IMPROVING CUSTOMER RELATIONSHIP MANAGEMENT IN HOTEL INDUSTRY BY DATA MINING TECHNIQUES

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1. Introduction

It's a fact that a successful company not only put customers first, but put customers at the center of the organization because the changes in customer behavior determines unpredictable profitability and may be the cause for inefficient marketing planning.

The main goal of CRM is the capability to handle customer interaction across different channels and functions, for building loyal and profitable customer relationships.

Although cost cutting and competitive pricing strategies may attract customers from competitors, in many services industries price advantages are not a sufficient reason for customers moving between suppliers. In these situations successful competitive strategies include developing strong relationships with customers and cross-selling them other services.

Data mining - techniques for exploration and analysis of large quantities of data in order to discover meaningful patterns and rules - helps businesses sift through layers of seemingly unrelated data for meaningful relationships, where they can anticipate, rather than simply react to, customer needs.

2. An overview of CRM

Customer Relationship Management (CRM) is an enterprise customer-centric approach that uses different techniques to understand and influence consumer behavior.

It is a process which has two objectives:

• to impact all aspects to the consumer relationship (improve customer satisfaction, enhance customer loyalty or increase profitability)

• to ensure that employees within an organization are using CRM tools. The need for greater profitability requires an organization to proactively pursue its relationships with customers [5]

In the real world, acquiring, building, and retaining customers are becoming top priorities. For many companies, the quality of their customer relationships provides their competitive edge over other businesses. In addition, the definition of *customer* has been expanded to include immediate consumers, partners and resellers - in other words, everyone who participates, provides information, or requires services from the company.

Companies are beginning to realize that surviving an intensively competitive and global marketplace requires closer relationships with customers.

In turn, enhanced customer relationships can boost profitability in three ways:

• by attracting more suitable customers,

• by generating profits through cross-selling and up-selling activities, and

- by extending profits through customer retention.

Generally CRM may be defined by a framework composed by four elements: know, target, sell and service[6].

It requires the company to know and understand its markets and customers. This involves detailed customer informations in order to select the most profitable customers and identify those no longer worth targeting. CRM also entails development of the offer: which products to sell to which customers and through which channel. In selling, firms use campaign management to increase the effectiveness of the marketing departments. Finally, it seeks to retain its customers through services such as call centers and help desks.

CRM is an association of several components. Before the beginning of the process, the company must have customer information. These informations may proceed from internal sources (summary tables that describe customers, customer surveys or behavioral data contained in transactions systems) or the data can be purchased from outside sources.

A critical component of a successful CRM strategy is an enterprise data warehouse. Then, it must analyze the data using statistical tools, OLAP, and data mining. The last component is campaign execution and tracking.

3. Data mining

Data mining is the exploration and analysis, by automatic or semiautomatic means, of large quantities of data in order to discover meaningful patterns and rules[3]. So, data mining is defined as the process of extracting interesting and previously unknown information from data, and it is widely accepted to be a single phase in a complex process known as Knowledge Discovery in Databases (KDD).

This process consist of a sequence of the following steps [12]:

- after analysing the goals of the end user and receiving all necessary prior knowledge, one selects a *target data* set. This means focusing on a subset of variables or on data samples.

- the target data are *preprocessed and cleaned* in order to remove noise or outliers. One also has to decide how to handle missing data fields.

- useful features have to be found to represent the data, depending on the goal of the discovery task. The *dimensionality is reduced*, i.e. one has to find the effective number of variables under consideration, or invariant representations for the data.

- the primary goals of the knowledge discovery process are predicting the future values of interesting variables or finding human-interpretable patterns in data. According to this goal an appropriate *data mining algorithm* is chosen and applied. There are algorithms for association, classification, clustering, sequence-based analysis, and other tasks.

- the patterns are *interpreted and evaluated*, for example with the aid of visualisation tools.

After each step, one can return to any other step prior to the current step. Thus, the knowledge discovery process may contain many loops between any two steps.

In order to ensure that the extracted information generated by the data mining algorithms is useful, additional activities are required, like incorporating appropriate prior knowledge and proper interpretation of the data mining results.

