

Data Mining in Customer Relationship Management (CRM)

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Abstract: *Data mining allows extracting valuable information from the historical data and predicting outcomes of future situations. CRM considers the customer as the centre point, which values the customers of the organization. In order to develop an integrated model, it is important to understand the existing Data mining and CRM models. Hence the article discusses some of the existing data mining and CRM models and finally proposes an integrated model of data mining for CRM.*

Keywords: CRM, DM, Mining Model

I. INTRODUCTION

A new business culture is developing today. Within it, the economics of customer relationships are changing in fundamental ways, and companies are facing the need to implement new solutions and strategies that address these changes. The concepts of mass production and mass marketing, first created during the

Industrial Revolution, are being supplanted by new ideas in which customer relationships are the central business issue. Firms today are concerned with increasing customer value through analysis of the customer lifecycle. The tools and technologies of data warehousing, data mining, and other customer relationship management (CRM)

Techniques afford new opportunities for businesses to act on the concepts of relationship marketing. The old model of “design build-sell” (a product-oriented view) is being replaced by “sell-build redesign” (a customer-oriented view). The traditional process of mass marketing is being challenged by the new approach of one-to-one marketing.

In the traditional process, the marketing goal is to reach more customers and expand the customer base. But given the high cost of acquiring new customers, it makes better sense to conduct business with current customers.

In so doing, the marketing focus shifts away from the breadth of customer base to the depth of each customer’s needs. Consumers make choices about where to shop based on their preferences for a shopping environment and experience as well as the selection of products at a particular store and distance to travel. They select a store that gives them the best combination of prices, convenience, variety and service, and time and distance to travel to the store, subject to their time and money constraints. The performance metric changes from market share to so called “wallet share”.

Businesses do not just deal with customers in order to make transactions; they turn the opportunity to sell products into a service experience and endeavor to establish a Long-term relationship with each customer. The advent of the Internet has undoubtedly contributed to the shift of marketing focus.

II. CUSTOMER RELATIONSHIP MANAGEMENT

Customer relationship management (CMR) is a customer centered business strategy. Firms abidingly accumulate, analyze and exploit customer comprehensive information to allocate resources rationally according to customer oriented WORKING mode, and meet customer demand through meaningful communication, understanding and influence customer behavior. Thereby increasing customer satisfaction and loyalty, and to obtain the maximum profit.

The general CRM covers customer resource management, marketing management, sales management, customer care and service management, and many other aspects. Its ultimate goal is to provide the basis for business management and decision-making through proactive market research and analysis and processing of customer feedback. Simple from the content of customer relationship management, CRM is customer propaganda, tracking, revisit and classification. Of course, with the development of modern information technology, the pursuit of personalized service has become the new target in the field of after- sales service.

According to **Microsoft**, CRM is “a customer-focused business strategy designed to optimize revenue, profitability, and customer loyalty. By implementing a CRM strategy, an organization can improve the business processes and technology solutions around selling, marketing, and servicing functions across all customer touch-points (for example: Web, e-mail, phone, fax, in-person)”. The overall objective of CRM applications is to attract, retain and manage a firm’s profitable (“right”) customers. Electronic support for such activities is provided by the firm’s business intelligence system (Anonymous 2001).

Analytical

The role of analytical CRM systems is to analyse customer data collected through multiple sources and present it so that business managers can make more informed decisions. Analytical CRM systems use techniques such as data mining, correlation, and pattern recognition to analyze the customer data.

These analytics help improve customer service by finding small problems which can be solved, perhaps by marketing to different parts of a consumer audience differently.

For example, through the analysis of a customer base's buying behaviour, a company might see that this customer base has not been buying a lot of products recently.

After scanning through this data, the company might think to market to this subset of consumers differently, to best communicate how this company's products might benefit this group specifically.

Data Mining

Data Mining is described as "the process of extracting knowledge data discovery of valid, authentic, and actionable information from large databases. These patterns and trends can be collected together and defined as a mining model, which can be applied to specific scenarios of the business. Data mining typically involves the use of predictive modelling, forecasting and descriptive modelling techniques as its key element. Using these techniques, an organization can able to manage customer retention(maintain), used to select the right prospects on whom to select, profile and segment customers (by identifying good customers), set optimal pricing policies, and objectively measure and rank which suppliers are best suited for their needs.

III. BASICS STEPS IN MINING MODEL

Building a mining model is part of the process which includes everything from the beginning of the task like asking questions about the data, creating a model to answer the questions and finally to deploy the model into a workable environment.

