

# Knowledge Management in CRM using Data mining Technique

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**Abstract**-Now a day's CRM has become very important factor in defining the enterprise growth because of economic globalization and rapid development in e-commerce. Today's world enterprise uses the data mining tool to extract the very critical information that can help in strategic decision making by the managerial decision maker." Knowledge Management in CRM using data mining technique" paper will introduce how company can use Data mining methodology in CRM and application of Data Mining method in CRM such as Classification, Clustering, Association mining, Prediction and Correlation.

**Index Term**- DM: Data Mining, AI: Artificial Intelligence, CRM: Customer relationship management, KDD: Knowledge Discovery in Database, DSS: Decision support system Data Mining, CRM and Knowledge management.

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## 1. INTRODUCTION

CRM consists of four dimensions: [1]

- (1) Customer Identification;
- (2) Customer Attraction;
- (3) Customer Retention;
- (4) Customer Development.

These four dimensions can be considered as a cycle of a customer relationship management system. The depth study of these all dimensions can help us to make good relationship with customer in long term. Data mining techniques, therefore, can help to extracting hidden customer characteristics and behaviours from large databases. The available Data Mining techniques are:

- (1) Association Mining.
- (2) Classification.
- (3) Clustering.
- (4) Prediction.
- (5) Regression.
- (6) Visualization.
- (7) Sequence discovery.

A graphical classification framework on data mining techniques in CRM is proposed and shown in Fig.1.1

This is based on a review of the literature on data mining techniques in CRM. Intensely reviewing the literature on data mining in CRM helped to identify the major CRM dimensions and data mining techniques for the application of data mining methodologies in CRM. Figure 1.1 described CRM dimensions as: Customer identification, Customer Attraction, Customer Retention and Customer Development. In addition, it also described the types of data mining model as Association, Classification, Clustering, Forecasting, Regression, Sequence discovery and Visualization. [1]

In this paper we are going to apply data mining and Statistical algorithm those are K-means clustering algorithm, Decision tree algorithm, Apriori algorithm, Classification algorithm and Correlation analysis on Retail Industry data base after that we derive the conclusion from it that can help in knowledge management and decision making.

