Data Mining in Digital Marketing

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Abstract. With Industry 4.0, the Internet of objects, Internet services and cyber-physical systems have led to radical changes in every aspect of society. Artificial intelligence and intelligent systems that emerge together with technological developments are rapidly advancing towards becoming technologies that we use in almost every field of our lives and that are convenient for us. Thanks to these developments, computer systems, processor speeds and storage capacities have also increased cheaper computer systems and increasing processor speed and storage capacities have caused to be collected huge amounts of data. We have produce huge of data by the log files of WEB servers formed by the web sites we visit, blogs, photos, videos, texts etc. that we share through social media tools. Analysing increased diversity and volume of data and the result of this analysis is that more meaningful information and interpretation of the acquired knowledge is beyond what human competence and relational databases can do. At this point, data mining which allows large quantities of data to be transformed into meaningful and useful information, offers many advantages and facilities.

Data mining enables the use of computer programs to find correlations and rules that provide meaningful, potentially useful future predictions from large amounts of available data. Nowadays, data mining is successfully applied in medicine, banking and insurance, telecommunication, marketing and customer service sectors. In the field of marketing, data mining techniques enable businesses to understand hidden patterns in their past history. Thus, it is possible to plan and realize new marketing campaigns in a fast and cost-effective manner, develop product and promotion activities for specific customer segments, price determination, customer preferences and product positioning, effect on sales, customer satisfaction, point-of-sale data analysis, supply and store placement optimizations as well as profits. This study is a review of literature to emphasize the importance of data mining and to identify applications related to data mining in digital marketing and customer relationship management. This work will enable data mining techniques to be used effectively and efficiently by businesses and to enable more ARGE activities in this regard.

Keywords: Data mining · Marketing

N. M. Durakbasa and M. G. Gencyilmaz (Eds.): ISPR 2018, *Proceedings of the International Symposium for Production Research 2018*, pp. 44–61, 2019.
https://doi.org/10.1007/978-3-319-92267-6_4

1 Introduction

It has become very important to reach, analyze, use and store information that will help to make strategic decisions in an environment where information is power today. The rapid development in information communication technologies and the cheapening of hardware have led to the formation and storage of large quantities of data. The data express a value after transformation into information. Significant information is obtained by analyzing large quantities of data with various statistical methods. Innovations in emerging information technologies and database management systems as well as meaningful information derived from data contribute to the effectiveness of the strategic decision-making process and the development of new strategies.

Together with technological improvements, successful works are being carried out in many areas such as artificial intelligence, robots, virtual reality, autonomous devices, machine learning, big data and data processing subjects. Along with these developments, traditional marketing has also evolved to carry a customer focused personalized digital lane. The ability to use information communication technologies and to meet customer demands and needs that are increasing day by day with the right time, place and minimum cost has become the building block of sustainable competition. This is only possible with technology. Businesses need to know a lot of information such as demographic information, interests, personalities, habits, purchasing behaviors to reach the target audience, understand the customers and establish sustainable communication with them. Organizations must make strategic decisions about the future by making inferences and analyzes from this information. Significant personalization of meaningful information by processing these data has recently attracted the interest of all businesses. Machine learning and data mining offers more opportunities for businesses in terms of giving accurate and consistent strategic decisions and sustainability. Machine learning allows data to be processed by programming them in a manner similar to data mining. With the automation of machine learning offers the use of algorithms to decompose the data, the ability to expand software knowledge without human intervention, the ability of computers to learn from the data without needing additional programming and the ability of a machine to learn input tasks and use them for automation.

2 Data Mining

Data mining is the search and analysis of meaningful and useful links and rules through computer programs that help predict the future from large amounts of data. In addition, data mining is a data analysis technique that helps to find the link between them by examining the relationships within a very large amount of data and enables the retrieval of information that is hidden in database systems [1]. According to [2], data mining is defined as a secondary analysis discipline that interacts with statistics, database technology, pattern recognition, machine learning, and secondary analysis of unpredictable relationships in large databases. In addition data mining is a field with many disciplines. This set of disciplines; database technologies, statistics, machine learning, visualization and other disciplines (Fig. 1).

