service departments; they must develop personal skills of ta-lented employees and reward them. For example, in tele-phone centers, six months is needed to turn an armature person to an experienced one and six month is needed for an experienced person to become specialized and profes-sional. Employees, who work in the internal sections, should be involved in the discussions related to the cus-tomers' needs. Customers' feedbacks should be consi-dered in the process of developing products and servic-es. Because all parts of organization collaborate in order to gain customer satisfaction, they should create a reward system for injecting the necessary motivation to these domains. The main challenges can be divided into four important cases that organization might face with during the implementing of CRM [2, 6, 7]:

3.1 Executive Challenges

- Initial launching Costs: It is considered as one of the challenges of CRM. Organizations may spend large amount of investment on customer man-agement application tools, but some of these tools may have a specific application that can be hard to share them in different parts.

- Integrated application tools: Organizations need some integrated application tools that have been created based on customer's life cycles and re-lated interactions. For example, organizations which need different languages and monetary units for managing customer interactions, cannot implement CRM through traditional technolo-gies and this will be a severe problem, because data types are various and the noise of data is high and inevitable.

- Collaboration of various segments: CRM is an in-tegrated approach and needs assisting of some parts of business that previously were working independently. Data that are collected in one portion should to share their data with be shared within all segments. It is possible that some sec-tions would be unpleased others.

Challenges that should be noticed in this approach are:

1- Non-obvious results that often require a combination of the analysis layer techniques (data mining), 2- Serious requests for collecting of data before using of analysis layer techniques (data mining), 3- Not being aware that what data are available for mining and what kinds of virtual activities should be done.

3.2 Stategy Challenges

These are parts of inter-organization challenges which provide forces that any decision should be made is based on it and Organization processes are managed from the starting point to the end within the rules of the Organization. The raised Challenges in this regard are: 1- output results must match the realities of the world, 2- good activities mechanism, 3- combination of the old knowledge.

3.3 Technology Challenges

These are one of the key challenges for the realization of policies, processes, people and their interaction with each other. Organizations need an integrated approach to unify the technologies within it. The raised Challenges in this regard are: 1- Reliable considerations don't exist for results of analysis and data because of lack of integrated approach in technologies. 2- Finding data for deeper understanding, which cause high accuracy and cost reduction, for example metric product evaluation.

3.4 Customer Dimention Challenges

These Challenges that relate to the customer loyalty and maintenance are: 1- Deeper models for identifying and developing customer behavior. 2- A framework for evaluating that leads to diagnosing the accuracy of customer understanding.

4 WEB MINING FOR CRM

The research method can be divided into three steps: (1) collecting and cleaning the information, store the information in the data warehouse.

(2) An iterative discovering process by the data mining tools and analysts review of the extracted patterns to generate new set of questions to refine the search. After refine the search, the results of the mining process is be translated to association rules, which stored in the knowledge base.

(3) The patterns are good predictors of purchasing behaviors, the CRM process uses the scores generated by the data mining process to sharpen the focus of targeted customers or prospects, thereby increasing response rates and campaign effectiveness. Fig (3) presents the applicable methods of web mining for CRM [1,9,10].

A. Data Collection Process

Suitable representation, in such a way that it is readable by the mining algorithm in the next step. This process ensures the data set is ready to use for specific mining technique and purpose. In this process, generalization can be done through attribute removal or attribute generaliza-

tion and aggregation can be done by combines conformed records and add up total amount.