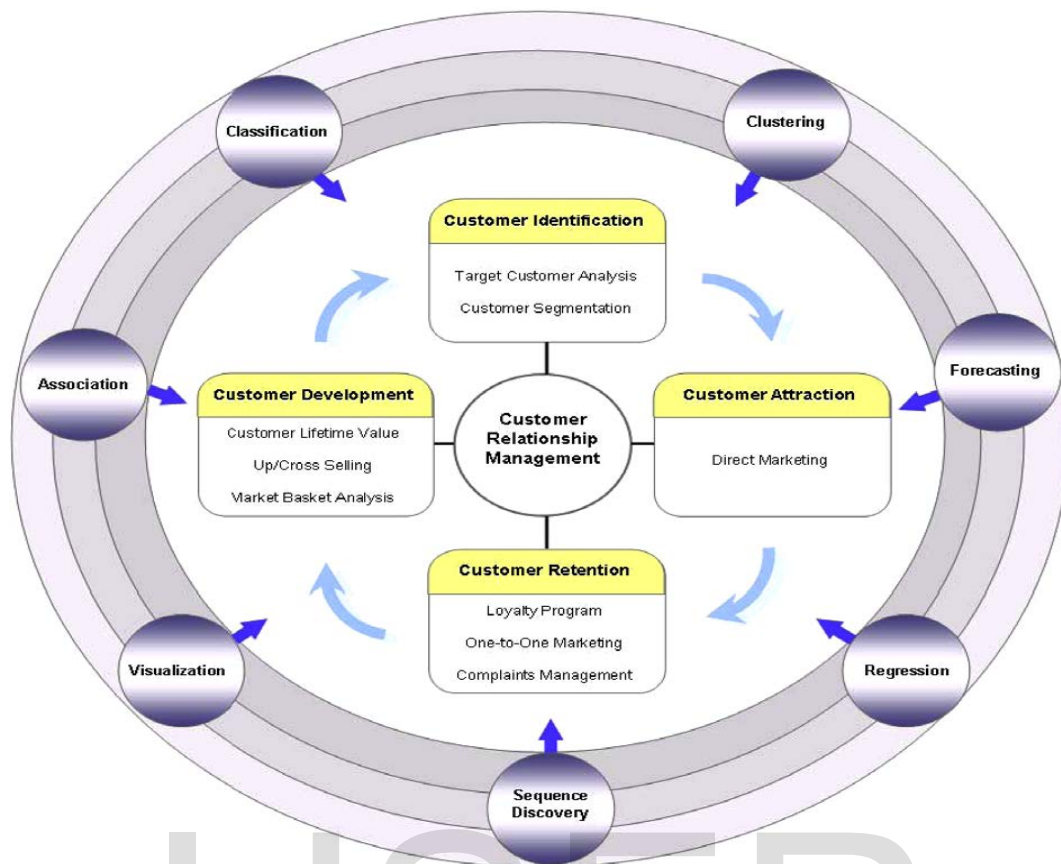


Fig. 1.1 Classification framework for data mining techniques in CRM. [1]

## 2. Literature survey

### 2.1 Application of data mining techniques in CRM: A literature review and classification:

“Application of data mining techniques in CRM: A literature review and classification” emphasises on using data mining techniques while designing a CRM for a particular organization. This paper aims at the application of different data mining techniques commonly used in mining process to be applied in CRM domain. According to the literature survey had done by the author of this paper, majority of the articles focus on retention of existing customers. These articles had provided insight to organization policy makers on the common data mining practices used in retaining customers. [1]

### 2.2 Application of data mining techniques in CRM:

In today’s competitive business world customer is a very important asset to an enterprise. The enterprises can get an edge in the drastically increasing competitive environment if they efficiently manage their customer relationship. The CRM’s system structure research, value evaluation and calculation, application of data mining and mathematical statistics are the areas of interest in this paper. The use of data mining technology can extract rules and patterns from a mass of data. These factors can play as a deterministic role in enterprise development. [2]

### 2.3 Implementation of Data Mining Techniques for Strategic CRM Issues:

Data mining techniques such as finding different patterns, association among objects and correlation hidden in the customer databases maintained by the enterprise can prove very helpful to the management personals. These methods can be used by the organizations for attracting new customers by providing segmented products to the customers. It will be also helpful in real time systems such as fraud detection, targeting particular customer group, retention of customers for a long time etc. Using the proper data mining technique for particular functionality of CRM can yield them with good customer relationships which will increase its profit margin. [8]

### 2.4 A Comprehensive Study of CRM through Data Mining Techniques:

Data mining is finding its application in commercial concerns enormously with the growth in commercialization of the products. The different statistical methodologies of data mining prove to be very efficient in customer separation and grading. It tries to find new and useful patterns by making use of its classic and new algorithms. These are very helpful at the management level. The enterprises try to retain their customers by applying different

customer attracting policies and strive to maintain customer relationship. This can be further more beneficial if data mining is applied in customer relationship management. The main focus of this paper is on customer retention by using different data mining tools in customer relationship management. Data Mining would fasten up the process of searching large databases so as to extract customer buying patterns, to classify customers into groups which also make databases to be handled efficiently. [9]

#### **2.5 Rise of Data Mining: Current and Future Application Areas:**

The different data mining trends and applications are discussed in this paper. It focuses on the numerous areas where data mining can prove as a promising tool for retrieving useful information. It provides a new perspective of a researcher regarding applications of data mining in social welfare. [10]

#### **2.6 Customer behaviour Analysis using CBA (Data Mining Approach):**

Data mining is a technique which consists of different algorithms to extract valuable information from raw data. It detects hidden patterns from the huge database which can be used to design different strategies. This paper gives the idea of classification algorithm and prediction in customer relationship management. This paper says how the behaviour of customer can be studied and forecasted with the help of naïve Bayesian classification algorithm. This paper focuses on banking applications of data mining which can also be used in insurance industry, retail industry etc. [11]