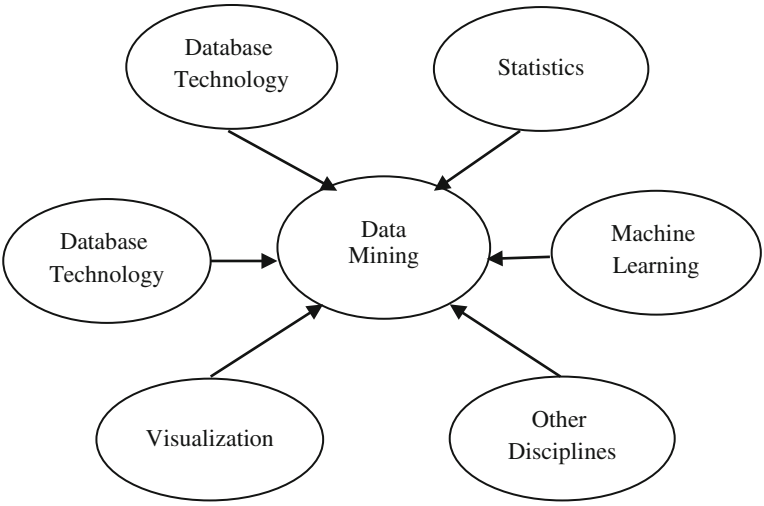

Fig. 1. Data mining relationship

Technological developments have made it easier for raw data to transform knowledge to respond to management and market needs to generate new opportunities and have forced organizations to work on data mining [3].

- As a result of the diversification of measuring instruments and the development of automatic data collection tools, the number and types of data collected have increased.
- As a result of the development of databases and database technology, a large amount of data is stored in the data repository.
- As a result of the development of computer and data processing technology, collected data can be analyzed quickly.

Data mining is a key issue in the field of marketing where intense competition is taking place, especially in order to achieve profit and market share. The answers to the questions such as which customer, which product, when to buy, who gives up the supplier and what kind of variables can be done to give up or acquisition such customers and what causes the loss of product value are in the data. Data mining solutions are needed to find these answers. With Data Mining, companies improve decision-making processes by revealing previously unknown information. Using data mining techniques; it is possible to reduce costs, increase revenues, productivity, uncover new opportunities, make new discoveries, automate labor intensive activities, identify frauds and improve customer experience. In sum, we can say that the data mining is due to the need to sort out the amount of collected data and increase the competence to make the right decisions in an increasingly competitive manner. Data mining is a process at the same time. In addition to revealing data by abstract excavations in the data stacks, it is also part of this process of separating the patterns during information discovery process and preparing them for the next step. The steps followed in the data mining process are generally as follows [4];

1. Identification of the problem,
2. Preparation of data,
3. Establishment and evaluation of the model,
4. Using the model,
5. Monitoring the model

Models used in data mining are examined under two main headings as predictive and descriptive [5]. In predictive models, it is aimed to develop a model from the known data and use this model to estimate the outcome values for unknown data sets. In descriptive models, it is possible to identify patterns in existing data that can be used to guide decision making [6]. According to functions of data mining models are examined in three parts as classification and regression, clustering and association rules. The most popular data mining programs which used in nowadays are SAS and SPSS statistical programs.

2.1 Classification and Regression

Classification and regression are models of data analysis that reveal important data classes or predict future data trends. While categorization predicts categorical values, regression is used to predict continuity values [7]. The main techniques used in classification and regression models are [8];

- Decision Trees,
- Artificial Neural Networks,
- Genetic Algorithms,
- K-Nearest Neighbour,
- Memory Based Reasoning,
- Saf Bayes.

2.2 Clustering

Clustering is the process of dividing into data classes or clusters. While the elements in the same cluster are similar to each other, they are different from the elements of other clusters. Clustering is used in many areas such as data mining, statistics, biology and machine learning. In the clustering model, there are no classes of data in the classification model [9]. Mainly clustering methods [7];

- Partitioning methods,
- Hierarchical methods,
- Density-based methods,
- Grid-based methods,
- Model-based methods.

