Marketing Knowledge Management Model

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Abstract. Database marketing (DBM) refers to the use of information databases to support marketing activities in order to obtain useful information to establish and maintain a profitable interaction with the customer. This work focuses the failures of traditional approaches to the database marketing, proposing the use of techniques from artificial intelligence, in the context of business intelligence in marketing areas. Based in literature review, it's explored a vision for the systemic use of methods and techniques of data mining in projects of DBM, and proposed a conceptual model that combines DBM activities with appropriate data mining techniques, contributing to efficiency and effectiveness of database marketing projects.

Keywords: Database Marketing, Data Mining, Business Intelligence, Knowledge Discovery from Databases.

1 Introduction

The volume of data grows every day in organizations challenging the storage capacity in the databases (DB) and obtaining access to these. The growing volume of data has given rise to a new problem in several areas that collect the data automatically, created an urgent need of new techniques and tools that can transform the data into meaningful information and knowledge. This information is valuable for planning, management and decision making process, which cannot easily be identified by conventional databases management systems (DBMS). Then, Data Mining (DM) emerges as response to this need.

The ability to capture and retain customers for many authors represents a major challenge in the field of marketing in organizations [1], [2], [3]. With the advances in information and communication technology, organizations can obtain and store transactional and demographic data of customers at reasonable cost [4].

The challenge is how to extract important knowledge from these large databases in order to gain competitive advantage [5]. In many organizations, the use of databases stills complex and sometimes not available, not only because DBMS require

knowledge relevant, but also because the data is not ready to be used outside of the purposes of these DBMS.

Currently, organizations have a clearer understanding of the importance of customer data, and critical decisions of decision models in business intelligence, are being built on the analysis of such data. The emphasis on the management of customer relations makes the function of the marketing an ideal area of application that can greatly benefit from using the tools of Data Mining (DM) for decision support in the context of Business Intelligence.

When using DBM, organizations can identify valuable customers, predict future behavior, and make decisions based on knowledge, or by calculating the statistical model development database queries for marketing. However, this approach is not structured and there is a need for a unified view to guide marketers in their search for relevant knowledge. This includes understanding of customer preferences and behavior through the analysis of their data. Many researches have been done in this direction, and DM techniques have been used successfully in several areas such as bankruptcy prediction [6], fraud detection [7], critical care medicine [8] and engineering, among other areas. In fact, the old model of design-build-sell is being replaced by the model sell-build-redesign; the oriented management model for the product was replaced by customer-oriented. The traditional process of mass marketing is being challenged by the approach to marketing one-to-one.

The definition of DBM as a strategy for marketing support has changed significantly in recent years. The current approach is based on estimated models of response to customer segmentation for submission of offers. These models accurately estimate the probability of a client responding to a specific supply and can significantly increase the response rate of a product offered. Their use in supporting marketing decisions highlights issues of interest, such as the management of customer relations, marketing, interactive real-time customer profiles and managing cross-organizational knowledge [9].

Have been published some of the contributions to overcome these constraints, particularly with regard to data manipulation [10], and aspects of the data quality [11], among others. There are still many aspects that remain unresolved, such as data integration and pre-processing in marketing activities.

Most contributions in the field of DBM refer to simple methods of use in specific cases, such as management of customer relationships [9], activities of cross-selling and up-selling [12], or analysis the shopping basket [13], or else to a specific set of techniques to improve specific outcomes, for example, segmentation, or one-to-one marketing activities [14].

In order to help marketers to make use of knowledge obtained through the approach of Knowledge Discovery in Databases (KDD) in their marketing activities and improve their results, we propose a model for systematic and efficient integration of involved processes.

This paper is organized as follows: after this introductory part, we present a general description of DBM and relevant issues concerning to KDD process, marketing activities and objectives of data mining; in the third section, is presented a model that integrates marketing activities with DM techniques; finally we draw some conclusions.