#### **2.7 An Algorithm for Frequent Pattern Mining Based On Apriori:**

Association rule mining has a wide range of applicability such as market basket analysis, medical diagnosis/ research, website navigation analysis, homeland security and so on. This paper surveyed the list of existing association rule mining techniques and compared those algorithms with new modified approach i.e. Record Filter Approach based on Apriori for Frequent Pattern Mining. The conventional algorithm of association rules discovery proceeds in two and more steps but in new approach discovery of all frequent item will take the same steps but it will take the less time as compare to the conventional algorithm. We can conclude that in this new approach, we have the key ideas of reducing time. This has proved how the proposed Apriori algorithm takes less time than that of classical apriori algorithms. That is really going to be fruitful in saving the time in case of large database. This key idea is surely going to open a new gateway for the

upcoming researcher to work in the field of the data mining. [12]

#### **2.8 Customer Data Clustering Using Data Mining Technique:**

This paper addresses the use of data mining technique to divide the customer into several groups using clustering algorithm as high-profit, high-value and low-risk customers. The final results demonstrate that the proposed approach revealed the high-value customers. From the results, cluster 3 has high revenue customers and represents about 35 percent of the revenue yet only by 6 percent of the customers. The cluster 3 has high value, low cost and is classified as High value cluster. The cluster 1 has high revenue, high cost and is classified as Medium value. The cluster 2 has low revenue, low cost and is classified as low value. Also, suggested possible strategies to retain and move the customers from lower band to upper band. [13]

#### **2.9 Outlier Detection: Applications And Techniques:**

The various outlier detection techniques are discussed in this paper in a structured way. It provides a better understanding of the different directions of research on outlier analysis for researcher and beginners on different areas of applications. [14]

#### **2.10 Solutions for analyzing CRM systems - data mining algorithms:**

This paper says that, the increasing amount of information requires advance processing technology such as data mining and Business intelligence system which can assist in decision making at managerial level. Business intelligence thus required can be built using different data mining techniques and predictive models. In this paper comparison between data mining technique and traditional statistical method is done where data mining proves more useful on the parameter of complexity and time consumed to generate a result. It concludes that full implementation of these techniques in CRM can increase customer value, retention and attraction. Also, investigating how to combine optimization and data mining techniques, especially in the CRM area, should be encouraged for many reasons. Data mining and optimization can be integrated to build customer profiles, which is absolutely necessary in many CRM applications. [15]

### **3. Applications of Data Mining in CRM**

Following are the application of data mining in the customer relationship management system [2]

- 1) Customer Classification Analysis.
- 2) Customer Gaining Analysis.
- 3) Customer Losing and Maintaining Analysis.
- 4) Customer Profit-making Ability Analysis and Forecast.

- 5) Cross Selling Analysis.
- 6) Customer Satisfaction Analysis.
- 7) Customer Credit Analysis.

#### 1) Customer Classification Analysis

Customer classification divides the customer by customer gender, occupation, age, location, customer consumption habit and purchase habit. With the help of data mining technology we can divide the large number of customers into different categories, according to which the customer-oriented products and services are provided. The most common methods are classification and clustering.

#### 2) Customer Gaining Analysis

With the help of data mining methodology, the enterprises can identify the valuable customers by doing the analysis on customer purchase habit and by targeting those customer purchase habit company sales can increase. The common methods of customer gaining are classification forecast and association analysis.

#### 3) Customer Losing and Maintaining Analysis

For development purpose of an industry constant increase in number of customers is needed as well as the old customers should be maintained because from previous research it was found that, in the industry it is commonly held that maintaining existing customers is more cost-effective than attracting new ones, and that 20% of customers create 80% of the profit for industry. From this the conclusion can be derived that it is easier and more cost effective to maintain old customers than investing time and money in gaining new customers. So the main focus of an enterprise should be to maintain their existing customers. Data mining can play a very important and efficient role in finding the ways to increase the customer satisfaction with the enterprise. It can also answer the questions like- Why customers are migrating to the opponent for the same products? How to bring them back? What all things should be done to increase the sales rate of the enterprise? After the complete analysis of the customer behaviour the management of the enterprise can take required measures to increase their profit.