2.3 Association Rules

Association rules reveals the relationships among the data. Depending on these rules, later it is predicted whether or not the data are co-existing [10]. It is the process of finding associations between different data in large data sets. The analysis is the discovery of relational rules for feature values that co-occur at a high frequency in a given set of data. The following two process steps are followed while there are coherence rules in large databases [11].

- There are often repeated items. Each of these items is repeated at least as often as the predetermined minimum number of supports.
- Establish strong association rules from frequently repeated items. These rules should meet minimum support and minimum confidence values.

3 Advanced Data Mining Techniques

Text, web and multimedia mining are interrelated areas that have been working much in recent years. Text mining is the analysis of very large documents and the creation of hidden patterns in text-based data. Web mining includes analysis of the web-related data, including web content, page structures, and web link statistics. Multimedia mining is also used for extracting interesting information for multimedia data sets, such as audio, video, images, graphics, speech, text and combination of several types of data set which are all converted from different formats into digital media [12]. These are:

3.1 Web Mining

Web Mining can be described as data mining on Internet data. Web mining is a sub-area of data mining; methods used in data mining are used in web mining. Analyzing and extracting information from web related documents and other data obtained automatically [13]. Web mining surveys can be classified as web content mining, web structure mining and web usage mining [14]. Web content mining is concerned with the discovery of useful information from the content of websites. Web structure mining is focused on the link between web structure and web sites. Web usage mining is working on the input patterns of web users.

Many topics can be exploited with web mining such as making detailed inferences about users, editing content according to users' tendencies, making improvements to increase the usability of the website, taking various security precautions after detecting various anomalies. In recent years, with the proliferation of e-commerce and online shopping services, work in this area has resulted in competition, revealing the importance of web mining [15].

3.2 Text Mining

Text mining is a combination of natural language processing (NLP) and data mining. Data mining is a search for data using large quantities of data that can be used to predict

the future. In text mining, data mining methods are used to classify, group, or relate data and relational, statistical results are created between models to create models. The generated model allows you to make a prediction about this record when a new record is not in the dataset you created [16].

In its simplest meaning, text mining is the practice of data mining that considers work as a text data source. Objectives to obtain structured data via text. For example, classification of texts, clustering, concept/entity extraction, production of granular taxonomy, sentimental analysis, document summarization, entity relationship modeling. In order to reach these targets, information mining activities such as information retrieval, lexical analysis, word frequency distribution, pattern recognition, tagging, information extraction, data mining, and even visualization [17].

3.3 Multimedia Mining

Rapid developments in multimedia and storage technology has led to enormous growth in databases. In general, multimedia database systems store and manage a large number of multimedia objects such as images, video, audio, and hypertext data [18]. Information discovery in multimedia documents deals with unstructured information. For this reason, we need tools such as discovering relationships between objects or sections within multimedia document components, classifying images based on content, casting templates, categorizing speech and music and recognizing and monitoring objects in video streams. In this context, data mining techniques are used to reach the desired information from images, video, audio and text data. Multimedia data mining can be defined as "the process of finding interesting patterns of media data such as audio, video, images and text that are not normally accessed by basic queries and aggregated results" [19].

4 Data Mining Applications Areas

Data mining has become a strategic analytical method that is used today in the decision making process and in the achievement of organizational goals. Data mining applications have frequently used finding hidden relationships with financial indicators, determining of customer buying patterns in marketing and in insurance determining of risky customer. Today, data mining is primarily used by companies in the financial, communication, and marketing sectors. Data mining allows firms to determine internal factors such as price, production planning, and personnel skills. In addition, economic indicators allow to determine external factors such as competition and market structure. Thus, the positive and negative effects on the sales of the companies, the satisfaction of the customers and the profits of the companies can be determined. In this framework, data mining can be applied to many areas [20]. Data mining has a wide range of uses, such as medicine, finance and banking, insurance and health services, marketing, astronomy, biology and telecommunications.