B. Data mining process

The Fig (4) process model for data mining provides an overview of the life cycle of a data mining project. It contains the corresponding phases of a project, their respective tasks, and relationships between these tasks. At this description level, it is not possible to identify all relationships. There possibly exist relationships between all data mining tasks depending on goals, background and interest of the user, and most importantly depending on the data.
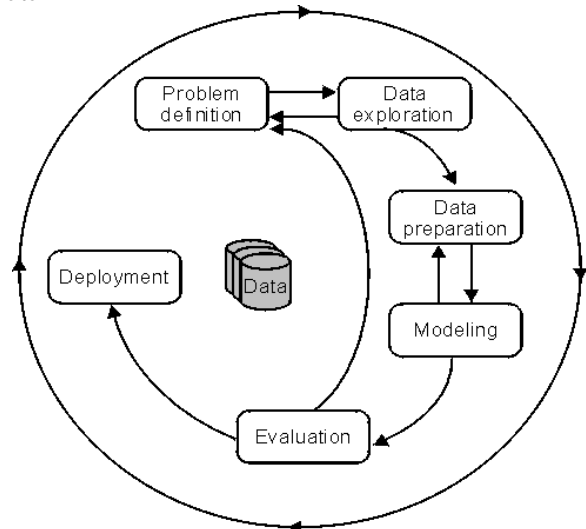

Fig 4: The CRISP-DM process model [8]

C. CRM process

The CRM process is the most influential customer oriented strategy of the decade. Despite its humble origins it has evolved into a relatively complex strategy. The essentials of a CRM program include focus, commitment to CRM goals and above all a desire to be customer focused [8].

Data warehouse, data mining, used to serve the purpose of supporting selection for acquisition, cross-sales, and retention of (real or potential) customers. By running data mining algorithms on customer dataset, data mining can uncover important associations about what products are often purchased together. This knowledge can then be used for product recommendations and product bundling. This knowledge is then used to make a recommendation for a future customer.

4 CONCLUSION

The most important results obtained from the above techniques are reorganization of data and information for easier access, yielding more effective Efficiency and better data classification in order to obtain best results from them. Web mining and CRM integration has advantages and lots of benefits for companies that need to discover profitability of some customers than other customers.

Web mining can identify important customers in large databases.

Intelligent CRM system is created based on web mining analysis on important customers that leads to customer's management ,sharing the obtained information from different channels, reforming of communications between different parts, organization and investigation of operational activities and the appropriate understanding of trade. Therefore, customer chooses the connection channel with the company according to his or her own interest to receive the best services .In table (1) Proposed Adaptive Classification Based On Web/Data Mining Methods to Solve Challenges of CRM are shown.

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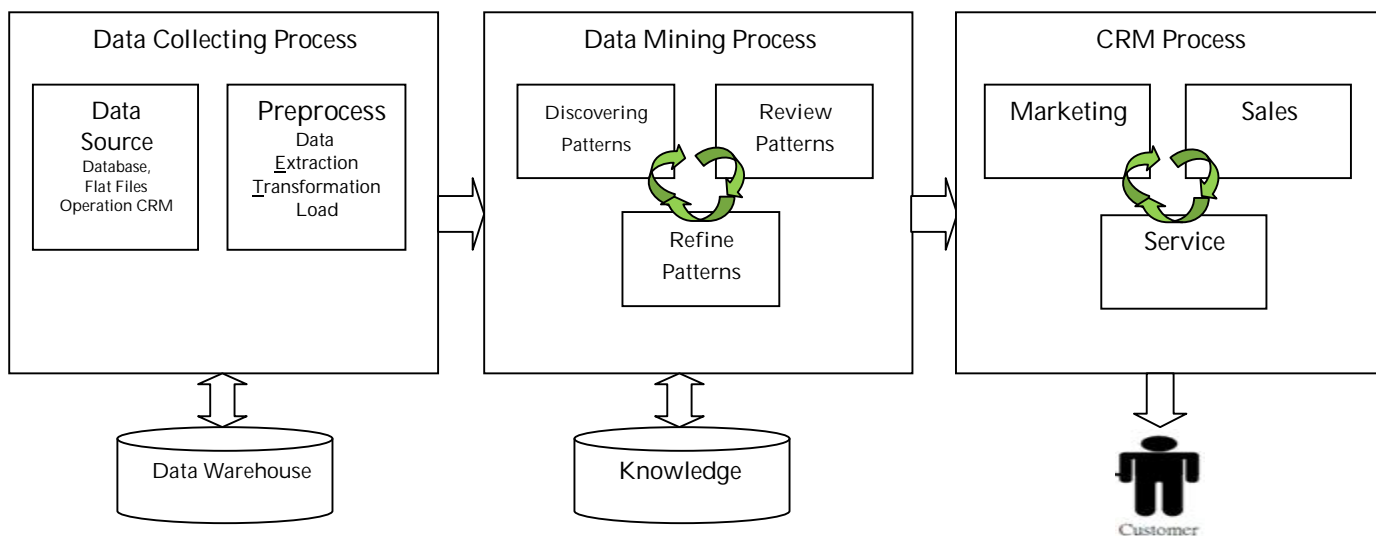
Fig 3: Presents the Applicable Methods of Web Mining for CRM [1]