#### 4) Customer Profit-making Ability Analysis and Forecast

From previous studies it is found that twenty percent of existing customers generate eighty percent of the whole profit and remaining eighty percent new customers generate twenty percent profit this concept is known as two-eight low in customer relationship management. So instead of taking more efforts to

#### 4) Customer Profit-making Ability Analysis and Forecast

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#### 5) Cross Selling Analysis

Cross selling analysis basically is analysing the group of frequently purchased products by the existing customer in order to arrange complementary product or gift items to please the customers. The popular algorithm for cross selling analysis is association mining.

#### 6) Customer Satisfaction Analysis

For analysing customer satisfaction level collecting the service feedback from the customer is the very first step. Later on performing the mining operation on these scattered feedbacks will fetch the satisfaction areas of the customers and their expectations from the firm. Accordingly strategies could be designed to attain the loyalty of customers.

#### 7) Customer Credit Analysis

From the huge customer databases based on their purchase habit they can be divided into different categories according to their credit rating by using different data mining techniques. On the basis of the credit rating different sales strategies can be designed to increase the sales rate.

### 4. Algorithm:

With this research paper we can show how bellow five algorithm is helpful in CRM and steps for respective algorithm is given bellow.

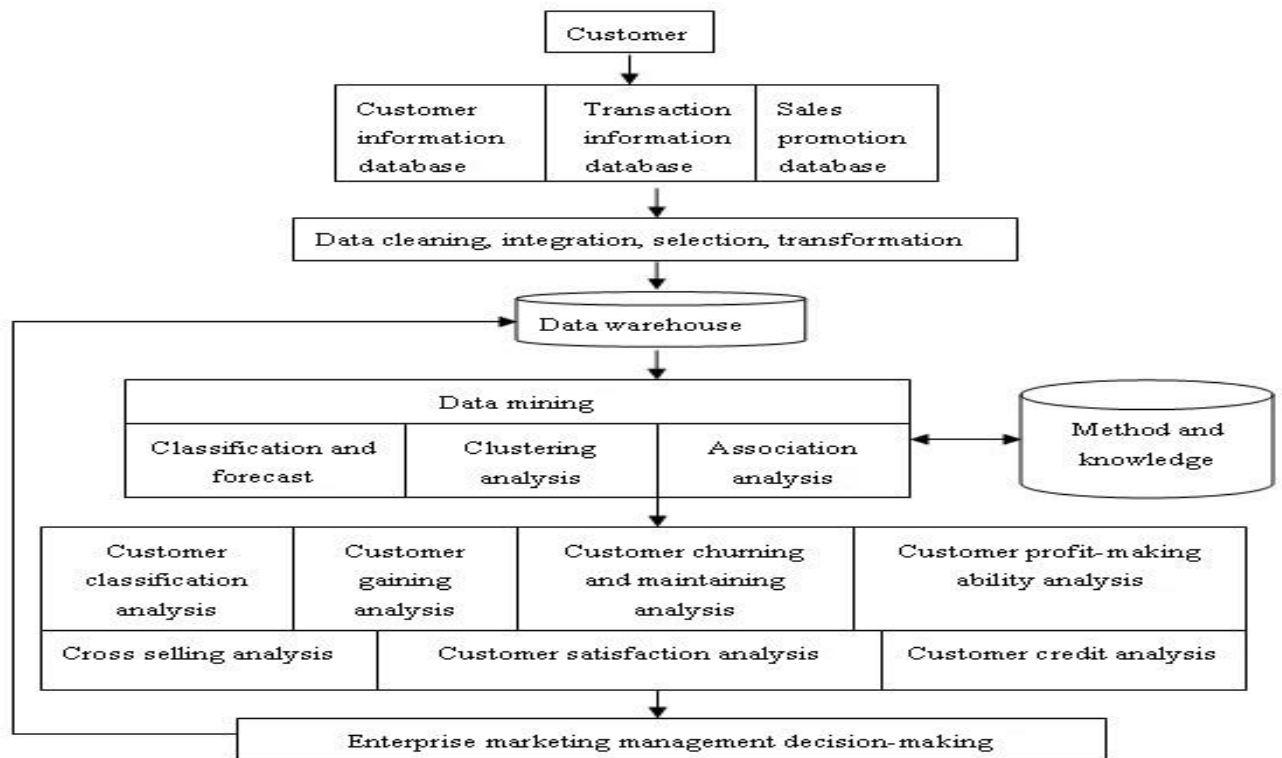
#### 1) Classification:

In Classification data mining technique we can apply ID3 algorithm to do the prediction of unknown value of attribute.

