

Investigating customer relationship management and evaluating the impact of data mining in CRM

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Abstract

Customer relationship management is all the strategies, processes and technologies that create, maintain, develop and optimize long-term and valuable relationships between the customer and the company and cause customer retention. Customer relationship management is not a new term and in the past it was very famous among businesses as people management. But the methods of implementing customer relationship management in today's environment are different. A customer relationship management system can be simple or complex depending on the nature of your business. Data warehouse tools and technologies, data mining and other customer relationship management techniques are methods that have provided new opportunities for business. In fact, the product-oriented view has given its place to the customer-oriented one. Therefore, by collecting customer data and making decisions based on the patterns extracted from the hidden relationships between the data by means of data mining tools, it is possible to fulfill the customer's desire. CRM deals with new ways of interacting with customers that promises a higher return on investment for businesses by improving customer-oriented processes such as sales, marketing and customer service. Data mining techniques for automating the discovery of related patterns in databases help hotels to establish personal and profitable relationships with customers by identifying and predicting customer needs throughout the customer life cycle.

Keywords: Customer relationship management, data mining, customer life cycle, CRM.

1. Introduction

The economic environment has changed significantly in recent years, and the way hotels interact with their customers has also changed, because in real conditions, the stability of a customer is not guaranteed for a long time. As a result, a hotel should understand customers better and should quickly respond to their wishes and needs. In addition, in order to achieve success, the hotel must anticipate and predict what a customer wants (K.Tearling). Data mining helps businesses sift through seemingly unrelated layers of data to discover meaningful connections. Data mining uses statistical techniques and machine learning to build models that predict customer behavior. For best results, the exploration process should be integrated with commercial data warehouses and provide models in a relevant way for business users. Showing these connections will require improvements in our theoretical understanding of the principles underlying data mining algorithms; such as an integrated approach for security and confidentiality in all phases of data management and analysis. Today, they use data mining tools to extract important and vital information that helps them in strategic decisions of hotels. Data mining is the process of selecting, discovering and modeling large amounts of data to discover unknown patterns. Data mining is used in the hotel industry to optimize prices, optimize services, attract new customers and retain current customers. This research aims to express the concept of data mining and customer relationship management, examine how data mining is used in customer relationship management for hotels and finally provide suggestions for the application of these two concepts in the hotel industry.

2. Customer Relationship Management (CRM)

All different definitions of customer relationship management have been presented, including one-to-one marketing or marketing throughout the customer's life. Perhaps the following definition provided by Moez Limaim is the best definition: "CRM refers to all the processes and technologies that the organization uses to identify, select, encourage, expand, retain and serve customers". Customer relationship management is actually a process for collecting and integrating information in order to use it effectively and purposefully. This information can be related to customers, sales, effective marketing, sensitivity or market needs. CRM is part of an organization's strategy to identify customers, keep them satisfied and turn them into permanent customers. The goal of CRM is to maximize relationships with customers throughout their lifetime. This requires focusing all aspects of the business, from marketing, sales, operations and service to establish and maintain beneficial two-way communication with the customer. It is very important to note that CRM is a business strategy of the organization and not a product or service that can be provided by an organization; In other words, CRM itself is not an information technology, but uses information technology to achieve its goals. Increasing communication with customers can increase profitability in three ways: by attracting more suitable customers; by creating benefits through Up-Selling (technique of persuading a customer to buy more products) and Cross-Selling activities; And finally by extending profitability through customer retention.

2.1. History of CRM

Perhaps the history of the emergence of topics related to CRM can be summarized in the following three periods:

- Industrial revolution period (manual production to mass production): Ford's initiatives in using mass production method instead of manual production method is one of the most important indicators of this period. Although the change in the production method caused the range of customers' choices in terms of product characteristics to decrease (compared to handicraft products), the products produced in the new method had a lower cost price; In other words, in choosing the mass production method by Ford, increasing efficiency and economic efficiency were the most important goals.
- Quality revolution period (mass production to continuous improvement): This period started simultaneously with the initiative of Japanese companies to continuously improve processes;

This, in turn, led to the production of lower-cost and higher-quality products. With the introduction of new methods of quality management such as TQM, this period reached its peak, but with the increase in the number of companies in the competitive arena and the expansion of the culture of maintaining and improving product quality (through various quality tools), this advantage is no longer. Competition did not work for the leading companies and the need to find new ways to maintain the competitive advantage was felt.