In general, CRM promises higher returns on investments for businesses by enhancing customer-oriented processes such as sales, marketing, and customer service.

Data mining helps companies build personal and profitable customer relationships by identifying and anticipating the needs of customers throughout the customer lifecycle.

Data mining can help to reduce information overload and improve decision making. This is achieved by deriving and refining useful knowledge through a process of searching for relationships and patterns from the extensive data collected by organizations. The extracted information is used to predict, classify, model, and summarize the data.

Data mining technologies, such as rule induction, neural networks, genetic algorithms, fuzzy logic, and rough sets, are used for classification and pattern recognition in many industries [4][10][11].

By example, a supermarket organizes its merchandise stock based on purchase patterns of shoppers, an airline reservation system uses travel patterns of customers and trends to increase seat utilization., or the web pages alter their organizational structure or visual appearance based on information about the person who is requesting the pages.

Data mining builds models of customer behavior by using statistical and machine-learning techniques. The basic objective is to construct a model for one situation in which the answer or output is known and then apply that model to another situation in which the answer or output is desired. The best applications of the above techniques are integrated with data warehouses and other interactive, flexible business analysis tools.

Hence, data-mining applications can help companies to identify market segments containing customers with high profit potential, by searching for patterns among the different variables that serve as effective predictors of purchasing behaviors.

Marketers can then design and implement campaigns that will enhance the buying decisions of a targeted segment. To facilitate this activity, marketers feed the data-mining outputs into campaign management software that focuses on the defined market segments.

Regarding the three ways of boosting profitability discussed in the above section, the data mining techniques may be used as following:

- *for attracting more suitable customers:* Data mining can help firms understand which customers are most likely to purchase specific products and services, thus enabling businesses to develop targeted marketing programs for higher response rates and better returns on investment.

- *for better cross-selling and up-selling:* Businesses can increase their value proposition by offering additional products and services that are actually desired by customers, thereby raising satisfaction levels and reinforcing purchasing habits.

- *for better retention:* Data-mining techniques can identify which customers are more likely to defect and why. A company can use this information to generate ideas that allow them to maintain these customers.

Moreover, there are additional ways in which data mining supports CRM initiatives.

- *Database marketing:* Data mining helps database marketers develop campaigns that are closer to the targeted needs, desires, and attitudes of their customers. If the necessary information resides 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 problems. For example, data mining can help answer questions such as "Which customers are most likely to acquire a certain tourist's service?" Answering

these types of questions can boost customer retention and campaign response rates, which ultimately increases sales and returns on investment.

Table 1.
Possible association between data mining techniques and CRM operations

Data mining technique	CRM operation
Association rules	Information from customer-purchase histories is used to formulate probabilistic rules for subsequent purchases.
Decision trees	Automatically constructed from data, these yield a sequence of step-wise rules; good for identifying important predictor variables, non-linear relationships, and interactions among variables.
Descriptive statistics	Averages, variation, counts, percentages, crosstabs, simple correlation; used at the beginning of the data-mining process to depict structure and identify potential problems in data.
Genetic algorithms	Use procedures modeled on evolutionary biology to solve prediction and classification problems or develop sets of decision rules.
Neural networks	Applications that mimic the processes of the human brain; capable of learning from examples (large training sets of data) to discover patterns in data.
Query tools	Provide summary measures such as counts, totals, and averages.
Regression-type models	Ordinary least-squares regression, logistic regression, discriminant analysis; used mostly for confirmation of models built by "machine-learning" techniques.
Visualization tools	Histograms, box plots, scatter diagrams; useful for condensing large amounts of data into a concise, comprehensible picture

• *Customer acquisition:* The growth strategy of businesses depends heavily on acquiring new customers, which may require finding people who have been unaware of various products and services, who have just entered specific product categories (for example, new parents and the diaper category), or who have purchased from competitors. Although experienced marketers often can select the right set of demographic criteria, the process increases in difficulty with the volume, pattern complexity, and granularity of customer data. Highlighting the challenges of customer segmentation has resulted in an explosive growth in consumer databases. Data mining offers multiple segmentation solutions that could increase the response rate for a customer acquisition campaign. Marketers need to use creativity and experience to tailor new and interesting offers for customers identified through data-mining operations.