5 Data Mining in Marketing

One of the most important actors of electronic marketing activities is creating technological infrastructure and internet. It is essential that businesses update their technological structure outside of their web sites, detailed content, products, employees and customer relationships in order to be successful in electronic marketing activities, respond to expectations and integrate with other systems [21]. In this context, it is very important to store and evaluate information about customers in the databases so that they can make decisions about the future.

The importance of data mining and usage rate in marketing decision have increased. Data mining which helps businesses demonstrate the evolution of customer relationships is the process of exploring the many dimensions of customer relationships, market trends, and behavioral models. The information held in the marketing database is crucial for the business to make strategic decisions. For this reason, data must be organized just like a marketing function. Businesses need consistent information to sustain their existence in today's ever-changing, complex market environment. In this context, data mining emerges as an important tool providing consistent information to businesses [22]. In this sense, data mining is the process of scanning database for the analysis of big data, revealing invisible patterns and associations and finding meanings of data by revealing trends in the market [23]. For this reason, in the marketing approach, data mining is most commonly used in database-based marketing and customer relationship management.

Data Mining is currently used by companies with strong consumer-focused retail, financial, communications and marketing organizations. Data mining allows businesses to understand hidden patterns in historical transaction data thus helping to plan and implement new marketing campaigns quickly and cost-effectively. Businesses use data mining methods to develop product and promotion activities for specific customer segments, such as pricing, customer preferences and product positioning, impact on sales, customer satisfaction, point of sale data analysis, supply and store placement optimizations, and profitability [24]. Market segmentation, competitiveness analysis, customer valuation and cross-selling analyzes are conducted with data mining [25]. Successful applications can be made in many different areas such as individualized campaigns, sales policies, new products, cross and additional sales and market arrangement for information obtained by data mining in marketing. According to [3]. these activities are;

Organizing Campaign Conditions: Selecting existing customer segments in various campaigns to be organized and developing approaches to behavioral characteristics of these customers. This is aimed at increasing the response rate to marketing or retail campaigns and reducing the cost of managing customer relationship management.

Organizing Special Campaigns: Applying special campaigns to potential customers which determining they can be most profitable. Transforming the most costly customers into less costly customers. For example, the most banking transactions are revealed to those who are directed to internet banking instead of branch banking.

Organizing Sales Policies for Customers: Finding "model" customer groups that share the same characteristics (income level, interests, spending habits, etc.) and determine sales terms and prices based on purchase profiles.

Developing New Product: By designating the features that different customer groups need, developing different products that meet the customer's expectations by extracting features they do not need.

Development of Market and Shelf Layout: The most typical example of the use of association rules is the application of a market basket. This process solves the purchasing habits of customers by finding associations between the products in the purchases they make. The discovery of these types of associations reveals the knowledge of what products customers receive together, and market managers can increase sales ratios and develop effective sales strategies by identifying market and shelf orders in this information [26].

Cross Sales: Finding connections and associations between product sales and models that can understand customer groups according to credit card expenditures, hidden correlations between different financial indicators, what customer profile means what, when and why, and offering additional products by developing these linkage-based estimates.

Additional Sales: To find the best customers or customer groups, to develop personalized products and services by identifying the needs of these customer groups, and to create product offerings that customers can not give up in this way.

5.1 Customer Relationship Management-CRM

It has observed that the differences among the products have decreased, the products have got shorter time to market, the profit margins have decreased and the customers' lifestyles and purchasing habits have changed in the globalizing world. This environment also obliges business to change their approach to customers. One of the tools used by businesses in this context is customer relationship management. The aim of CRM is to find customers, to reach customers more efficiently, to provide customers with appropriate goods and services by understanding their demands, to create customer loyalty by providing customer satisfaction and to make more profit by making more sales to customers [27]. CRM consists of a set of processes and systems that support business strategy to build long-term and profitable relationships with specific customers [28]. Customer relationship management aims to optimize the customer value of an organization through data analysis and communication. An important tool or method of businesses which using in their CRM applications is data warehouse and data mining. Data mining is the selection and evaluation of data of a particular feature from a very large number of data with computer programs, the recognition of consumers and the development of marketing applications accordingly. In the early stages of CRM, applications such as customer related data, call center, sales campaigns, relationship management were given importance. In later CRM applications, the customer's life-long value is

