

APPLICATION OF DATA MINING IN CUSTOMER RELATIONSHIP MANAGEMENT: A REVIEW

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Abstract—Data mining is a technique to extract new useful information from existing database. It is used to predict various patterns from present dataset. It has a great application in the field of sales/marketing. In today's competitive world, it has become necessary for businesses or organizations to adopt a strategy or technique before introducing their product in the market to earn huge profit from the customers by maintaining healthy relationship with them. In this paper we want to explain the use of data mining techniques such as association rule mining, decision trees, clustering, etc. that helps businesses in developing and maintaining a healthy relationship with customers.

Index Terms—Data mining, Customer Relationship Management, WEKA, Decision Tree, Classification, Clustering, Regression Analysis, Association rule mining.

I. INTRODUCTION

A. Data Mining

Data Mining is a technique to find new useful information or to extract new patterns or to generate some rules from the pre existing database. It is a process which involves following steps [11]:

- 1) *Data Cleansing*: It means to clean the data available or we can say to remove noise and inconsistency from available data and store it in data warehouse. The data that is stored in data warehouse is cleaned data. The data that is stored in data warehouse is cleaned data.
- 2) *Selection and Transformation*: Data selection means to select only required data i.e. data which is needed to solve our problem. Data transformation means to transform the data into various forms which is required for mining.
- 3) *Data Mining*: In this, a number of methods are applied to extract or generate data patterns from available and pre-existing dataset. It can be done using various techniques and algorithms such as clustering, classification, regression analysis, etc. Some of them are explained in the next section.
- 4) *Post processing and Visualization*: At last, post processing of extracted data is done that whether it matches the desired result or not i.e. whether desired output is generated or not and then visualization takes place i.e. to provide data to the users in a way they understand.

These are the main four steps of data mining and are shown in the Fig. 1.

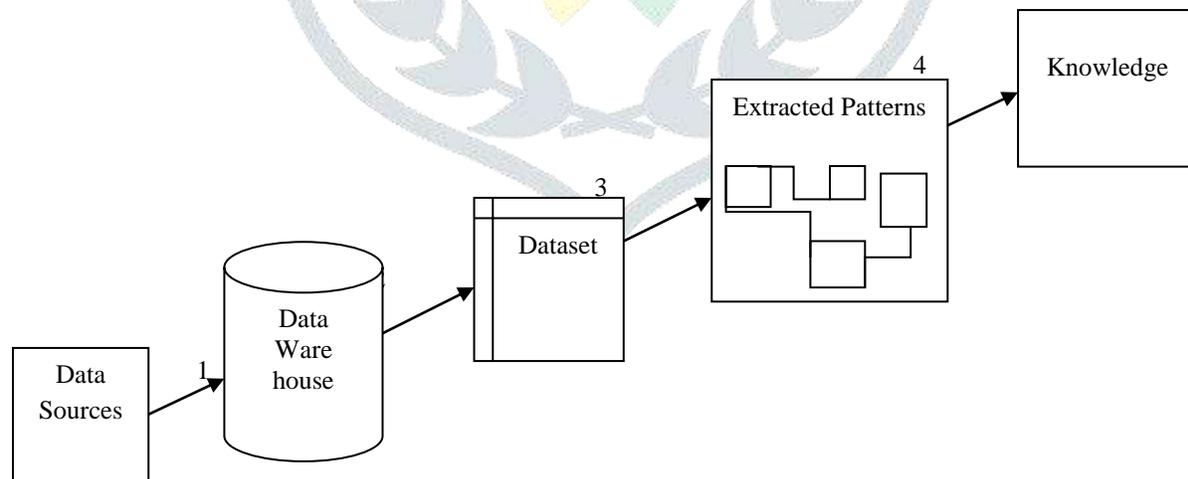


Fig. 1 Process of data mining

B. Data Mining Techniques

There are various techniques of data mining [12]. Some of them are:

- 1) *Association Rule Mining*: In this type of mining, rules containing relation between various variables are generated. It is mostly used in market basket analysis to generate rules which tells what generally people use to buy along with some other thing or item i.e. what are the items people buy together which help retailers to design store layout, catalog, etc.
- 2) *Clustering*: In this type of mining, various objects are grouped in same group or cluster if they are similar and in different groups if they are dissimilar. Cluster is the collection of related items.

- 3) *Classification*: It is similar to clustering that various objects are classified in different or same groups or classes but here the data analyst has the knowledge of existence of different classes (unlike clustering).
- 4) *Regression Analysis*: In this type of mining, relation between various variables is generated. It tells how value of a dependent variable changes when value of other variable is changed.
- 5)

C. Customer Relationship Management

CRM refers to strategies that companies adopt to maintain healthy relationship with their customers, to attract them, to retain them, etc. It is an ongoing process. CRM has 4 dimensions [2]:

- 1) *Customer Identification*: It means first to divide the population into segments on various bases such as their behavior, geographical conditions, physiographic attributes, etc and then targeting a particular segment.
- 2) *Customer Attraction*: It involves adopting strategies to attract customers by companies so that demand for their product increases and they can earn profits. This can be done by direct marketing, advertisements, etc.
- 3) *Customer Retention*: It involves strategies to retain customers because it's more profitable to do so rather than identifying and attracting new customers. This can be done by organizing loyalty programs, managing customers' complaints, etc.
- 4) *Customer Development*: It involves adopting strategies to increase customer lifetime value or customer profitability.