2 Database Marketing and KDD

2.1 Database Marketing

The DBM is the set of processes that allows using the data stored in the internal and external databases, with the objective of extracting relevant information to support the decision-making of the marketers in the marketing activities, giving a clear vision of the needs of the clients, and thus anticipate their desires. In this paper, the DBM is presented as the use of technology databases to support marketing activities, while the marketing databases are referred as the database system itself. Coopers & Lybrand proposed three levels of DBM in order to better organize these concepts [6]:

- Direct marketing: organizations manage lists and conduct performance reviews of basic promotions;
- Marketing customer relationship: companies apply, adapted a more sophisticated approach, and technological tools to manage your customer relationships;
- Relationship management customer-focused: customer information guide business decisions across the enterprise, enabling resellers to talk directly with individual customers and thereby ensure a relationship of loyalty.

DBM is defined as the creation of a database of customers and prospects that enables organizations to communicate with each in a personalized way [16]. There others that consider DBM as a way to use information on consumers for the purpose of increasing the effectiveness and efficiency of marketing activities [14]. Finally, DBM can be defined as the use of customer information with benefits for both the organization and the customer [17].

All these definitions emphasize the technologies of databases to support marketing activities, and impose the definition of DBM, a set of processes based on marketing databases for analysis and data exploration, seeking new knowledge [18].

2.2 Knowledge Discovery in databases

KDD refers to the process of discovering knowledge from data stored in databases, culminated with the implementation of DM techniques.

In a systemic approach to knowledge acquisition, can be defined through the system changes that allow re-do in the future tasks more effectively and efficiently. In view of mathematics, knowledge acquisition can be seen as the perception of data sets [19]. The acquisition of knowledge becomes feasible to rely on the experience and being supported by the understanding of the data set.

KDD aims to develop methods and techniques for extracting high-level knowledge from information stored in databases. It can be defined as the process that allows identifying patterns and/or models that are potentially useful and understandable.

According to Fayyad et al. (1996), the term KDD was created in 1989 as a reference to the broad process of finding knowledge in data. KDD refers to any

process of finding useful data knowledge, while DM refers to the application of algorithms to extract models from the data. Until 1995, many authors considered the terms KDD and DM as synonyms. The KDD process is a set of continuous activities that share the knowledge discovered from databases. [20]

The process of knowledge acquisition is usually composed of the following general steps: (1) selection; (2) pre-processing; (3) transformation; (4) data mining and (5) interpretation and evaluation.

In the first step, selection, once the scope and objectives of the process have been defined, the data are collected with characteristics that are considered useful. The next step, pre-processing, is characterized by the cleaning of noise and errors (wrong data and omissions); and non-relevant data are eliminated. The transformation step is characterized by the search for the most important characteristics of the data in order to reduce the number of variables or modify the form of a given variable, making the data extremely organized. The fourth step, DM, algorithms are applied algorithms to discover patterns in the data, using the methods and techniques for extraction of data patterns. Finally, the interpretation and evaluation step, where the patterns identified by the system are interpreted as knowledge, which will be visualized to make possible its interpretation and evaluation, being possible to resume the process in any of the previous steps for a new iteration.

2.3 Data Mining Objectives

The term Knowledge Discovery in Databases refers the process of discovering knowledge from data stored in databases, this process culminated in the implementation of DM techniques.

DM is one of the components with more notoriety of KDD with which is often confused. The knowledge discovery in databases allows you to transform data into quality information, allowing making strategic decisions for the best performance of organizations, facing the growing competition and globalization of the market. DM refers to the extraction of non-trivial identification of patterns in the data valid, new and potentially useful and understandable from the data in databases [20].

The main difference between the DM and other data analysis tools, it's how they explore the relationships between data. While the various analysis tools available you build hypotheses about specific relationships, it may corroborate or refute them through the outputs produced by the tool used, the process of DM is responsible for creating hypotheses, providing greater speed, range and reliability to the results.