- Customer revolution period (continuous improvement to mass ordering): In this period, due to the increase in customer expectations, manufacturers were required to produce their products with low cost, high quality and wide variety; In other words, producers had to turn their attention from mere production to finding ways to satisfy and retain their former customers.

2.2. Main and standard CRM engines

CRM systems have 5 main and standard engines as follows:

1. Concentration of customer information in one point: because in the current situation, in most organizations that keep customer information precisely, this information is collected in approximately 20 points, which have problems in using them and developing the market. A lot and sometimes it is impossible.
2. Analyzing and segmenting customer information: In case of diversity of goods and services of an organization, this engine performs customer segmentation and special analysis for the current situation and development of target markets based on the information of each segment.
3. Customization of customer needs: Due to the possibility of special communication with customers, this engine will be able to collect customer needs in a specific way and provide them to the organization so that the organization can design and provide their specific needs.
4. The possibility of contacting each customer through his favorite means: some customers use the fax system, some use e-mail, and some use letters and the like. This engine, while establishing active and fast communication with all customers, contacts each one through his chosen device.
5. Transfer of information and exchanges between the customer and the organization: All communications and exchanges between the customer and the organization are managed through this engine. This information includes ordering goods and services, financial information and payments, information on making and completing customer orders, sending goods or services to customers, sending invoices, sending information on goods and after-sales services, customer training and support, information Delivering to customers is based on the interest and needs of each one, and the rest.

2.3. Types of CRM technologies

The technologies used in CRM can be divided into the following three general categories:

- Operational CRM
- Analytical CRM
- Collaborative CRM

2.3.1 Operational CRM

It is responsible for automating basic business processes, such as sales, marketing, etc. In this method, all stages of communication with the customer, from marketing and sales to after-sales service and receiving feedback from the customer, are entrusted to one person; Of course, in such a way that salesmen and service engineers can have the history of each customer available without referring to this person. This category of software emphasizes processes such as customer contact points, communication routes and integration of the organization's headquarters. In addition, creating a model for using information from existing systems in the organization should also be included in this category of CRMs. Another necessary component is the enterprise application integration system, which works in the field of integration and coordination of front-office and back-office processes of the organization.

Operational CRM itself is divided into three parts:

1. Sales Force Automation (SFA): Sales force automation automates some of the company's sales and sales management processes and is in charge of all operations related to contact management, exchange and sales department management. This department collects and tracks information related to purchasing habits, tastes and demographics of customers and the efficiency of sales staff.
2. Customer support and service (CSS): This department is responsible for automating some services, such as requesting information, complaints, returned products, etc. Face-to-face, Internet, fax and special kiosks are used to answer customers.
3. Automation of the company's marketing affairs (EMA): The marketing department provides information about competitors, market trends and macro environmental variables. Integrated CRM softwares that have all the above three functions are often called virtual office solutions, because these softwares interact directly with customers.

2.3.2. Analytical CRM

The most important type is a CRM software that is responsible for obtaining, storing, processing, interpreting and presenting reports to users of customer data. In analytical CRM, tools and methods are used that analyze the information obtained from operational CRM and prepare its results for business performance management. In fact, operational and analytical CRM are in a two-way interaction; That is, the data of the operational department is provided to the analysis department; After analyzing the data, the results will have a direct impact on the operation department. By examining the information available in information warehouses, this model provides the possibility of categorizing customers in order to optimize the organization's behavior, improve marketing activities and retain customers. One of the most important goals of Analytical CRM is to discover various marketing and sales ways to attract customers. For example, by observing all the customers, whenever the amount of purchases of some of them exceeds a certain limit, it informs us to do something special for those customers. This reaction can be automatic (for example, automatically sending an email to the customer, containing news about a special discount for him) or non-automatic (for example, a phone call from one of the support personnel to the customer and inviting him to participate in a special ceremony). Customer data analysis approaches include Data Mining, OLAP and Click Stream Analysis.