• *Campaign optimization:* Many marketing organizations have a variety of methods to interact with current and prospective customers. The process of optimizing a marketing campaign establishes a mapping between the organization set of offers and a given set of customers that satisfies the characteristics and constraints of a campaign, defines the marketing channels to be used, and specifies the relevant time parameters. Data mining can elevate the effectiveness of campaign optimization processes by modeling the channel- specific responses of customers to marketing offers.

The different data mining techniques may be associated with CRM tasks. Table 1 present some of these associations.

4. Data Mining Application for the Hotel Industry

Information technology was initially viewed by the hotel industry as a back-office function that supports the finance and accounting areas. The industry has advanced far beyond this view during the past decade.

In two sessions sponsored by the International Hotel and Restaurant Association (IH&RA), one in Singapore in 1997 and the second in Nice, France, in 1998, hotel-industry leaders pondered the role of technology. Among the conclusions reached were: "Going forward, technology will be the most competitive weapon for any hospitality company.

If hospitality organizations want to compete successfully, they must do so by using technology to drive value to both the customer and to the firm."[7]

In the hotel industry knowing the guests - where they are from, how much they spend, and when and on what they spend it- can help a company to formulate marketing strategies and maximize profits. Due to technological development hotel companies have accumulated large amounts of customer data, which can be organized and integrated in databases that can be used to guide marketing decision.

Because identifying important variables and relationships located in these consumer-information systems can be a difficult task, some hotel companies have attempted to raise the power of information by using data mining technologies that exploits the data regarding the consumer.

Such data-mining technology allows hotel companies to predict consumer-behavior trends, which are potentially useful for marketing applications. For example, Best Western marketing staff can run reports and analysis on customer and occupancy data stored in a data warehouse that combines customer and transaction information from all company properties.

Such information indicates where live the customers who visit a specific hotel. If the data reveal that the Best Western in Gura Humorului experiences a abundant in visitors from Iasi in April, for instance, hotel marketers can increase promotional efforts in Iasi during the late winter months.

Related the hotel industry the tasks performed by data mining can be grouped into the following five categories.

- *Classification* arranges customers into pre-defined segments that allow the size and structure of market groups to be monitored. Also, predictive models can be built to classify activities. Classification uses the information contained in sets of predictor variables, such as demographic and lifestyle data, to assign customers to segments.

- *Clustering* groups customers based on domain knowledge and the database, but does not rely on predetermined group definitions. This function is beneficial because it aids hoteliers in understanding who are their customers. For example, clustering may reveal a subgroup within a predetermined segment with homogenous purchasing behavior (a subgroup of holiday shoppers within the transient segment) that can be targeted effectively through a specific ad campaign with the scope that the members of the subgroup will increase their number of stays or become more loyal. On the other hand, clustering may indicate that previously determined segments are not parsimonious and should be consolidated to increase advertising efficiency. Information such as demographic characteristics, lifestyle descriptors, and actual product purchases

are typically used in clustering.

- *Deviation detection* uncovers data anomalies, such as a sudden increase in purchases by a customer. Information of this type can prove useful if a hotel corporation wants to thank a guest for her or his recent increase in spending or offer a promotion in appreciation. Marketing managers may also attempt to draw correlations between surges in deviations with uncontrollable business-environment factors that are not represented in the database .

- *Association* entails the detection of connections between records, driven by association and sequence discovery. For example, a possible detected association may be that a particular segment's average length of stay increases after a specific advertising campaign. Another association task could be employed in an effort to determine why a specific promotion was successful in one market, but ineffective elsewhere. Specific information regarding customer-purchase histories is necessary to formulate probabilistic rules pertaining to subsequent purchases.

- *Forecasting* predicts the future value of continuous variables based on patterns and trends within the data. For instance, the forecasting function can be used to predict the future size of market segments. With forecasting one can also use data trends to project which hotel amenities are of growing importance to consumers and will be key drivers of the future perception of value of consumers.