This process can be explained by the following six basic steps:

- Define the Problem
- Prepare the Data
- Explore the Data
- Build mining Models
- Explore and Validate the Models
- Deploy and Update the Models

Data mining can be uses to answer queries like:

- What product does the customer purchase? What are all the products that are sold together?
- How to predict risk customers those are ready to leave the product?
- Where is the marketplace of the organization (current position) and where is it going?
- How business can analyze its patterns?

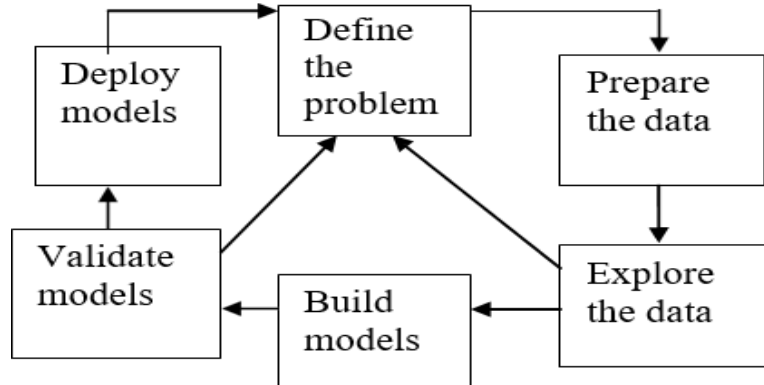


Fig1: Mining model

Link between Data Mining and CRM

Data mining and customer relationship management are the two common functions used by the organization to focus the customers. Data mining is a quantitative process by which organization collect specific information about their customers. CRM allows an organization to alter business operations based on the information obtained through data mining.

For example, a company can change sales prices or other product attributes to meet consumer demand. The bridge between common functionalities used by the organization requires creation of reports based on information gathered from data mining.

Using CRM, it is easier to select the right customers from a large set of potential customers. Data mining can help the organizations to offer the most appealing products to the existing customers or identify customers by which the organization is at risk of losing. So the result is improved revenue because of a greatly improved ability to respond to each individual contact and reduced costs due to properly allocating resources.

Techniques for Data Mining in CRM

When you search for information that doesn't match expected behavior or a projected pattern, that is anomaly detection. Anomalies can provide actionable information because they deviate from the average in the data set.

Association Rule Learning

Association rule learning is a rule-based machine learning method for discovering interesting relations between variables in large databases. It is intended to identify strong rules discovered in databases using some measures of interestingness.

Based on the concept of strong rules, Rakesh Agrawal, Tomasz Imieliński and Arun Swami introduced association rules for discovering regularities between products in large-scale transaction data recorded by point-of-sale (POS) systems in supermarkets. For example, **the rule**

$\{\text{onions,potatoes}\} \rightarrow \{\text{burger}\}$ found in the sales data of a supermarket would indicate that if a customer buys onions and potatoes together, they are likely to also buy hamburger meat.

Such information can be used as the basis for decisions about marketing activities such as, e.g., promotional pricing or product placements.

In addition to the above example from market basket analysis association rules are employed today in many application areas including Web usage mining, intrusion detection, continuous production, and bioinformatics. In contrast with sequence mining, association rule learning typically does not consider the order of items either within a transaction or across transactions.

Association Rule Learning (Process)

Association rules are usually required to satisfy a user-specified minimum support and a user-specified minimum confidence at the same time. Association rule generation is usually split up into two separate steps:

- A minimum support threshold is applied to find all frequent itemsets in a database.
- A minimum confidence constraint is applied to these frequent itemsets in order to form rules. While the second step is straightforward, the first step needs more attention.

Clustering

Identify similar data sets and understand both the similarities and the differences within the data. Data sets that have similar traits can be used for conversion rate increases. For example, if the buying behavior of one group of customers is similar to that of another group, they can both be targeted with similar services or products. There are many uses of Data clustering analysis such as image processing, data analysis, pattern recognition, market research and many more. Using Data clustering, companies can discover new groups in the database of customers. Classification of data can also be done based on patterns of purchasing.

Based on geographic location, value and house type, a group of houses are defined in the city. Clustering in data mining helps in the discovery of information by classifying the files on the internet. It is also used in detection applications. Fraud in a credit card can be easily detected using clustering in data mining which analyzes the pattern of deception

IV. REQUIREMENTS OF CLUSTERING IN DATA MINING

Interpretability

The result of clustering should be usable, understandable and interpretable.

Helps in dealing with messed up data

Usually, the data is messed up and unstructured. It cannot be analyzed quickly, and that is why the clustering of information is so significant in data mining. Grouping can give some structure to the data by organizing it into groups of similar data objects. It becomes more comfortable for the data expert in processing the data and also discover new things.