II. LITERATURE REVIEW

Esra Kahya Ozyirmidokuza, Kumru Uyarb, Mustafa Hakan Ozyirmidokuzc [1] in 2015 showed how to extract patterns from firms marketing channel. They did clustering by using SOM. They did so to reduce attributes. They also generated a decision tree for effective managing of customers' complaints. The model's accuracy rate was 92.67%.

E.W.T. Ngai, Li Xiu, D.C.K. Chau [2] in 2009 gave a summary of application of data mining in CRM. They told that research in this field will go on increasing in future as competition will increase. They told that managing customers' complaints is the most crucial part of CRM.

Dr. Sankar Rajagopal [3] in 2011 told that clustering and extracting patterns from customer data is very much important part of CRM. His main goal was to search for high value and low risk customers for a company on the basis of historical data available. He used IMB Intelligent Miner to do so. Demographic clustering algorithm was used which form cluster which represent 6% customer from whom 35% of the total profit is generated.

Charles Dennis, David Marsland and Tony Cockett [4] in 2001 showed that available data about customer can be used to identify what are the needs of customers and which customers (segment) a company want to target. For this they had used clustering technique of data mining. They also highlighted the requirement of satisfying customers as more the customer is satisfied, more his lifetime value for the company.

M Suman, T Anuradha, K Manasa Veena [5] in 2011 told that there are two types of marketing namely, mass and direct marketing. Mass marketing means marketing on a large scale that target a large population and direct marketing means to target only valued and loyal customers. Direct Marketing can be done by sending emails, calling, etc. to customers directly. They had implemented decision tree for direct marketing. Algorithms such as ID3 and C4.5 were used. They also told the problems in classification for direct marketing.

Hasan Ziafat, Majid Shakeri [6] in 2014 told that using data mining techniques along with business expertise proves to be a boon to revenue of the company. They told that customer segmentation is to be done using clustering technique. They focused on behavioral segmentation (using clustering technique).

Rabiya Shamsheer, Parul Agarwal [7] in 2017 showed the taxonomy of CRM dimensions. They surveyed different data mining functions helping in customer relationship management.

Ke Wang, Senqiang Zhou et al. [8] in 2005 worked upon KDD cup 98 challenge regarding direct marketing. They told that out of total people mailed (if email is chosen for direct marketing), only 5% people respond back. So the main problem is to determine those 5% people with the help of historical data. There was a challenge KDD-CUP 98 in 1998 regarding this to find an algo for it so as to maximize profit for the company. Winner of the cup had achieved average profit of 0.26 per customer. They (authors) worked upon it and have achieved 41% more profit than the winner. They had used association rule mining.

Su-Yeon Kim, Tae-Soo Jung, Eui-Ho Suh [9] in 2006 told that to earn maximum profit in a business, it has to satisfy their customers. Customer satisfaction starts from identifying customers' loyalty. Customer segmentation is to be done. Regression Analysis is done for customer segmentation.

III. PROPOSED WORK

By using data mining techniques in the field of marketing, companies can reach to the sky (earn profit) by taking decisions clearly and strategically on the basis of results of techniques applied on customer data.

In this scheme customer data is created by taking various variables in consideration for e.g. number of customers interested in buying your product again (through surveys, etc.), number of people replying back to your e-mails, customer satisfaction level, etc. Then this dataset is analyzed using various techniques of data mining and further decisions about companies actions for future to earn more profit are taken on the basis of these results.

IV. METHODOLOGY USED

Tool used is WEKA which refers to Waikato Environment for Knowledge Analysis. It is written in Java language. WEKA is a tool used for data mining. This tool consists of inbuilt algorithms such as decision tree algorithm, clustering algorithm, association rule algorithm, etc. required for analyzing the data.



Fig. 2 WEKA Startup Screen [10]

V. GENERAL APPROACH

There is lot of competition in business markets. Companies are trying to move ahead of each other in today's competitive world. They have to adopt various strategies to win the competition. There is a lot of difference between the company taking any step just by an idea coming in the mind and a company adopting some IT techniques along with business mind to achieve the same objective. The later one will achieve more success undoubtedly.

Data Mining can help businesses in achieving success to a great height by analyzing customer data in a way that a person can't do manually. Various techniques of data mining can be used for managing customer relationships.

VI. CONCLUSION

We have reviewed few articles about application of data mining in managing customer relationships. Most of the techniques that are used by researchers in this field are association rule mining, classification (decision tree), and clustering and regression analysis. After applying data mining techniques on customer data and adopting strategies on the basis of the results of those techniques, companies or businesses have gained much profit in this competitive world and further research is going on which technique is the best.

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