2.3.3. Collaborative CRM

Collaborative CRM is considered as the final border of the process of creating a relationship between the customer and the organization, in such a way that it is placed on one side of the customer and on the other side of the organization. Its purpose is to expand traditional customer relationship management programs to manage relationships with all external stakeholders and throughout the supply chain (even suppliers, distributors and retailers). In this type of CRM, the customer uses the easiest possible method to communicate with the organization, such as telephone, mobile phone, fax, internet and other methods; Participatory CRM due to the possibility of choosing the method by the customer and the fact that most of the processes (from data collection to processing and referring the customer) are done in the shortest possible time to the relevant official, causes the customer to return and continue the relationship with the company It can be.

2.4. Effectiveness of a CRM System

In order for a CRM system to be practically effective, the organization must have decided in advance which of the customer's information it is looking for and what it is looking for from the collection of this information. For example, many financial institutions carefully monitor the living conditions of their customers so that they can provide them with appropriate banking services such as mortgage or rent at appropriate times to meet their needs in the best way. In the next step, the organization should pay attention to the various sources through which customer information enters the organization and determine where and how this data is currently stored and how it is used. For example, an organization may interact with its customers in many ways, such as correspondence, website, physical warehouses, call centers, mobile sales and

marketing teams, and advertising. Very reliable CRM systems are able to connect these points; Exchange collected information between operational systems (such as sales and warehouse) and information analysis systems, and extract and sort the formats in them. Then, through this information, the analysts of the organization will be able to get a comprehensive picture of each customer and the areas that need better services. For example, if a person uses a bank's mortgage, business loan, retirement savings account, and checking account, it is cost-effective for the bank to treat the person best upon contact.

3. Types of customers

By customer, we mean all natural and legal persons who are included in the target market of the organization and can potentially become customers of the organization, intend to become customers, or are currently customers. Customers can be classified in two ways:

1. Geographical method: which examines and identifies customers using the Pareto analysis method (taking into account that 20% of customers provide 80% of the company's revenues).
2. Psychological method: identification of customer's thinking and behavior and mutual effects of customers are considered. In this attitude, four types of customers are identified: loyal customers, fairly loyal customers, unfaithful customers, loyal competitor customers.

3.1. Customer life cycle

The term "customer life cycle" refers to the stages in the relationship between the customer and the business, and awareness of it leads to greater profitability. There are generally four stages in the customer life cycle:

- Potential customers: people who are not yet customers but are in the target market;
- Customers who react: potential or possible customers who show interest and reaction to a product or service.
- Actual customers: people who are currently using a product or service.
- Former customers: such people are not suitable customers; Because they have not been in the sales target for a long time or they have taken their purchases to competing products.

3.2. Importance of customer retention

The cost of keeping the customer satisfied and encouraging him to use the hotel again is much less than the costs and problems we face in attracting a new customer. In addition, the satisfaction of each customer can cause free advertising of the hotel by him and as a result attract new customers. This is why, along with their policies to attract new customers, hotels also pay special attention to maintaining and maintaining their current and old customers. Developing customer relationship management strategies is one of the methods that hotels use to provide better services to customers and also to obtain analytical statistics from their customers. "The main goal of a CRM system is to help the hotel provide better services to customers by using reliable processes and interaction procedures with customers".

