

ROLE OF DATA MINING IN CUSTOMER RELATIONSHIP MANAGEMENT: A CONCEPTUAL REVIEW

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Abstract-

In this article we specify the customer relationship management (CRM) and Data mining techniques . we also discuss the different types of data mining processes are applicable for corresponding CRM. Data mining predicts future trends by analysing past behaviour adopted by the people, helps segment your target audience based on demographics, buying behaviour, gender, and other factors. It also uses customer clustering whereby it uses data from users on social media sites to generate ideas for the improvement of brand service, satisfying customers, and increasing loyalty. CRM removes inefficiency by removing customers from the list who shows little to no interest in your product, saving you time and money.

Keywords- Customer Relationship Management; Customer identification; Know Service; Customer Retention

INTRODUCTION

Data mining is the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems. Customer satisfaction ensures profitability for businesses in the long run. Customer bases constructed over a period of time proved to be of immense help in increasing the reach of a particular business's product or service. However, the recent increase in the operating costs of business made it more compelling for businesses to increase loyalty among existing customers while trying to attract new ones. The processes by which an organization creates value for the customer, is often referred to as Customer Relationship Management (CRM) [1].

Business intelligence for CRM applications provides a firm with actionable

information from the analysis and interpretation of vast quantities of customer/market related data. Databases for business intelligence include customer demographics, buying histories, cross-sales, service calls, website navigation experiences and online transactions[1].

The automation of data collection and the relative decrease in the costs of operating huge data warehouses has made customer data more accessible than ever. The analysis of data, which until a few years ago was associated with high-end computing power and algorithms decipherable by only professional statisticians, is increasing to become more popular with user-friendly tools available on desktops .

CRM is specified as helping organizations to better discriminate and more effectively allocate resources to the most profitable group of customers. In operational CRM, customer relationship management in all areas that contain a direct relationship with the customer is established in these dimensions. Sometimes a customer points of contact with both of these places that can be and truth in connection with the organization of the customers in parts of this happens. [6]

In Collaborative CRM, interactive systems based on the customer participation, are seeking to use the infrastructure and proper tools, communication channels more and more suitable to the organization and customers. In fact, this kind of systems are seeking to increase with Jupiter communication channels with the organization and increase the quality of the canals during the period of time period of customer relationship with the organization[7]

OBJECTIVES

- To analyse the role of the data mining in CRM to increase the revenue
- To incorporate the data mining concepts in CRM to get the customers, increase the profit of customers, retaining them.

LITERATURE REVIEW

The predictive capabilities of data mining enable the businesses to make proactive, knowledge-driven decisions. Data mining tools facilitate prospective analysis, which is

an improvement over the analysis of past events provided by the retrospective tools. The emergence of large data warehouses and the availability of data mining software is creating opportunities for businesses to find innovative ways to implement effective customer relationship strategies [1].

we build upon our discussion of CRM to identify key data mining challenges and opportunities in these application domains. The following is a list of challenges for CRM [2].

1) *Non-trivial results almost always need a combination of DM techniques.* In order to analyze CRM data, one needs to explore the data from different angles and look at its different aspects. This should require application of different types of DM techniques and their application to set of data.

2) *There is a strong requirement for data integration before data mining.*

In both cases, data comes from multiple sources. For example in CRM, data needed may come from different departments of an organization. Since many interesting patterns span multiple data sources, there is a need to integrate these data before an actual data mining exploration can start [2].

3) *Diverse data types are often encountered.*

This requires the integrated mining of diverse and heterogeneous data. In CRM, while dealing with this issue is not critical, it is nonetheless important. Customer data comes in the form of structured records of different data types (e.g., demographic data), temporal data (e.g., weblogs), text (e.g., emails, consumer reviews, blogs and chat-room data), (sometimes [2].

4) *Highly and unavoidably noisy data must be dealt with.*

In CRM, weblog data has a lot of -noise (due to crawlers, missed hits because of the caching problem, etc.). Other data pertaining to customer -touch points has the usual cleaning problems seen in any business-related data [2].

