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Data Mining in Automotive Customer Management

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Abstract - Data mining extracts useful information from a large data set among heterogeneous data base. This paper shows how the data mining techniques can be used in Automobile industry. Data mining Techniques such as Classification, Association rules, Clustering etc. can be appropriately applied to arrive a solution which will enable the vehicle manufacturing companies to take decision on model preferences and choice, create stimuli to push customers to choose among choice of variance and to aid help and support to customers in the aspects of financial and insurance products. By applying these techniques, the car manufacturers can identify the potential customers; develop products according to customer choice and to build customer relationship to promote business by attracting new customers while retaining the existing customers. The Automobile manufacturing companies are investing millions of rupees to understand, absorb, and listen their customers and their changing preferences to choose the vehicle of their choice. Market environment determines the buying behavior of customers. This is inevitable because the competition is emerging though it is a healthy situation but a potential threat to the automobile manufactures to come out with lot of innovative ideas on invention and development of their product to delight the customers

Keywords: Data mining, customer relationship management, clustering, association rules.

I. INTRODUCTION

Data mining refers to extract knowledge and mining data from large data. Data mining is treated as Knowledge discovery in database [KDD][5]. Data mining is the exploration and analysis of large quantities of data in order to discover meaningful patterns and rules. The goal of data mining is fast retrieval of data or information; to identify hidden patterns and easily identify the required information .The automotive industry in India is one of the sixth largest in the world. In India, customer prefers a product which must be easy to operate, maneuverability, best of service and it should fit in their budget [3]. This paper gives a brief idea about how data mining techniques can be applied in automobile industry such as product development, vehicle insurance, and Vehicle financing and Customer relationship management. The goal of data mining is to allow a corporation to improve its marketing, sales and customer support operations through a better understanding of its customers [1]. In this way, automobile companies can increase the revenue, reduce the cost and achieve a good competitive position [3]. Basically everyone wants to possess a car for the purpose of mobility of himself and his family. Among all, possessing a car is for attaining social status and self esteem. According to the customers' earning capacity, to keep up his image and social prestige, he would prefer a car, based on many factors like his occupation, income, peer standards, age, offers and discounts for the product, periodicity of such schemes, seasonal influence and so on. These factors are the major influencing parameters and car manufactures aims in these factors to attract the customer to push their products.

II. DATA MINING TECHNIQUES

There are various important tasks of data mining which are applied in various areas. They are Classification, Sequencing, association rules Regression, Clustering, Dependency modeling, Deviation detection and summarization [2]

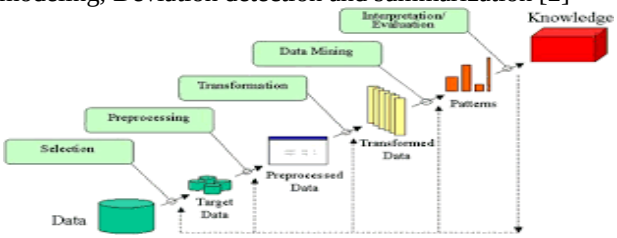

Figure: 1 Data mining process

Data mining is the process which provides data into useful information. So, data mining is termed "Knowledge Discovery Device" [KDD].
Knowledge extraction or discovery is done in seven sequential steps used in data mining:
1. Data cleaning: we remove noise data and irrelevant data from collected raw data, at this step.
2. Data integration: At this step, we combine multiple data sources into single data store called target data.
3. Data Selection: Here, data relevant to analysis task are retrieved from data base as pre-processed data.
4. Data transformation: Here, data is consolidating into standard formats appropriate for mining by summarizing and aggregated operations.
5. Data Mining: At this step, various smart techniques and tools are applied in order to extract data pattern or rules.
6. Pattern evaluation: At this step, strictly identify tree patterns representing knowledge.
7. Knowledge representation: This is the last stage in which, visualization and knowledge representation techniques are used to help users to understand and interpret the data mining knowledge or result [8]. The goal of knowledge discovery and data mining process is to find the patterns that are hidden among the huge set of data and interpret useful knowledge and information [2].

A *Categories of data mining*

The two categories are descriptive and prescriptive mining. Summarizing or characterizing the universal properties of data

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in data repository is referred as Descriptive mining while Predictive mining is to perform inference on existing data to make prediction based on past data [4].