4. Data mining

Data mining is defined as the process of extracting useful and previously unknown information from data, and in many cases it is accepted that it is a phase in the complex process of knowledge discovery in databases (KDD). This process includes a sequence of the following steps: data cleaning, data integration, data selection, data transformation, data mining, pattern evaluation, and knowledge presentation. This is combined with the efforts of humans who design the databases, describe the problems and objectives, and the accountants who process the data to find patterns that fit these objectives they do. Data mining is located at the common boundary of several disciplines, which include: database systems, artificial intelligence, statistics, machine learning, patternology or intellectual visualization of data. The main goal is to build a model for a situation where the answer or output is known and then apply that model to another situation where the answer or output is desired. In this case, the data mining tool takes the data and creates a picture of reality in the form of a model, which describes the relationships in the data. These models predict future behaviors based on past analysis. Using data mining as a lever to prepare

data and complete data warehouse capabilities creates the best position to gain competitive advantages.

4.1. Classification of data mining activities

In terms of process, data mining activities are divided into three general classifications:

1. Discovery: The process of searching a database to find hidden patterns, without having a pre-determined hypothesis about what the pattern might be. Similar to the analyzes that are done in terms of the purchased goods, such basket analyzes indicate the items that customers are willing to buy. This information can lead to the improvement of inventory, design strategy, store layout and advertising.
2. Prediction model: a process that takes the discovered patterns from the data bank and uses them to predict the future. such as forecasting sales in retail; Discovered patterns for sales help them make decisions regarding inventory.
3. Forensic analysis: It is related to the process of using extracted patterns to find unreasonable and contradictory data factors. such as identifying and detecting fraud in financial institutions; Fraud is very costly and harmful, and banks can get patterns to detect and detect fraud by analyzing past fake transactions.

4.2. The necessity of data mining in customer relationship management

Customer relationship management is defined by four elements of a simple framework: knowledge, purpose, sales and service. Customer relationship management will lead to improvement by considering what products or services to offer to which customers, at what time and through what channel. This management consists of different components. Before the process can begin, the company must have the customer's information. This information can be obtained from the internal data of customers or from data purchased from external sources. For internal data, there are different sources; Such as questionnaires, blogs, credit card records and external data sources or purchased data banks such as addresses, phone numbers, profiles of visiting websites, is the key to gaining more knowledge from the customer. Most of the hotels have huge data banks including marketing data, human resources and finance. Therefore, investment in the field of data warehouse is one of the vital components in customer relationship management strategy. After preparing and allocating data resources, the customer relationship management system must analyze the data by using tools such as data mining. Whether the hotel uses traditional statistical techniques or one of the software tools such as data mining, it needs experts to understand customer data and business relationships. Therefore, it is important to have experts who can extract these data with relevant tools and turn them into information. Data mining helps hotels to establish personal and profitable relationships with customers by identifying and predicting customer needs throughout the customer's life cycle.

Data mining can help to reduce the information that is stored multiple times and improve decision making. This is achieved through deriving and refining useful knowledge through a search process to discover connections and patterns from vast data collected by organizations. Extracted information for prediction, classification. and data modeling and summarization are used. Data mining technologies such as law induction, neural networks, genetic algorithms, fuzzy logic and anomalous sets are used for classification and patternology in many industries. Data mining builds customer behavior models based on statistical techniques and machine learning. Therefore, data mining applications can help companies to identify segments of the market that include customers with Potential profits are high, identify. Marketers can then design and implement a series of operations that will increase the purchasing decisions of a targeted segment. To facilitate this activity, marketers enter data mining outputs into supply chain management software that focuses on specific market segments. In relation to the three ways of increasing profitability discussed in the second part, data mining techniques can be used in this way; Data mining can help companies to understand which customers are more likely to buy specified products and services; Therefore, it enables businesses to develop targeted marketing programs for higher rates and better ROI. Businesses can increase their value proposition by

offering additional products and services that are exactly what customers want. Data mining techniques can identify which customers are more likely to leave the company and why; Companies can use this information to create ideas that allow them to retain these customers. In addition, there are other ways in data mining that support CRM initiatives. Data mining helps marketers to develop a database and a chain of operations that are closer to the needs, desires and tendencies of their customers. If the necessary information is located in a database, data mining can model a wide range of customer activities. The key objective is to identify patterns that are relevant to current business issues. Different data mining techniques may be related to CRM tasks. Table (1) presents some of these dependencies. What is presented above proves the fact that there are some data-mining techniques that apply them to the data related to the customers of a company, can lead to improvement in various aspects in The field of customer relations.