5) *Privacy and confidentiality considerations for data and analysis results*

They are a major issue. In CRM, lots of demographic data is highly confidential, as are email and phone logs. Concern about inference capabilities makes other forms of data

sensitive as well—e.g., someone can recover personally identifiable information (PII) from web logs [2].

6) *Legal considerations influence what data is available for mining and what actions are permissible.*

In some countries it is not allowed to combine data from different sources or to use it for purposes different from those for which they have been collected. For instance, it may be allowed to use an external rating about credit worthiness of a customer for credit risk evaluation but not for other purposes. Ownership of data can be unclear, depending on the details of how and why it was collected, and whether the collecting organization changes hands [2].

7) *Real-world validation of results is essential for acceptance.*

In CRM, as in many DM applications, discovered patterns are often treated as hypotheses that need to be tested on new data using rigorous statistical tests for the actual acceptance of the results. This is even more so for taking or recommending actions, especially in such high-risk applications as in the financial and medical domains.

RESEARCH METHODOLOGY

As the nature of research in CRM and data mining are difficult to confine to specific disciplines, the relevant materials are scattered across various journals. Business intelligence and knowledge discovery are the most common academic discipline for data mining research in CRM. Consequently, the following online journal databases were searched to provide a comprehensive bibliography of the academic literature on CRM and Data Mining:

- ABI/INFORM Database;
- Academic Search Premier;
- Business Source Premier;
- Science Direct; and
- IEEE Transaction.

DISCUSSION

CRM refers to the cycle of customer identification, customer attraction, customer retention and customer.

(i) *Customer identification*: This phase involves targeting the population who are most likely to become customers or most profitable to the company. Besides, it involves analyzing customers who are the lost to the competition and how they can be won back. Elements for customer identification include target customer analysis and customer segmentation. Target customer analysis involves seeking the profitable segments of customers through analysis of customers' underlying characteristics, whereas customer segmentation involves the subdivision of an entire customer base into smaller customer groups or segments, consisting of customers who are relatively similar within each specific segment.

(ii) *Customer attraction*: After identifying the segments of potential customers, organizations can direct effort and resources into attracting the target customer segments. An element of customer attraction is direct marketing. Direct marketing is a promotion process which motivates customers to place orders through various channels. For instance, direct mail or coupon distribution are typical examples of direct marketing.

(iii) *Customer retention*: This is the central concern for CRM. Customer satisfaction, that refers to the comparison of customers' expectations with his or her perception of being satisfied, is the essential condition for retaining customers. As such, elements of customer retention include one-to-one marketing, loyalty programs and complaints management. One-to-one marketing refers to personalized marketing campaigns which are supported by analysing, detecting and predicting changes in customer behaviours. Thus, customer profiling, recommender systems or replenishment systems are related to one-to-one marketing. Loyalty programs involve campaigns or supporting activities which aim at maintaining a long term relationship with customers. Specifically, churn analysis, credit scoring, service quality or satisfaction form part of loyalty programs.

(iv) *Customer development*: This involves consistent expansion of transaction intensity, transaction value and individual customer profitability. Elements of customer development include customer lifetime value analysis, up/cross selling and market basket analysis. Customer lifetime value analysis is defined as the prediction of the total net income a company can expect from a customer. Up/Crossselling refers to promotion activities which aim at augmenting the number of associated or closely related services that a customer uses within a firm. Market basket analysis aims at maximizing the customer transaction intensity and value by revealing regularities in the purchase behaviour of customers.

Customer relationship management is used for managing all customer interactions at one software. In practice, this requires using information about your customers and prospects to more effectively interact with your customers in all stages of your relationship with them. We refer to these stages as the customer life cycle.

The customer life cycle has three stages:

1. Obtaining customers
2. Improving the worth of existing customers
3. Retaining good customers

Data mining can improve your profitability in each of these stages when you integrate it with operational CRM systems or implement it as independent applications [3].