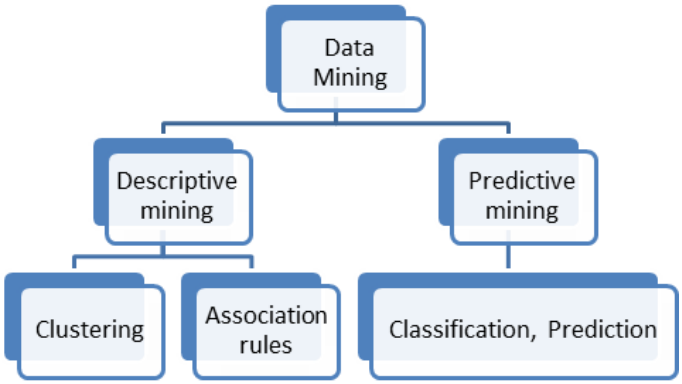

Figure 2: Categories of data mining

There are various approaches to apply data mining techniques in automobile industry, but in this paper, I am highlighting the three important tasks of data mining such as Classification, Association rules and Clustering. Since these tasks are major determining factors in deciding the product of choice by customer.

1 Classification

The classification algorithm helps the automobile industry to find their productive customers. Decision trees made by the classification algorithms increase productivity based on customer choice (Customer, age, Income, brand choice, service availability of the vehicle). There are other supporting factors which influence customers to take decision of buying a car are such as ease of operation or maneuverability, maintenance, service back up, brand name, after sales service. Considering all the above, a person can decide and go for a final decision to buy a car of his choice such as economy version of car or mid size car or a luxury car, based on the influences and references recommendations and reward factors.

Table I Customer details

S. No	Customer Name	Income p/m	Age	Occupation	Car selection
1	Rajan	100000	45	Employed	Luxury car
2	Aadharsh	45000	51	Employed	Economic car
3	Ganesh	70000	38	Employed	Luxury car
4	Ramprakash	55000	56	Business	Mid range car
5	Kumar	200000	45	Business	Luxury car

Table I gives an example of customer data who are interested in buying car with different range in car selection. Customer classification can be based on the real life test cases, collected from various sources reveals that a customer who is interested in buying a car and the type of the car either a economic car, mid range car or luxury car may be under the influence of family back ground, his economic conditions, social status, peer standards etc., Based on the data, decision tree is formed. Income is the main criteria or as the root for the decision tree. Decision tree can be followed with age and occupation. Based on the data, customer status and his desire are arrived and those are the deciding factors to choose the type of car, the customer is interested.

2 Association rules

Association rule mining discovers the frequent patterns among the item-sets. It aims to extract interesting associations, frequent patters, and correlations among set of items in the data repositories. The two significant measures of association rules are support and confidence. Support is defined as the proportion of records that contain XUY to the overall records in the database. Confidence is defined as the proportion of number of transaction that contain XUY to the overall records that contain X where, if the ratio outperforms the threshold of confidence [4].Association rules can be formed based on certain parameters. One is Income, for example if income is greater than 50000, occupation is employed or business and age is 45-55, the customer selects luxury cars. If income is less than 50000, occupation is business, age is above 55 these customers select mid range cars. The category income is less than 50000, occupation is employed age of 35 to 45 these customers select economic cars. The car manufacture can select the customer based on their income, age, occupation and decide what type cars the customer is preferred.

3 *Clustering*

Clustering is dividing data points into homogeneous classes or clusters [9]. Points in the same group are as similar as possible. When a collection of objects is given, we put objects into group based on similarity. Clustering helps marketers to improve on the target areas. It navigates to categorize people such as age, income, budget, purchasing power etc. [3].

III. APPLICATIONS OF DATA MINING TECHNIQUES IN AUTOMOBILE INDUSTRY

Data mining techniques can be applied in various fields of automobile industry. This paper gives an idea about specific fields in which data mining techniques can be used. They are

A Customer relationship Management
B Product development
C Vehicle Insurance
D Vehicle finance

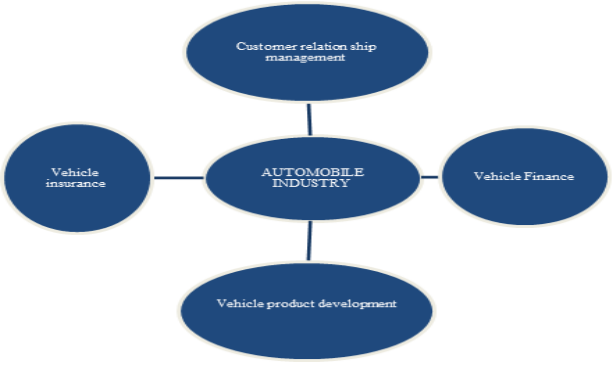

Figure 3: Automobile industry

A Customer relationship Management

Customer relationship management in automobile industry is mainly based on customer choice and preferences [3]. Data mining is applied for customer relationship management, marketing, customer profiling, retention of customers, identification of potential customers, market segmentation. Customer relationship management provide the strategic and decision making support for the development of trade related activities, merchandising and also help automobile enterprises find their business trend and predict the unknown results as well as help the automobile sales enterprises to analyze and complete the key factors needed by their tasks [10]. Using data mining techniques for classification such as ID3, C4.5, Decision trees etc are used to find the productive customers. Using these algorithms, we can analyze the customer data and the range of categories that are the deciding factors for classification. By applying these techniques, we could classify the customer which can promote the business and make profit for the automobile industry.