Following are the steps.

- I. Start
- II. Select the categories which are to be classified.
- III. Run the basic classification algorithm.
- IV. Get the result.
- V. Derive conclusion.
- VI. End.





**Fig.3.1 Process of customer relationship management [2]**

**2) Clustering:**

By using this algorithm we can divide the data sample into several numbers of groups as per our requirement. Following are the steps for clustering algorithm.

- I. Start
- II. Enter the Value of 'K' where K is number of group.
- III. Run k-means algorithm in retail database.
- IV. Get the desire number of cluster sample.
- V. Generate the plan as per requirement.
- VI. End.

**3) Association:**

Association algorithm is helpful to find frequent item set from database. Following is the steps for Association mining.

- I. Start.
- II. Select the categories.
- III. Run apriori algorithm in selected categories.
- IV. Get the frequent item set.
- V. Generate plan as per business need.
- VI. End

**4) Prediction:**

ID3 algorithm is helpful to predict the value of unknown sample. Following is the steps for prediction.

- I. Start
- II. Give the name of product which is to be predicted.
- III. Apply ID3 algorithm.
- IV. Get the result either yes or no
- V. End

**5) Correlation:**

With the correlation algorithm we can see how the two attribute are related.

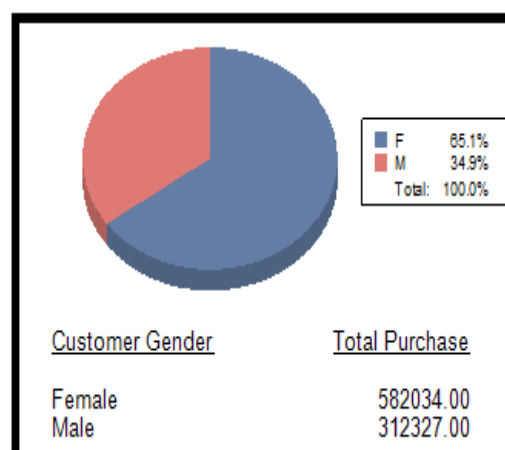
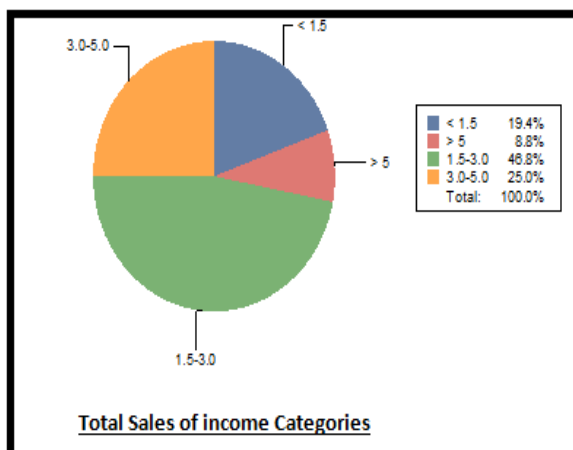
Following are the steps for correlation.

- I. Start.
- II. Select the category for correlation.
- III. Find correlation value and scatter graph.
- IV. Derive the conclusion.
- V. End

**5. Result and Discussion:**

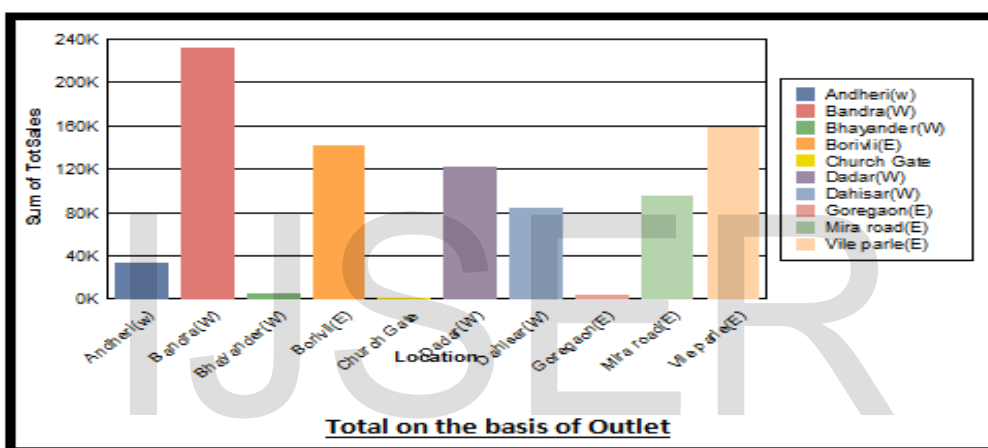
**Classification Data mining technique:**