High Dimensional

Data clustering is also able to handle the data of high dimension along with the data of small size.

Attribute shape clusters are discovered

Arbitrary shape clusters are detected by using the algorithm of clustering. Small size cluster with spherical shape can also be found.

Algorithm Usability with multiple data kind

Many different kinds of data can be used with algorithms of clustering. The data can be like binary data, categorical and interval-based data.

Classification

This technique is used for gathering information about data so that the data sets can be placed into proper categories. One example is the classification of email as either regular, acceptable email or as spam. Classification is a data mining function that assigns items in a collection to target categories or classes. The goal of classification is to accurately predict the target class for each case in the data.

For example, a classification model could be used to identify loan applicants as low, medium, or high credit risks.

Regression

Regression analysis is one of the advanced data mining techniques in CRM. The objective is to find the dependency between different data items and map out which variables are affected by other variables. This technique is used to determine customer satisfaction levels and their impact on customer loyalty.

Regression is a data mining technique used to predict a range of numeric values (also called continuous values), given a particular dataset. For example, regression might be used to predict the cost of a product or service, given other variables.

Role of Data Mining in CRM

Although it is still a relatively new technology, businesses from all industry verticals be it healthcare, manufacturing, financial, transportation etc. have invested in it to take advantage of historical data.

Data mining techniques in CRM can assist your business in finding and selecting the relevant information that may then be used to get a holistic view of the customer life-cycle which comprises of four stages: customer identification, customer attraction, customer retention and customer development. The more data there is in the database, the better the models will be created whose use will result in more business value. Data mining typically involves the use of predictive modeling, forecasting and descriptive modelling techniques as its key elements. Using these techniques, an organization is able to manage customer retention, select the right prospects & customer segments, set optimal pricing policies, and objectively measure and rank which suppliers are best suited for their needs.

Bottom Line

Data mining together with the rise of Artificial intelligence will shape the future of CRM and aid companies in their quest to become more customer-oriented. The combination of CRM and DM tools will augment the knowledge and understanding of customers, products, and transactional data, thereby improving strategic decision-making and tactical marketing activity. The outcome? Increased revenue as a result of improved ability to respond to each contact and reduced costs due to the optimal allocation of resources.

e-CRM

The **e-CRM or electronic customer relationship management** coined by Oscar Gomes encompasses all standard CRM functions with the use of the net environment i.e., intranet, extranet and internet. Electronic CRM concerns all forms of managing relationships with customers through the use of information technology (IT).

With the increasing power of the Internet and many organizations making their virtual presence felt, CRM has a new direction to focus on. E-commerce solutions are being deployed at a pace like never before and with them is increasing the data about e-customers. Web Data Mining, has gained popularity with many Internet companies to better target their marketing efforts and build loyal customer bases.

ECRM is being adopted by companies because it increases customer loyalty and customer retention by improving customer satisfaction, one of the objectives of eCRM.

E-loyalty results in long-term profits for online retailers because they incur less costs of recruiting new customers, plus they have an increase in customer retention.

Strategy Components

When enterprises integrate their customer information, there are three eCRM strategy components:

Operational: Because of sharing information, the processes in business should make customer's need as first and seamlessly implement. This avoids multiple times to bother customers and redundant process.

Analytical: Analysis helps company maintain a long-term relationship with customers.

Collaborative: Due to improved communication technology, different departments in company implement (intra organizational) or work with business partners (inter organizational) more efficiently by sharing information

V. CONCLUSION

The CRM system using data mining technology has become the key for firms to winning in the increasingly competitive knowledge economy and e-commerce economy mode. Data mining as the premise and foundation of CRM is no longer just confined to customer contact level customer relationship management. On the contrary, it has been deep into customer behavior and customer preferences, and can anticipate their needs and meet their expectations. Thus, firms can insight into customer, understand customer value from a more in-depth and comprehensive perspective.

Effective use of data mining in CRM, can continually promote a single customer value enhancement and expansion of the customer base, guide high-level decision makers to work out best marketing strategy, reduce operating costs, increase profits, strengthen customer relationships, improve customer satisfaction, improve commodity

promotions, enhance information exchange of goods, improve customer loyalty, accelerate the development of firms, and enable firms to gain long-term benefits.

Summary

The article defined the concepts of data mining and CRM, explained the current models of CRM. The new model of data mining for CRM proposed in this article, is an integration of the existing models of data mining and CRM, with a reference to the various techniques that could be adopted as well as the various applications of the results of the analysis

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