analyzed and the applications for the customer's re-purchasing are taken as basis. Data mining is the process of revealing meaningful new relationships, patterns, and trends by examining a wide range of data stored in the data warehouse using pattern recognition techniques and statistical and mathematical techniques. In the process of data mining, hidden information is extracted in the data by using statistical analysis methods and artificial intelligence algorithms and it is the basis for the decisions of the managers [27].

Customer segmentation is the process of separating customers into different, meaningful and homogeneous subgroups based on various qualities and characteristics. It is used as a differentiated marketing tool. It enables organizations to understand customers and create different strategies [29]. Customer segmentation is a popular application of data mining with existing customers. A segmentation project begins with identifying business objectives and ends with the presentation of differentiated marketing strategies for segments [30]. There are many different types of partitioning based on certain criteria or qualities used for partitioning. The customer segmentation categories obtained by the apriori algorithm from the association rules are given below [31];

Buyer-Readiness Segmentation: The division of prospects and customers into groups reflecting the different stages which consumers normally pass through during the purchase process. These usually comprise ignorance, awareness, knowledge, preference and conviction.

Benefits Segmentation: Dividing the market into groups according to the different benefits that consumers seek from the product.

Behaviour Segmentation: The division of customers into groups based on attitude, usage or response to a product or promotion.

Occasion Segmentation: The division of customers into groups which consume a product or service at particular times, in certain situations, in response to particular events or according to seasonal or cyclical times.

Psychographic/Lifestyle Segmentation: The division of customers into groups based on lifestyle, social behaviour, values, sensitivities and personality characteristics.

Demographic Segmentation: The division of customers into different groups based on demographic variables such as age, gender, family size, income, occupation, education, language, religion, race and nationality.

Life-Cycle Segmentation: The division of customers into different groups that recognise the different needs of consumers at different stages in their life.

Geographic Segmentation: The division of customers into different groups based on countries, regions, climate and population density.

Loyalty Segmentation: The division of customers into different groups based on different degrees of loyalty to supplier or brand.

Product Segmentation: The division of customers into different groups based on levels and type of usage of the product or service.

Profitability Segmentation: The division of customers into different groups based on the different levels of value or profitability of the customers.

Interaction Segmentation: The division of customers into different groups based on their preferences regarding channels, payment method, promotions and communications.

Satisfaction Segmentation: The division of customers into different groups based on their recorded satisfaction levels, complaint history, fault history and upgrade history.

The firm's potential benefit to each client is called lifetime customer value [32]. Customer lifetime value is a measure of the profit generating potential or value of the increasingly important customer in managing customer relationships. Predicting the customer's lifetime value has become very important for companies competing in highly rich media environments [33]. Determining firm's lifetime value of customer accurately will determine the areas where the company will operate in the future and will provide innumerable benefits, especially in offering appropriate benefits to its customers. The customer profile defines the customers' characteristics such as age, income and lifestyle. It is a basic tool for marketers to create customer profiles, to provide better service to existing customers and to communicate with customers to keep them. Profiling is achieved by gathering the demographic and behavioral information from the collected data related to the customers. Creating a customer profile is also used to target new customers who use external resources, such as demographic data purchased from various sources. This data is used for customer segmentation by customers' purchasing characteristics [34].

5.2 Customer Value Analysis

Customer value is one of the most basic marketing strategies today. It refers to the emotional process that occurs in the mind as a result of the monetary value comparison with the customer's purchased product/ service. In terms of businesses, it is the difference between customer value, total customer value and total customer cost [35]. According to [36], the concept of customer value summarized the following characteristics;

- Customer value is perceived value by the customer.
- Customer value is total benefit and total costs are perceived by the customers proportionally.
- It is important to reduce costs as well as to increase benefits in increasing customer value.
- Customers' sense of value is subjective.
- Product and service characteristics as well as presentation and customer relationships play an important role in the formation of customer value.