Here Classification of sales data is shown with pi-chart and bar chart by applying basic Classification algorithm. Here classification is done on the basis of income based and outlet based which is shown given fig.5.1, 5.2 and 5.3.

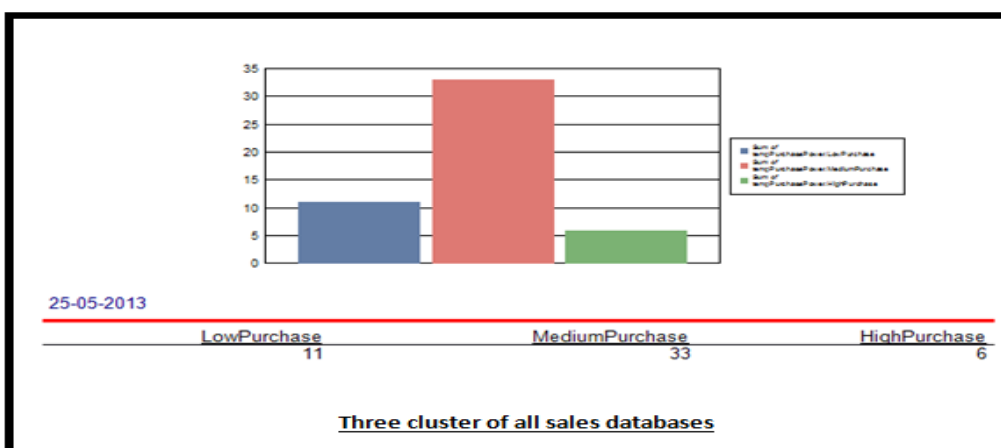


**Fig.5.1 Income based Classification**

**Fig.5.2 Gender Based Classification**



**Fig.5.3 Outlet Based Classification**



**Fig.5.4 Clustering on the basis purchase habit**

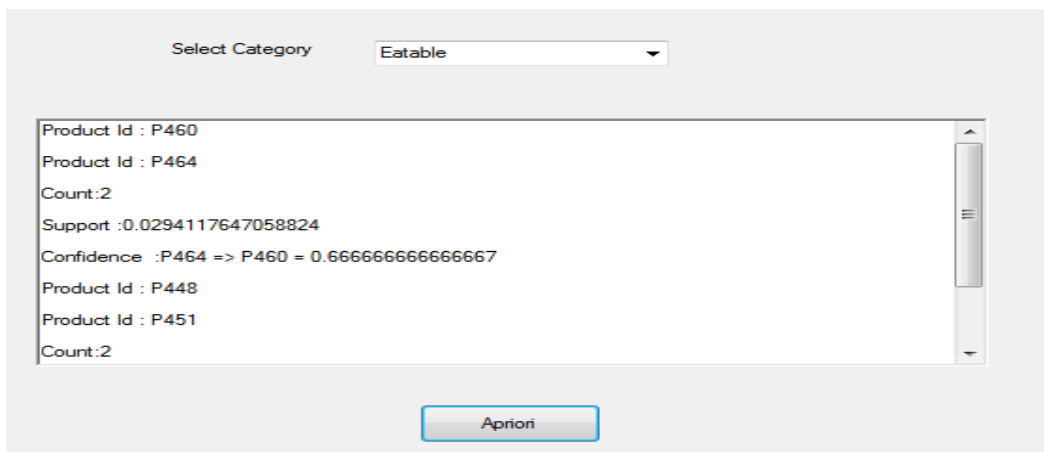


Fig.5.5 Frequent Item set of eatable categories

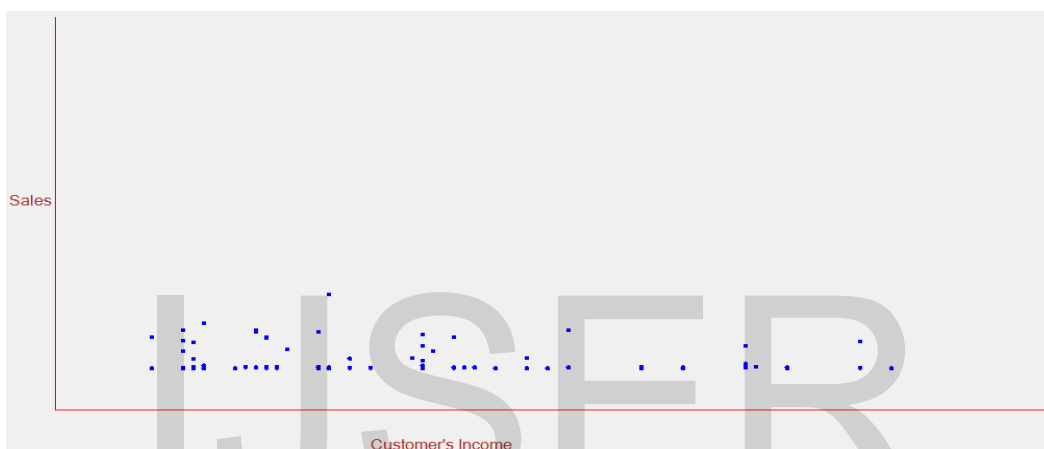


Fig.5.6 Correlation between Customer income and sales

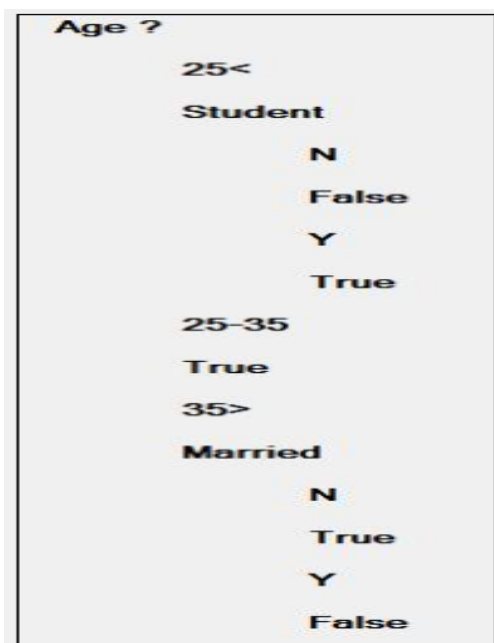


Fig.5.7 Decision Tree for purchase of Computer

### **Clustering Data mining technique output:**

Here the entire customer is clustered into three groups by using K-means algorithm on basis of purchase amount. Three clustered are named as Low purchase, Medium purchase and high purchase which is shown in fig.5.4.

### **Association Mining:**

With the association Data Mining technique we can find the frequent item set. In given fig.5.5 result of Eatable category item set is shown by applying apriori data mining techniques sales database.

### **Correlation technique:**

By calculating correlation coefficient we can see how two parameter are related and this behaviour can also be shown with given scatter graph fig 5.6.

### **Prediction:**

With the help of ID3 algorithm we can do the prediction of unknown sample and for prediction the useful attribute are Age, Student status and marital status considered. The tree for sales database is shown in fig.5.7.

## **6. Conclusion**

In this paper after applying the data mining technique in enterprise database following conclusion we can derive;

Where-

- With the help of clustering data mining technique we are grouping the customer into several numbers of groups on the basis of his purchase behaviour.
- In classification algorithm we are doing the prediction of unknown sample or missing sample.
- In classification algorithm we are doing the classification of data into several numbers of groups.
- With the help of prediction algorithm we are doing the prediction of customer behaviour regarding the purchase order.
- With the help of association mining we are getting the frequent item set which occur during the purchase order of product.
- With the help of Correlation analysis technique we can show how the different parameter of database is related.

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