

## An Analysis Of The Existing Data Mining Techniques In Customer Relationship Management

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### Abstract

*Data mining is most widely used in all fields because of its purposeful usage in the field where it is applied to. This paper deals with the theoretical study of the existing solution for Customer Relationship Management with the aid of the available Data Mining Techniques. The techniques such as Clustering, Association rules and Classification are studied. It describes how these techniques are used to improve the customer relationship with the company which leads to a considerable profit. A conclusion is given which emphasized the used of these techniques in CRM.*

### 1. Introduction

Customers are the most important asset of an organization. For building, managing and strengthening loyal and long-lasting customer relationship, the strategy called Customer Relationship Management (CRM) is used. CRM is defined by four elements of simple framework namely Know, Target, Sell and Service. The concept of CRM defined as "the process of acquiring, retaining and growing profitable customer which requires a clear focus on service attributes that represent value to the customer and creates loyalty". Customer relationship management is not only pure business but also ideate strong personal bonding within people. Development of this type of bonding drives the business to new levels of success.

Once this personal and emotional linkage is built, it is very easy for any organization to identify the actual needs of customer and help them to serve them in a better way. It is a belief that the more sophisticated strategies involved in implementing the customer relationship management, the more strong and fruitful is the business.

CRM has been initially performed manually by employees of the organization. Due to the increase in online transactions, it becomes better and efficient to automate this process [7], [8].

Research has been conducted to evaluate CRM effectiveness. Companies are now aware of the many potential benefits of CRM. They are

- 1) Increased customer retention and loyalty
- 2) Higher customer profitability
- 3) Creating values for the customer
- 4) Customization of products and services
- 5) Lower process, higher quality products and services

The paper is organized as follows: Section 2 describes about Data Mining in CRM. The Section 3 studies the techniques such as Association rules, Clustering and Classification in CRM. And the Section 4 concludes the paper.

### 2. Data Mining

Data mining, which is also called KDD (Knowledge Discovery in Database), is the process of abstracting unaware, potential and useful information and knowledge from plentiful, incomplete, noisy, fuzzy and stochastic actual data. Simply speaking, it is a process to pick up the information and knowledge which cannot be discovered directly but with potential value from a mass of data. Here, we use the process of Clustering, Classification and Neural Networks for the mining data.

Data mining (DM) refers to extracting or "mining" knowledge from large amounts of data [11]. DM is the science of finding new interesting patterns and relationship in huge amount of data. Data Mining is defined as "the process of discovering meaningful new correlations, patterns, and trends by digging into large amounts of data stored in warehouses". Data mining is not specific to any industry. It requires intelligent technologies and the willingness to explore the possibility of hidden knowledge that resides in the data.

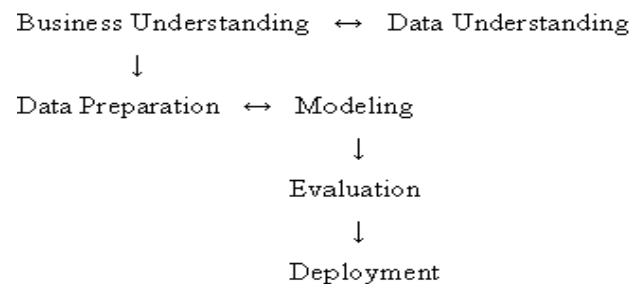


Figure 1: Data Mining Process

#### 2.1 Neural Networks

An artificial neural network (ANN), often just called a "neural network" (NN), is a mathematical model or computational model based on biological neural networks, in other words, is an emulation of biological neural system. It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation.

In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase.