The DM aims to build data models. There are many algorithms available, each with specific characteristics. DM main activities are [21]:

- Estimation modeling: These models are built starting from the set of input data (independent variables) to the output values (dependent variables) which can be developed in two ways depending on the type of output:
  - Classification: learning a function that allows you to associate with each data object a of a finite set of classes and pre-defined user (example customer profile);

  - Regression: learning a function that "maps" each object in a data value continuous (example value of the transaction).
- Descriptive modeling: discover groups or categories of data objects that share similarities and helps in the description of data sets provides a space (example customer segments);
- Dependencies modeling: is a model that describes dependencies or associations between certain relevant data objects (example content of the order of the market basket analysis);
- Deviations modeling: tries to detect the most significant deviations from measurements and / or past behavior considered as a reference (example fraud detection).

The selection of data mining activities is directly dependent on the marketing objectives initially set.

2.4 Data Mining models

Marketing activities refer to the exchange of products and services, being driven by marketing goals. There is an important set of questions to which marketing activities must be capable of responding:

(1) Who do I achieve?
(2) Achieve them with What?
(3) When should I do it?
(4) Which promotional channel should I use?
(5) How should be promoting?

The DBM is a process-oriented for marketing objectives, which will determine the whole process of gathering information. From here, and adopting the above model, it is possible to suggest at least one task of DM for each objective. Find the "How" means using DM techniques to segment the likely responses, repeated users, acquisition targets, customers with increasing costs, and potential defectors. The question "What" suggests finding the key characteristics of customers with more value for the company. This can be achieved by analyzing the data on products and consumer behavior. A set of prediction activities are associated to the question "How" (example: How many clients may come to leave the company). The time activity on marketing activities is represented by the question "When", which includes all marketing activities that refer to temporal tasks (example: when the company must send promotional emails to customers). The question "What" is one of the key word most used in the definition of marketing activities, due to the selection of the characteristics associated (example based on the analysis of the market basket, marketers want to know which products are associated). By their nature all marketing questions include some prediction of its results, so it is possible to assign each a DM prediction. The descriptive models of DM are better to answer the questions "Who" and "How", not only for its characteristics of classification but also by the type of desired results. The dependency analysis models have a wide application in marketing activities and may be included in these objectives "When", "Who" and "What".

Finally, the model variance analysis can be used to answer questions of marketing "How", "When" and "Who".

3 Marketing Knowledge Management Model

Data mining may be useful in addressing the questions of marketing "Who", "What" and "When". On the other hand, DM is not enough by itself, requiring a set of related activities to ensure quality results.

An approach to the development of DBM must adopt a certain set of steps to follow and requirements to fulfill. We presents a proposed framework for exploration of the concepts and features of the KDD process and its intersection with marketing activities and questions related to the integration of data mining models.

The database marketing model (see Fig.1) has three phases: Information Gathering, Knowledge Discovery, Evaluation and Implementation. Initially, the data are collected from various sources, external sources, internal and market research. After data registration and analysis the marketing database is created in order to support the whole process of KD.

KDD process is part of the proposed second phase, and includes a set of steps that allow the data to extract new knowledge from databases of marketing:

- Selection of data: consists in selecting a subset of data on which the algorithms used in modeling will work;
- Preprocessing: and data transformation, the selected data is processed appropriately for the extraction process of knowledge [4];
- Modeling: crucial step in which various techniques are applied to discover potentially useful patterns. These techniques are used to achieve the initial objectives such as the segmentation and classification.

In the third phase, the evaluation and implementation, refers to the integration of the knowledge obtained from the KDD process models in marketing database. Since the answers to marketing issues supported by these models.