Value analysis enables organizations to direct their product development activities to areas of greatest customer value. More specifically, value analysis helps to establish a relationship between the expenditure and functional requirements of the product as defined by the customer. Then A value sequence can be created mathematically to define the relationship between the cost of a product system and the customer value placed in those systems. Value analysis is also the key to the successful implementation of target costing, the process of profit planning and cost management used to control costs in the design phase of new product development. Cost targets are derived by subtracting the necessary profit margins from market driven product prices. In practice, once a cost target for a product has been identified, a team tries to design a product that meets customer needs more than the target cost. However, the target cost is not just about cost reduction. More importantly, organizations use target costing to increase product value for customers [37].

5.3 Determining Customers' Purchasing Patterns

Businesses have stored much data about customer, product and service characteristics and customer interactions. Although log analysis programs are important in determining customer behavior, they can provide relatively simple analysis of customer behavior. In contrast, data mining can provide highly developed customer research analysis by finding hidden patterns in databases [38]. Data mining requires the creation and recording of customer and product/service characteristics and customer interactions. Such as understanding and forecasting of customer purchasing actions and tendencies, customer profiles, industry analysis are increasingly being used in business.

5.4 Increasing the Rate of Answering in Mail Campaigns

Mail marketing is a popular marketing communication tool that brings the highest investment in direct marketing. But getting a high response rate, as well as having excellent cost effectiveness of email campaigns, is a big challenge for marketers [39]. An important element of ecommerce applications is web advertising. Companies can send ads directly to their customers using different channels, such as email campaigns and content-based ads [40]. E-mail communication with customers provides cost effectiveness and time benefits. However, if companies want to use their e-mail as a direct communication channel with their customers, they have to understand how e-mail campaigns affect their attitudes and behaviors [41]. So businesses can turn their e-mail campaigns into competitive advantage by optimizing them.

In e-mail campaigns, segmentation is done to target the email list to interests, purchasing behavior, demographics, and specific email campaigns to a message that is likely to respond to your message or to your offer. Segmentation in direct marketing has become more productive in recent years due to the development of database marketing techniques. Data mining approaches emerge as the best way to develop existing marketing strategies by segmenting existing customers or directing them to the market. In recent years, database marketing techniques have evolved into statistical techniques such as chi square automatic interaction detection and logistic regression from simple

RFM models (renewing customer purchases, purchasing frequency and amount of money spent) [39]. Recently, neural network models have been used in the field of database marketing [42].

5.5 Retention of Existing Customers and Acquisition of New Customers

Customer life cycle refers to the stages of a relationship between a customer and a business. The customer life cycle is very important because it is directly related to customer revenue and profitability. There are three ways to increase customer value. These; Increasing purchases of products or services by existing customers, selling products with higher margins and retaining customers for longer [43]. The customer life cycle analyzes the change over time in the relationship between the customer and the business. These customer groups are examined in four stages;

Prospects: The potential that is not yet a customer in the target market.

Responders: Responding members. They are candidates who have performed an activity with the business through web or mobile devices with registration or application.

Active Customers: Customers who use or continue to use the product or service.

Former Customers: They may be "bad" customers who do not pay their bills or are exposed to high costs.

According to [44], the customer life cycle consists of four dimensions: customer identification, customer acquisition, customer retention, and customer development. These four dimensions can be seen as the closed loop of a customer management system. These four dimensions are trying to maximize customer value in the long run. For this reason, data mining techniques help achieve such a goal by extracting or identifying hidden customer attributes and behaviors from large databases. Models can be created by extracting meaningful information from these data belonging to the customers with the data mining techniques mentioned below. Each data mining technique can perform one or more of the following data models [45];

- Association Rules,
- Classification,
- Clustering,
- Forecasting,
- Regression,
- Sequence discovery,
- Visualization.

With the analysis of data mining and business intelligence information, operators give customer ratings by analyzing billing information, customer service relationships, website visits and other information to prevent customer losses. It is aimed to retain customers by offering different incentives and offers to high-risk customers who are considering leaving as a result of this rating [46].