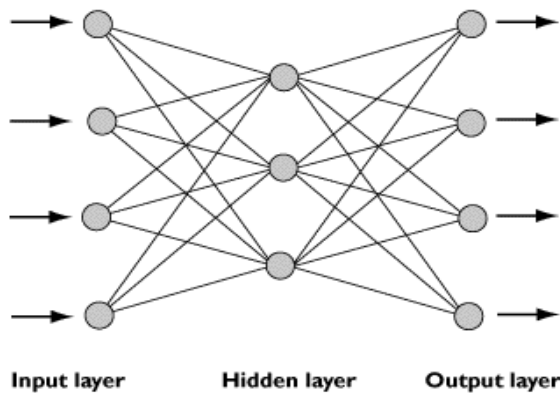


Figure 2: Structure of an artificial neural network

An ANN is typically defined by three types of parameters:

1. The interconnection pattern between different layers of neurons
2. The learning process for updating the weights of the interconnections
3. The activation function that converts a neuron's weighted input to its output activation

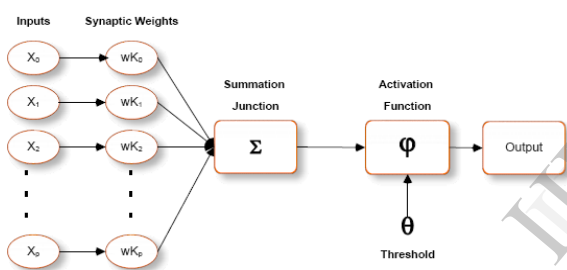


Figure 3: Mathematical Model of a Neural Network

## 2.2 Clustering

Data clustering is a method in which we make a cluster of objects that are somehow similar in characteristics. The criterion for checking the similarity is implementation dependent. Data Clustering is a technique in which, the information that is logically similar is physically stored together.

## 2.3 Classification

Data classification is the categorization of data for its most effective and efficient use. In a basic approach to storing computer data, data can be classified according to its critical value or how often it needs to be accessed, with the most critical or often-used data stored on the fastest media while other data can be stored on slower (and less expensive) media.

By applying these techniques in CRM, the process of customer analysis becomes more accurate [1], [2], [6].

## 3. Data Mining Techniques in Analyzing the Effectiveness of CRM:

A Rule based Data Mining technique has been used to generate new rules and patterns by using sales, marketing, IT and customer's data. Customer's data are clustered by using several characteristics of customers to recognize and understand the customer [9]. Data Mining is used to extract knowledge from these databases and evaluate it for future purpose. Association, Clustering and Classification technique are used for making data in manipulated form. Whenever a query is raised, the reply will be given with the help of mined data and this will be saved in a database for future augmentation.

Association rules have been used to discover regularities between products in large scale transaction data recorded by point-of-sale (POS) systems [10]. Classification and prediction aims to build a model to predict future customer behaviors through classifying database records into a number of predefined classes based on certain criteria [10].

Clustering is used to classify the similar customers and divide the dissimilar customers into different groups. By using cluster analysis, the enterprise can find a customer group of different characteristics by purchase mode, for making more efficient marketing strategy. Classification methods can be used to classify the potential customers in the existing categories [11]. Customers will be abandoned, if they are found to not fit for bringing profit to customers. The applications of classification are as shown in the Figure 4.

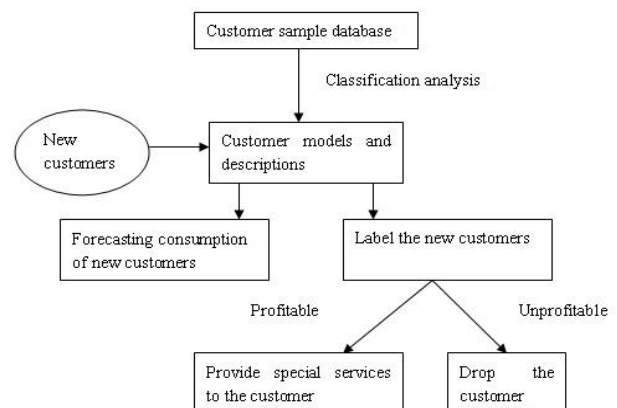


Figure 4: Application of Classification

Back propagation learning algorithm which is a generalization of Widrow-Hoff error correction rule is used [12]. Range of the output is within [0, 1]. The input-output data is normalized before the initiation of training of Neural Network. The input variable is made to fall in range [-1, 1]. Neural Network based integrated evaluation method is used for simulation. Matlab can be used as a tool. The test results and error variation curve are given as in Table 1 and

Figure 5 respectively. The results of simulation are found to be satisfactory.