B. Obtaining new customers via data mining [3]

The first step in CRM is to identify prospects and convert them to customers. Let's look at how data mining can help manage the costs and improve the effectiveness of a customer acquisition campaign. Big Bank and Credit Card Company (BB&CC) annually conducts 25 direct mail campaigns, each of which offers one million people the opportunity to apply for a credit card. The conversion rate measures the proportion of people who become credit card customers, which is about one percent per campaign for BB&CC. Getting people to fill out an application for the credit card is only the first step. Then, BB&CC must decide if the applicant is a good risk and accept them as a customer or decline the application. Not surprisingly, poor credit risks are more likely to accept the offer than are good credit risks. So while six percent of the people on the mailing list

respond with an application, only about 16 percent of those are suitable credit risks; approximately one percent of the people on the mailing list become customers. BB&CC's six percent response rate means that only 60,000 people out of one million names respond to the solicitation. Unless BB&CC changes the nature of the solicitation – using different mailing lists, reaching customers in different ways, altering the terms of the offer it is not going to receive more than 60,000 responses. And of those 60,000 responses, only 10,000 are good enough risks becoming customers. The challenge BB&CC faces is reaching those 10,000 people most efficiently.

BB&CC spends about \$1.00 per piece, for a total cost of \$1,000,000, to mail the solicitation. Over the next couple of years, the customers gained through this solicitation generate approximately \$1,250,000 in profit for the bank (or about \$125 each), for a net return of \$250,000 from the mailing. Data mining can improve this return. Although data mining won't precisely identify the 10,000 eventual credit card customers, data mining helps focus marketing efforts much more cost effectively.

First, BB&CC sent a test mailing of 50,000 prospects and carefully analyzed the results, building a predictive model showing who would respond (using a decision tree) and a credit scoring model (using a neural net). BB&CC then combined these two models to find the people who were both good credit risks and were most likely to respond to the offer. BB&CC applied the model to the remaining 950,000 people in the mailing list, from which 700,000 people were selected for the mailing. The result? From the 750,000 pieces mailed (including the test mailing), BB&CC received 9,000 acceptable applications for credit cards. In other words, the response rate rose from one percent to 1.2 percent, a 20 percent increase. While the targeted mailing only reaches 9,000 of the 10,000 prospects – no model is perfect – reaching the remaining 1,000 prospects is not profitable. Had they mailed the other 250,000 people on the mailing list, the cost of \$250,000 would have resulted in another \$125,000 of gross profit for a net loss of \$125,000.

The following table summarizes the results.

TABLE I. NET PROFITS FROM MAILING

	OLD	New	Difference
Number of pieces mailed	\$ 1,000,000	\$ 750,000	\$ 250,000
Cost of mailing	\$ 1,000,000	\$ 750,000	\$ 250,000
Number of responses	\$ 10,000	\$ 9,000	\$ 1,000
Gross profit per response	\$ 125	\$ 125	\$ 0
Gross Profit	\$ 1,250,000	\$ 1,125,000	\$ 125,000
Net Profit	\$250,000	\$ 375,000	\$ 125,000
Cost of model	\$ 0	\$40,000	\$40,000
Final Profit	\$250,000	\$ 335,000	\$ 85,000

Notice that the net profit from the mailing increased \$125,000. Even when you include the \$40,000 cost of the data mining software and the computer and employee resources used for this modeling effort, the net profit increased \$85,000. This translates to a return on investment (ROI) for modeling of over 200 percent, which far exceeds BB&CC's ROI requirements for a project.

c. Improving the worth of your existing customers via data mining [3]

Cannons and Carnations (C&C) is a company that specializes in selling antique mortars and cannons as outdoor flower pots. It also offers a line of indoor flower pots made from large caliber antique pistols and a collection of muskets that have been converted to unique holders of long-stemmed flowers. The C&C catalog is sent to about 12 million homes. When a customer calls C&C to place an order, C&C identifies the caller using caller ID when possible; otherwise the C&C representative asks for a phone number or customer number from the catalog mailing label. Next, the representative looks up the customer in the database and then proceeds to take the order.