5.6 Market Basket Analysis

Data mining technique is used in Market Basket Analysis. With the development of barcode applications, all information related to the products that transferred to the electronic medium when the sales process is realized. These data which are usually collected at the sales points of the markets called market basket data. In a record the market basket data, information such as the transaction number, the date and the product code, quantity and price for the purchased products are included [47]. The purpose of market basket analysis is to find the relationships between sales and to draw up rules related to them. Knowing these relationships can be used to increase the company's profits [26]. This technique helps to understand the relationship between the different items that the customer puts into the shopping chart and the purchasing behavior of the customers [48]. If it is known that buyers of product X are very likely to buy product Y with X and if a customer is buying a product X but not a product Y, then we say that he is a potential Y customer. By doing data analyzes like this, we can reach sales estimates for the next month for each product, promotional applications and lineups can be made for the products purchased together, customers can be grouped according to the products they buy, potential customers for a new product can be identified [49].

5.7 Sales Forecasting

Retailers use sales forecasts specifically for inventory control. Answering the question of when a customer will shop again after shopping. Data mining is used to determine the purchasing habits of customers with varying price increases in the field of data mining marketing to determine the relationships between cross sales analysis and product sales and their relationships and to determine which products customers are purchasing according to customer profile determination studies [50].

Sales forecast refers to sales expectations for a certain future time period. it is important to understand consumer trends and influences new product designs because statistical data in the past also show preference for products. The purpose of making sales forecasts; the managers need to realize planning, execution, organizing and control activities. Managers take advantage of these estimates in many factors such as production planning, labor and financial resource needs, inventory levels and raw material purchases. Sales forecasts are an integral part of marketing planning because forecasting is necessary to ensure that marketing decisions are made effectively and the planning function is successful. The knowledge of how market conditions can give an image which sales forecasts for business in the future. Sales forecasts form the basis of marketing programs, production unit requests, business programs, budgets, production schedules, personnel expenses, expansion programs and procurement plans. Stages of sales forecasting period [51];

- Determining the intended use of sales forecasts
- Division of business goods into heterogeneous groups,
- Determining the factors affecting the sale of each good,
- Selection of sales forecasting technique,
- Collection of data,

- Analysis of data,
- Control of results from data,
- Application of forecasting to operating activities
- Periodic review of forecast results.

Quantitative methods include qualitative methods based on subjective evaluation and techniques based on technological developments, while quantitative methods are divided into time series techniques and mixed (based on economic and causal relations) techniques [51].

Qualitative Forecasting Techniques: Qualitative estimation methods can be divided into market research, expert opinion and Delphi technique. Qualitative, in other words, qualitative estimation methods can also be called subjective or judicial methods. If no information is available on the subject or if the collection is costly, the entity should proceed to a forecasting system that does not require numerical data.

Quantitative Forecasting Techniques: The use of quantitative techniques in the decision-making process is based on numerical data, as in quantitative methods, as well as statistical methods of analyzing past numerical data related to the variables or circumstances to be estimated, rather than experts' opinions and opinions. Calculation of sales forecasts using numerical methods is time consuming and expensive. Examples of quantitative estimation techniques include causal techniques and time series analysis.

6 Data Mining in Other Areas

Data mining is widely used in scientific and engineering, banking and finance, customer relationship management, fraud detection, security and intelligence, education, healthcare and biomedical. These areas:

6.1 Data Mining in Finance and Banking

A lot of data is generated in online transactions, so the ability to determine the right information at the right time becomes financially important. Nowadays many banks and financial institutions offers a wide range of banking services such as invest, credit, credit card and so on. The data collected by these organizations is generally reliable, complete and of high quality, providing reliable information.