Table 1- Possible dependence between data mining techniques and CRM operations

Data mining technique	CRM operations
Dependency rules	Customer purchase history information is used to formulate possible rules for future reservations.
Decision trees	It is automatically created from the data that obtains a sequence of rules in a step-by-step manner; To identify important predictive variables, non-linear relationships and interactions between variables are good and appropriate.
Genetic algorithms	It uses the procedure modeled on evolutionary biology to solve prediction and classification problems or to develop a set of decision rules.
Neural networks	Applications that mimic human brain processes; They are able to learn from samples (large training data sets) to discover patterns in the data.
Query tools	Provides summary measures such as counts, sums, and averages.
Regression type models	The most common ones are: least squares regression, logical (computational) regression, discriminant analysis; They are often used to verify models made by machine learning techniques.
Visualization tools	Histogram charts, box charts, scatter charts, which are useful for compactly condensing large amounts of data, comprehensible images.

According to a survey conducted by KDNuggets on 138 hotels in 2007, CRM data mining has taken the first place among data mining applications in the industry. The results of this investigation are presented in Figure (1).

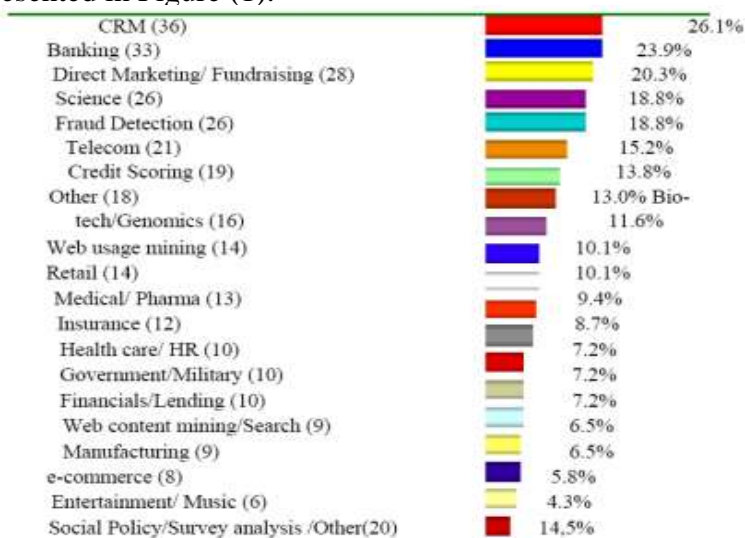


Figure 1- The results of the study of the use of data mining in hotel management

4.3 Data mining process in customer relationship management

Data mining is one of the elements of customer relationship management and can help hotels move towards customer-centricity. The process of data mining in customer relationship management is as follows. (Figure 2)