B Product development

Research and development is a continuous process since customer preferences on safety, luxury, comfort and maneuverability of the vehicle are getting upgraded day by day. Features like fuel computer, ABS (Anti lock Breaking System), EPS(Electric power steering), power windows, sensor based automotive wipers, MPFI(Multi point fuel injection) for petrol cars, CRDI(Common Rail Direct Injection) [13] for Diesel cars and other facilities simulates the customer to decide upon the car of their choice for which vehicle manufactures research and provide solutions to edge over competition.Data mining techniques are the real validating factors in product development for the manufacturing companies and to take firm decisions on value addition, elimination of waste, cost appropriation, inventory management and to keep the customers to have a feel of joy and satisfaction for the value of money they spent to buy a car. For product development clustering technique such as hierarchical, partitioning, grid based, model based clustering can be used to cluster the products based on customer choice.

C *Vehicle Insurance*

Vehicle insurance is one of the key elements in automobile industry. Any vehicle sold across the world should cover under motor insurance to overcome the risk of danger of loss of life and / or vehicle. Vehicle insurance is a legal requirement and is mandatory by law in every country [6]. Motor insurance protects the vehicle from human mistakes or errors or natural calamities like earth quake, cyclone, hurricanes, thefts and riots and in addition to third party claims for damages. There are different types of motor insurance in India.

- Private car insurance
- Two wheeler insurance
- Commercial vehicle insurance [6]

The vehicle insurance covers the following

- Loss or damage by accident, fire, lighting, self ignition explosion, burglary, house breaking, theft and malicious act.
- Liability for third party injury/death/third party property and liability to pay to driver / owner of the vehicle.
- On appropriate additional premium laws or damage to electronic accessories [11].

Data mining techniques such as classification, clustering can be applied in vehicle insurance systems. Vehicle insurance grouping is possible only through classification methodology since the vehicle can be classified as two wheeler, cars (private, taxi), commercial (Light Commercial and Heavy Commercial), buses (private and government owned), tractors and other stationary vehicles.

D *Vehicle finance*

Vehicle can be purchased by two major methods

- Own cash
- Finance by banks/finance institutions

Car manufactures strategically plan and execute to attract prudential customer to make them avail vehicle financing and make their sale[14]. Of the entire methods, vehicle financing plays a vital role since 90% of car sales in India is made through vehicles financial made through bank/financial institutions. Major reason for vehicle financial is to enable the potential customers can decide a vehicle of his choice according to his economic condition and the level of repayment which are the major factors to have a better choice.
Even Big corporate companies go for financial companies. There are several reasons listed below

- They don't want to spend their surplus amount to buy vehicles rather they can invest in business.
- Vehicle depreciation can be counted while computing their income tax and the same will be offset through repayment of loan for business people.
- For individuals to pay Monthly EMI (Easy Monthly Installments) to keep the expenses within their budget but to have a car of this choice [12].

Considering this importance, vehicle manufactures start their own venture in vehicle financing such as Ashok Leyland Finance, Maruti Auto Finance etc. Vehicle financing is also now available for old/second hand used vehicles in India. Hence vehicle financing has become vulnerable and inseparable in automobile industry in India.Data mining techniques such as classification, clustering can be applied in vehicle financing products. Clustering can be applied for grouping vehicle finance such as two wheeler finance and four wheeler finance.

IV. CONCLUSION

Data mining focus on extraction and analysis of data from a large amount of data from a data warehouse. This paper introduces an idea about data mining techniques applied in automobile industry. Data mining techniques such as classification, association rules, clustering can be applied to find the productive, valuable customers. Customer plays an important role in increase of market share and size of the business of every enterprise. The entire study is to focus and provide achievable results of obtaining more number of satisfied customers for every enterprise by adopting thorough analysis on customer needs, their preferences, budget, economic conditions, social status, self esteem, besides the factors of financial, insurance needs and after sales service back up. As Gandhi said, a customer is a most important visitor

to any enterprise. The purpose of business is getting fulfilled since the customer is giving an opportunity to serve them.

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