Many field enabled methods such as data mining, risk analysis, fraud detection, credit payment forecasting, customer acquisition and retention analysis, cross selling, customer credit policy analysis, customer segmentation for target market, classification and determination of the amount of money to be distributed over ATM during the day it is used. Reducing risk is used to assess risks in the banking and insurance sectors, which have a high potential for loss after product or service delivery. Banks predict a financial risk when they give credit to customers, predicted risk models and the possibility that the borrowers can not repay their loans. Models are set up by the way of

consumer behaviors of past periods, and it is determined that no one will fulfill the payments

The risk of dishonesty is also an important issue for banks. When the credit card is lost, the banks undertake some of the losses incurred during the loss. Fraud detection systems have been devised to reduce damages in this period. It is one of the methods used to pre-define typical spending patterns of customers, to detect sudden changes in expenditure trends, and to stop approving purchases in this direction [52].

Successful results are obtained in stock exchange transactions such as stock market price estimation, general market analysis and optimization of trading strategies, determination of customer loss causes in insurance activities, prevention of irregularities, reduction of main expenses and determination of policy prices [25]. Use of data mining is beneficial in financial activities [53];

- Collecting and analyzing customer behavior data and taking strategic decisions increases customer loyalty,
- Helps to find hidden relationships between various financial indicators to detect suspicious activity in order to identify high-potential risk activities,
- Supports real-time decision making,
- Helps define fraudulent actions by gathering past data and transforming it into valid and useful information.
- Data mining helps to predict the life value of each customer in the bank and to serve each segment appropriately by offering special opportunities and discounts [43].

6.2 Data Mining in Health Services

Data mining practices in healthcare can have enormous potential and usefulness. However, the success of health care data mining depends on the availability of healthy data. From this point of view, the healthcare sector has a critical focus on how to better acquire, store, prepare, and deduce data. Standardization of clinical vocabulary knowledge and data sharing among institutions are included in the health sector to increase the effectiveness of data mining practices [48]. Data mining applications in health sector can be classified as medical diagnosis and determination of appropriate treatment period, classification, estimation of test results and medical product development applications. In terms of estimation and decision making, data mining techniques have a significant expansion in the medical sector [54] with regard to diverse diseases such as diabetes, heart disease, liver diseases, cancer and others. It is also frequently used in gene studies in the biomedical field. It is very difficult to find the genes that lead to diseases among thousands of genes. Sequence analysis and similarity search methods developed in data mining have made it easier to analyze on DNA data.

6.3 Telecommunication

Data mining has been successfully used in many issues such as quality improvement, fraud detection, error density estimation, customer acquisition and retention analysis in the field of telecommunications. One of the most important problems of the

telecommunication sector is loss of customers. If businesses can predict which customers will lose, they can develop strategies to hold these customers and organize low cost effective campaigns [50]. Telecommunication companies are faced with increasing competition to force existing pricing schemes to be aggressively marketed to protect existing customers and attract new innovations. Telecommunication companies carry out information discovery from the data they have acquired in order to retain customers and make strategic decisions. This information discovery [43];

Call Detail Record Analysis: Telecommunication companies accumulate detailed call records. Companies can develop attractive pricing and feature promotions by identifying customer segments with similar usage models.

Customer Loyalty: Some customers may want to change their service providers to take advantage of competing firms' attractive incentives. Companies can use data mining to determine the characteristics of customers who are likely to be loyal so companies focus on customers who will maximize their profits.

7 Conclusion

Technology is progressing rapidly and the power is increasing day by day. With the increase of computers' storage capacities, the number of information recording areas are also increasing. Hence the analysis of the available data and the consequence of these methods of data deduction are becoming increasingly important for decision makers. Data mining is now widely used in service sectors such as marketing, banking and insurance, as well as many field applications where decision making is required. Many applications can be made especially in the field of marketing such as determining customer buying habits, determining the relationships between customers' demographic characteristics, increasing campaign response rate, retaining existing customers and acquiring new customers, increasing customer satisfaction and reducing complaint numbers, facilitating market basket analysis, facilitating customer relationship management practices, making customer assessments, helping to make accurate sales forecasts, and conducting various customer analyzes. In this context, the use of data mining in the marketing field has a strategic importance. Using data, web, text and multimedia mining methods and techniques for marketers to make strategic decisions and forecasts for the future will help them to compete sustainably.

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