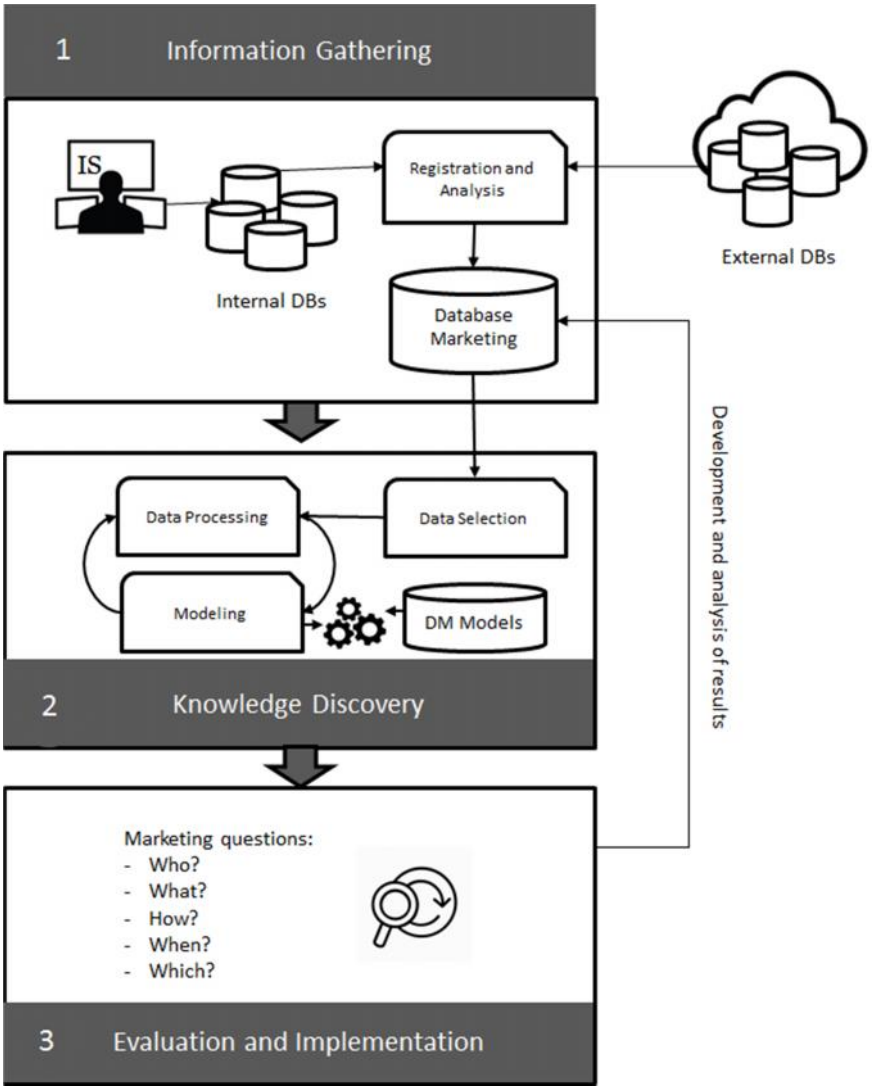

Fig. 1. Marketing knowledge management model.

4 Conclusions

In this work, we used a KDD approach to DBM projects, looking for the systematization of the whole process, in order to facilitate its use in support of marketing activities. In today's customer-centric business environment, it is our belief that there is need for a deep understanding of the use of DM and KDD as a decision support for marketing.

To this end, we showed how the DM can be integrated into the model of knowledge management marketing. The availability of large volumes of data, enabled by modern information technology, one of the main problems is to filter, sort, and process, analyze and manage these data, in order to extract the relevant information to the user. The growth in size and number of existing databases is much superior to the human capacity to analyze the data using traditional tools, which creates the need and opportunity for use of DM tools. With the shift from mass marketing to relationship marketing one-to-one, one area that could benefit greatly from DM is its own marketing function.

The systematic application of data mining techniques enriches the process of knowledge management and it provides marketers a better understanding of their customers, allowing provide them a better service. For us, it is also clear that Web technology will have a major impact on the practice of data mining and knowledge management, and will present interesting challenges for future research in information systems.

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