Table 1: Test Results and Categorization

| order                     | 1      | 2      | 3      |
|---------------------------|--------|--------|--------|
| Test results              | 0.4508 | 0.8366 | 0.6615 |
| Results from experts      | 0.4600 | 0.8170 | 0.6300 |
| Errors / %                | 1.68   | 2.37   | 4.74   |
| Categorized by simulation | Poor   | Good   | Medium |
| Categorized by experts    | Poor   | Good   | Medium |

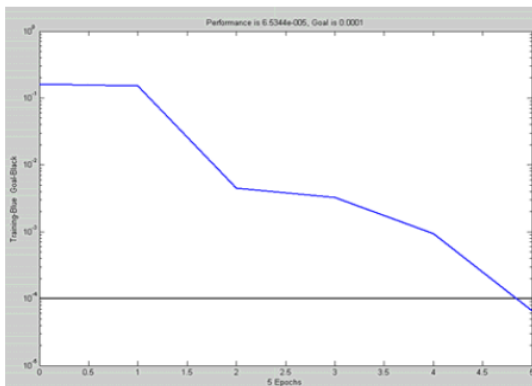


Figure 5: The error variation curve

A new method based on Neural Network is used for integrating decisions between CRM and Enterprise Resource Planning activity production. It has 3 phases. First phase is collection of data and passing it to Neural Network [13]. The output customer value is provided by analyzing the properties and combining it with weight values. Product value is provided by analyzing the data relating to the product which is the second phase. A new customer data is presented to the system in third phase. Multi layer feed forward Neural Network is trained by using Back Propagation Learning Algorithm. The model which is used is given in Figure 6.

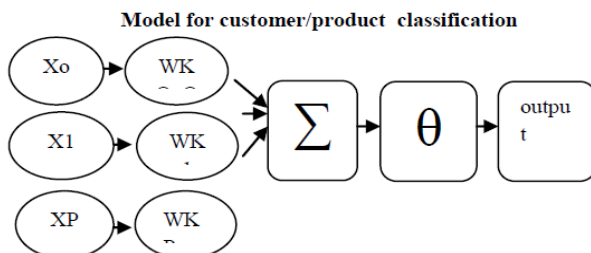


Figure 6: Model for Customer/Product Classification by using Neural Network.

Here  $X_0$ ,  $X_1$ ,  $X_P$  are the inputs represents Customer's information like their age, salary, income

etc. as well as product information like brand value, quality, quantity etc.  $W_{K0}$ ,  $W_{K1}$ ,  $W_{KP}$  denotes the weights. Weights assignment depends upon the importance of the relative attribute in relation with buying pattern of the customer and sales pattern of the products.  $\Sigma$  represents the potential value of the customer that is the total summation of all inputs and total sales value  $\Theta$  is a threshold value. Various functions of classification are applied on this basis only. Output provides the final result of various customer classifications and the type of product selection by them for purchasing. In case of Product classification this output provides the details about the product's sales pattern and the range of customers who could purchase the particular type of the product. The results observed showed that the Multi layer feed forward network shows higher accuracy.

#### 4. Conclusion

Data Mining is a part of CRM. It is a growing discipline in the database management community. Application of CRM with Data mining is found to be more beneficial. The application of Data Mining techniques in CRM provides satisfactory results. The future work is to focus on the customer retention technique to enhance customer relationship via Data Mining techniques which leads to a good profit.

#### 5. References

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