Table 1. Proposed Adaptive Classification Based On Web/ Data Mining Methods to Solve Challenges of CRM

Mining	Types of Methods	Main Idea	Dimensions of CRM	CRM Challenges
Data mining	**Association Rules**	Statistical and former algorithms are used for diagnosing the behavior of an event or specific process that identifies the communication between elements in a specified record uses.	Customer Development	Integrated application tools Technology challenges Collaboration of various segments
	Classification	Classification is one of the most common learning models in data mining. It aims at building a model to predict future customer behaviors through classifying Database records into a number of predefined classes based on certain criteria. Common tools used for classification are neural networks, decision trees and if then-else rules.	Customer Identification	Initial launching Costs Strategy challenges Customer Dimensions Challenges
	Clustering	Clustering is the task of segmenting a heterogeneous population into a number of more homogenous clusters. It is different to classification in that clusters are unknown at the time the algorithm starts. In other words, there are no predefined clusters. Common tools for clustering include neural networks and discrimination analysis	Customer Identification	Initial launching Costs Strategy challenges Customer Dimensions Challenges
	Forecasting	Forecasting estimates the future value based on a record's patterns. It deals with continuously valued outcomes. It relates to modeling and the logical relationships of the model at some time in the future. Demand forecast is a typical example of a forecasting model. Common tools for forecasting include neural networks and survival analysis.	Customer Attractions	Integrated application tools Collaboration of various segments
	Regression	Regression is a kind of statistical estimation technique used to map each data object to a real value provide prediction value. Uses of regression include curve fitting, prediction (including forecasting), modeling of causal relationships, and testing scientific hypotheses about relationships between variables. Common tools for regression include linear regression and logistic regression.	Customer Retention	Collaboration of various segments Strategy challenges Customer Dimensions challenges
	Sequence	Sequence discovery is the identification of associations or patterns over time. Its goal is to model the states of the process generating the sequence or to extract and report deviation and trends over time. Common tools for sequence discovery are statistics and set theory.	Customer Retention	Collaboration of various segments Strategy challenges Technology challenges
	Visualization	Visualization refers to the presentation of data so that users can view complex It is used in conjunction with other data mining models to provide a clearer understanding of the discovered patterns or relationships. Examples of visualization model are 3D graphs.	Customer Development	Integrated application tools Technology challenges Collaboration of various segments
Web Mining	**Web Content Mining**	Active methods of Automatic discovery, retrieve, organization, and management of a huge volume of web information and resources. It helps in improving or filtering the search information that is usually based on the information derived from user profile or request so provides more complex queries from a simple keyword for more accuracy.	Customer Identification (Customer's Primary Information)	Initial launching Costs Strategy challenges Customer Dimensions Challenges
	Web Structure Mining	Web is a graph. Its nodes are web pages and hyperlinks create edges that provide the communication between the related pages.	Customer Identification (Customer's Primary Information)	Initial launching Costs Strategy challenges Customer Dimensions Challenges
	Web Usage Mining	It focuses on techniques that can predict user behavior interactively while working with the web pages. Mostly, e-commerce is very important for web based companies and CRM can be an effective advantage of web usage mining.	Customer Attractions, Retention, Development (Customer's Secondary Information)	Integrated application tools Technology challenges Collaboration of various segments Customer Dimensions Challenges