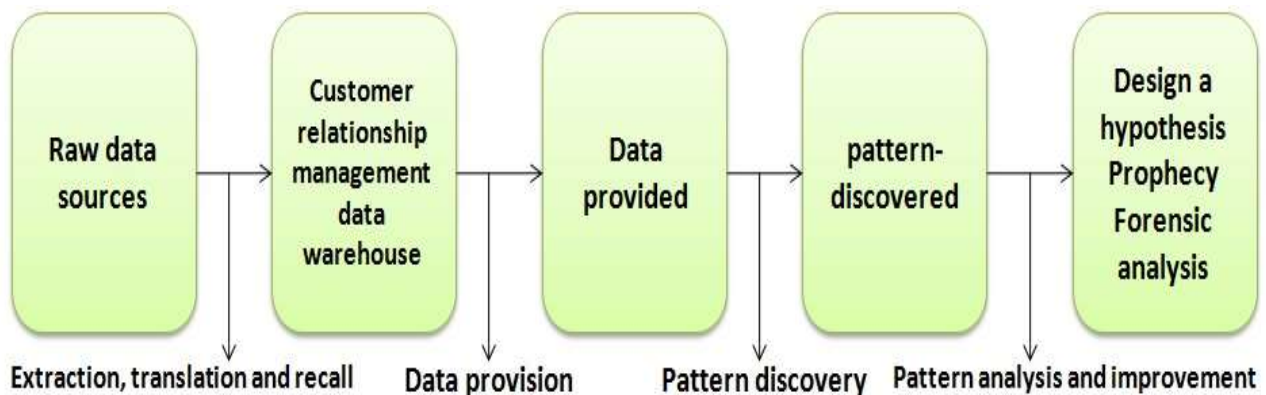


Figure 2- Data mining process in customer relationship management

Raw data is collected from various sources and entered into customer relationship management data warehouse through extraction, translation and calling processes. In the data preparation section, the data is taken out of the warehouse and converted into a suitable format for data mining. The pattern discovery section includes four layers:

1. Commercial questions; such as customer description;
2. Applications; such as scoring, prediction;
3. Methods; such as time series, classification;
4. Algorithms.

In this section, data mining methods with their own application to answer the commercial questions that come to mind, extract algorithms and these algorithms are used to create patterns. In the pattern analysis section, the patterns become a useful and usable knowledge, and after their improvement, the patterns that are considered efficient will be used in an executive system.

5. Gap Analysis

The major challenges of KDD in CRM arise from the objectives of extracting all information and coordinating analysis and activities. These goals require methods related to several specific challenges that we discuss in turn:

- Cold Start: In CRM, one thing tries to influence the customer's behavior based on previous knowledge. Often, such valid prior knowledge does not exist.
- Correct understanding versus false understanding of the customer: Understanding the customer is the core of CRM. This work is the basis for maximizing customer lifetime value, which in turn includes segmentation and customer activities to maximize customer conversion, retention, loyalty and greater profitability. Misunderstanding of the customer can lead to risky activities. Similarly, decentralized activities, such as unlimited efforts to acquire or retain all customers, can lead to a decrease in customer lifetime value (law of diminishing returns).
- Data authority: There is no such thing as a CRM data warehouse, we are dealing with multiple data sources. If and when the issues of semantic disagreement are resolved, we will still face legislative and political obstacles. We need solutions that allow the data owner to specify what data they want to receive, at what level of abstraction and with what granularity.
- Data quality: some company-customer interactive channels deliver very good data. Others deliver very poor quality data. The web server provides data belonging to the second category. The issue of data authority prevents the accumulation of raw data. Despite these cases, the data should increase confidence that the results of the analysis are reliable.

- Deeper understanding: documentation is based on some incomplete behavioral data and some priorities are carefully extracted from questionnaires or learned from data using data mining methods. they become
- Questioning prior knowledge: Everything related to prior knowledge is assumed to be true. We need mechanisms to capture and align previous knowledge in the face of conflicting information.
- Executable: pattern discovery should lead to activities. In some cases, this is simple and understandable, such as location customization and personalization; But this step is often omitted. We need mechanisms that incorporate patterns into operational processes in an integrated way. We also need an understanding of executive processes and their effect on which patterns are most valuable.

6. Challenges and opportunities of data mining in CRM

In this section, based on our discussion about CRM and life sciences, we used data mining to identify key challenges and opportunities in these application areas. Below is a list of challenges for CRM:

- Non-obvious results almost always require a combination of data-mining techniques. In the chain or combination of data mining and more general data analysis, operations are important. In order to analyze CRM data, it is necessary to extract data from different angles and look at its different aspects. This requires the use of different types of data mining techniques and their application to different pieces of data in an interactive and iterative way. Therefore, it is necessary to use different data mining operators and combine them into a single exploratory plan.
- There is a very important need for data integration before data mining. In both cases, data comes from multiple sources. For example, in CRM, the required data may come from different departments of an organization. Because many useful patterns are spread across multiple data sources, there is a need to integrate these data before a true data mining exploration can begin.
- We will often encounter different types of data, which requires integrated exploration of diverse and heterogeneous data. In CRM, even when there is no critical issue, it is still important. Customer data comes in the form of records created in different types of data (such as statistical data), temporary data (such as blogs), text (such as emails, customer visits) , blogs and chat room data), occasionally audio data (such as phone conversations saved for service requested by customers).
- The large and unavoidable confusion of data must be handled. In CRM, blog data is very messy. Other customer data "contact points" in any business-related data have common cleaning issues.
- Privacy and confidentiality considerations for data and analysis results are an important issue. In CRM, a large amount of statistical data is strictly confidential; Like email and phone number. Concerns about inference capabilities make other forms of data sensitive, for example anyone can retrieve personally identifiable information (PII) from blogs.
- Legal considerations affect what data is available for exploration and what activities are permitted. In some countries, it is not allowed to combine data from different sources or to use them for a purpose other than the purposes for which they were collected. Ownership of data can be opaque, depending on how and why it was collected and whether the collecting organization handled it.
- Acknowledging the results in the real world is necessary for acceptance. In CRM, as in many data-mining applications, the discovered patterns are often treated as hypotheses that need to be tested on new data using rigorous statistical tests to accept the results as true. This becomes more important for recommending activities, especially in high-risk applications such as financial and medical fields. For example: ordering investments for customers.
- Developing deeper models of customer behavior: One of the key things in CRM is how to understand customers. The current models of customers are mainly based on their purchase patterns and click patterns on websites. Such models are very superficial and shallow and do not

provide a deep understanding of customers and their individual situations. Therefore, many predictions and activities about customers are incorrect. It is suggested that information from all customer contact points be considered in building customer models. Marketing and psychology researchers should also be involved in this effort. Here, two special things need to be considered. First, at what level should the customer model be built? For example, at the cumulative level, the level of a department, or at the individual level? The deciding factor is how the CRM effort needs to be personalized. The second case is the dimensions that are considered in the customer's file. These dimensions include aspects of statistics, psychology, macro-behavior (buying, etc.), micro-behavior (minor activities in a store such as individual clicks in an online store).

- Obtaining data for deeper understanding in a non-curious, low-cost and accurate way: In many industrial complexes, data collection for CRM is still an issue. Some methods are curious and expensive. The collected data sets are very chaotic and are in different forms and are located in different departments of an organization. It is necessary to solve these prerequisite and necessary problems for data-mining applications.

- Problem management (slow start/self-starter): At the beginning of the customer's life cycle, little is known, but the list of customers and the amount of information known about each customer increases over time. In most cases, a minimum amount of information is required to achieve acceptable results (for example, product recommendations calculated through collaborative filtering require a customer purchase history).

- Evaluation framework for distinguishing between true and false understanding of the customer: apart from the difficulty of building customer models, evaluating them is also an important task. There is still no satisfactory measurement scale that can tell if one model is better than another and if the model really reflects the customer's behavior. Although there are some scales for measuring the quality of customer models (for example, there are several scales for measuring the quality of proposals), they are completely incomplete and there is a fundamental need to work on better measurements.

7. Conclusion

Customer relationship changes with time and if business and customer know more about each other, this relationship will evolve and grow. Customer life cycle provides a good framework for using data mining in customer relationship management. In the input part of data mining, the customer life cycle tells what information is available and in the output part, the life cycle tells what is likely to be interesting and what decisions should be made. Data mining can predict the profitability of potential customers who can become actual customers, how long they will remain as loyal customers and how likely they will leave us. Some customers regularly change their visits to hotels to gain the advantages that arise during the competition between them. In this case, hotels can focus their goals on customers who are more profitable. The combination and integration of DM and CRM has many benefits for hotels, because it should be known that some customers, significantly, more than Other customers are beneficial. Data mining can help identify and target these customers whose data is buried in huge databases, thereby helping to redefine customer relationships. and strengthen Therefore, through data mining, it is possible to determine the value of customers, predict their future behavior and make informed decisions.

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