C&C has an excellent chance of cross-selling, or selling the caller something

additional. But C&C discovered that if the first suggestion fails and the representative suggests a second item, the customer might get irritated and hang up without ordering anything. And, there are some customers who resent any cross-selling attempts. Before implementing data mining, C&C was reluctant to cross-sell. Without a model, the odds of making the right recommendation were one in three. And, because making any recommendation is unacceptable for some customers, C&C wanted to be extremely sure that it never makes a recommendation when it should not. In a trial campaign, C&C had less than a one percent sales rate and received a substantial number of complaints. C&C was reluctant to continue cross-selling for such a small gain.

The situation changed dramatically once C&C used data mining. Now the data mining model operates on the data. Using the customer information in the database and the new order, it tells the customer service representative what to recommend. C&C successfully sold an additional product to two percent of the customers and experienced virtually no complaints. Developing this capability involved a process similar to what was used to solve the credit card customer acquisition problem. As with that situation, two models were needed.

In summary, data mining helped C&C better understand its customers' needs. When the data mining models were incorporated in a typical cross-selling CRM campaign, the models helped C&C increase its profitability by two percent.

D. Retaining good customers via data mining [3]

For almost every company, the cost of acquiring a new customer exceeds the cost of keeping good customers. This was the challenge facing KnowService, an Internet Service Provider (ISP) who experiences the industry-average attrition rate, eight percent per month. Since KnowService has one million customers, this means 80,000 customers leave each month. The cost to replace these customers is \$200 each or \$16,000,000 – plenty of incentive to start an attrition management program. The first thing KnowService needed to do was prepare the data used to predict which customers would leave. KnowService needed to select the variables from its customer database and, perhaps, transform them. The bulk of KnowService's users are dial-in clients (as opposed to clients who are always connected through a T1 or DSL line) so KnowService knows

how long each user was connected to the Web. KnowService also knows the volume of data transferred to and from a user's computer, the number of e-mail accounts a user has, the number of e-mail messages sent and received along with the customer's service and billing history. In addition, KnowService has demographic data that customers provided at sign-up. Next, KnowService needed to identify who were -goodll customers. This is not a data mining question but a business definition (such as profitability or lifetime value) followed by a calculation. KnowService built a model to profile its profitable customers and unprofitable customers. KnowService used this model not only for customer retention but to identify customers who were not yet profitable but might become so in the future. KnowService then built a model to predict which of its profitable customers would leave. As in most data mining problems, determining what data to use and how to combine existing data is much of the challenge in model development. For example, KnowService needed to look at time-series data such as the monthly usage. Rather than using the raw timeseries data, it smoothed the data by taking rolling three-month averages. KnowService also calculated the change in the three-month average and tried that as a predictor. Some of the factors that were good predictors, such as declining usage, were symptoms rather than causes that could be directly addressed. Other predictors, such as the average number of service calls and the change in the average number of service calls, were indicative of customer satisfaction problems worth investigating. Predicting who would churn, however, wasn't enough. Based on the results of the modeling, KnowService identified some potential programs and offers that it believed would entice people to stay. For example, some churners were exceeding even the largest amount of usage available for a fixed fee and were paying substantial incremental usage fees. KnowService offered these users a higher-fee service that included more bundled time. Some users were offered more free disk space to store personal Web pages. KnowService then built models that would predict which would be the most effective offer for a particular user. To summarize, the churn project made use of three models. One model identified likely churners, the next model picked the profitable potential churners worth keeping and the third model matched the potential churners with the most appropriate offer. The net result was a reduction in KnowService's churn rate from eight percent to 7.5 percent, which allowed KnowService to save \$1,000,000 per month in customer acquisition costs. KnowService discovered that

its data mining investment paid off – it improved customer relationships and dramatically increased its profitability.

CONCLUSION

Customer relationship management is essential to compete effectively in today's marketplace. The more effectively you can use information about your customers to meet their needs, the more profitable you will be. Key to the success of customer relationship management is to have a good strategy in the management of customer life cycle. We can conclude that operational CRM needs analytical CRM with predictive data mining models at its core. The route to a successful business requires that you understand your customers and their requirements, and data mining is the important guide.

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