An important task of data mining application for CRM is building appropriate segmentation and predictive models. For good results it is essential an extensive knowledge of the hotel business. In [8] there are presented some ways that hotel guests can be segmented. These refers to demographic aspects like: age, life-cycle stage, gender or income, or to psychographics aspects like: social class, life-style, personality, behavior, user status (potential, former, first time) or loyalty status.

The different kind of hotels (transient hotels, convention hotels, extended-stay hotels) segment guests differently. Furthermore, guest segmentation is distinctive for most hotel properties. For instance, Best Western or Holiday Inn property-management systems segment and code markets at the property level, since each location has its own particular segments. A given property may serve a set of clients, a group of government clients, and social clients (weddings or reunions).

The segment categories discussed above can be linked into a large set of combinations. Furthermore, a guest could potentially fit into several categories, which poses a challenge for current data-mining techniques.

Once a data-mining model is built, it must be tested to assess its predictive accuracy. For instance, a model designed to predict who will respond to a promotion should be based on a prior offering in which it is known who did or did not respond. After the model is constructed, a sample group from a previous promotion can be analyzed to verify reliability. If the sample predictions do not replicate the results of the past promotion, then the model may not be significantly predictive. To further enhance accuracy, a score can be assigned to the model based on the level of agreement between the sample group and the entire group.

Accurate data collection is critical for successful data mining. Data problems lead to a decrease in the value of any data warehouse, in addition to decreasing the value of proposed models.

The first possible problem involves missing or inaccurate data. For example, when occupation information is available for only 10 percent of a data set, it is difficult to create a profile of customer occupations. Then again, it is a problem if the data file

contains occupation information for 90 percent of the population, but the accuracy of the information is poor. Hotel companies can reduce inaccuracy of this kind by asking guests for their current occupation.

A second problem is poorly coded data. Databases must have standards regarding data formats, text case, and redundant codes. Problems can occur when data-input sources are added over an extended time and no one has ensured that the data entering the warehouse is properly formatted. This would occur, if, when original data-mining technology was installed, predictions were made based on the reservations system and the property-management system, but then a subsequent decision was made to input data from guest-satisfaction surveys. Problems occurs also when additional data inputs are not standard or are coded improperly. For example, some models require continuous and ordinal data, while others demand categorical data fields or binary constructs.

Due to the fact that numerous analytical tools can be employed to transform data into useful information it is very important to select the appropriate tools for analysis and prediction. Each methodology has strengths and weaknesses, and each is appropriate for a specific scenario.

It is obvious that technology must serve the purposes of managers, rather than dictate processes. Along that line, data mining cannot capture all the information relating to what drives consumer behavior. Data mining is simply one of a number of research methods that help predict the demand trends of travelers. Therefore, data-mining technology should be used in conjunction with other forecasting and research techniques.

Data mining is a useful tool, but managers should be aware of the following limitations of data-mining technology:

- *Data mining analyzes only data collected from existing customers*. Data-mining software generates information by analyzing data patterns derived from the company's reservation, property-management, and guest-loyalty program systems. Patterns thus detected can help predict the actions of current guests in the system and of those with similar needs and wants. Data-mining technology does not, however, provide information about market segments not found in the company's databases. Moreover, a market segment that is currently small but is on the limit of experiencing substantial growth may not be detected by data mining.

- *Databases used in the mining process are often hotel-brand specific*. Just as data mining cannot analyze the markets of competitors, it also creates prediction models that are brand specific. Thus, companies that operate multiple brands often must create a data warehouse and conduct data mining for each brand. This is also true for the franchisees that may have a portfolio comprising, say, six Holiday Inns and four Best Western.

- *Data mining may not segment travelers by psychographics traits*. Segmenting consumers based on psychographics traits, such as personality and lifestyle, can be useful in the hotel industry. This is because psychology and emotion play significant roles in the decision process of hotel guests . That is, a traveler may select a destination for a variety of psychological reasons (education, escape, relaxation, social interaction). One limitation of data mining is that common system inputs do not account for psychological factors that influence the purchase decision of a traveler.

5. Conclusion

Data-mining technology can be a useful tool for hotel corporations that want to understand and predict guest behavior. Based on information derived from data mining,

hotels can make well informed marketing decisions—including who should be contacted, to whom to offer incentives (or not), and what type of relationship to establish.

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