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The role of business intelligence in the analysis of customers' shopping carts to shape electronic marketing using data mining techniques

MohammadAli Azmoudeh[1], Maryam Hajiesmaeili[2], Mohsen Gharahkhani[3]

1- Master's student in Information Technology Management. Knowledge Management Department. Electronics Branch, Islamic Azad University, Tehran. Iran
2- Assistant Professor, Central Tehran Branch, Islamic Azad University. Tehran. Iran
3- Assistant Professor, Faculty of Finance and Accounting, Iranian Electronic Higher Education Institute, Tehran, Iran

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Abstract

The purpose of this study is to investigate the role of business intelligence in customer shopping cart analysis and its impact on shaping e-marketing in businesses. In this study, data mining methods in the field of online businesses have been used to analyze data related to 30,000 customers of online stores in Iran. Various algorithms, including K-means and multilayer perceptron neural network, have been used through SPSS MODELER software to cluster customers and analyze their behaviors. RFM criteria have been used to analyze customer shopping carts, and the results of the analysis have shown that the multilayer perceptron neural network has better performance than other algorithms and has provided high capabilities in accurate analysis of customer data. The final results show the clustering of customers into five groups with specific characteristics and optimized marketing strategies, emphasizing the role of business intelligence in improving e-marketing and intelligently responding to different customer needs.

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Corresponding Author: MohammadAli Azmoudeh | **Email:** mohammadaliazmoudeh@outlook.com

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Introduction

The penetration of the Internet in the marketing and e-commerce environment has greatly affected the entire business world. From the customer's perspective, a new and low-cost way of doing business has been created, and the globalization of trade, along with the reduction in the effectiveness of offline marketing, has prompted organizations to change their plans towards e-marketing. Therefore, customers have increasingly become fans of online transactions (Babai & Kalhor, 2017). Today, organizations must operate in a dynamic environment to maintain a competitive advantage because the lack of acceptance of change and lack of coordination with the environment can prevent them from achieving their goals. In order to meet their future needs, organizations must first have a precise understanding of their social and internal changes and developments, and secondly, feel the need for development. Understanding the relationship of an organization with its environment is not only a necessity, but also has an undeniable impact on the continuity of its activities due to its dynamic nature and the connection and interaction of information and energy. In general, the most influential environment of an organization is everything outside its borders, affected by political, economic, social, and cultural factors, and even the level of technology of the countries in which the organization operates (Hameti & Vojoudi, 2015).

In today's rapidly changing business environment, the need for useful business information for organizations is vital not only for success but also for survival. With the growth of the information technology industry and the acquisition of various experiences in the field of information collection, storage and retrieval, the issue of giving meaning to data and facilitating the decision-making process has simultaneously become the focus of attention of information technology experts and management and business science specialists. Business intelligence solution is a new technology that, after collecting, storing, cleaning, integrating, analyzing and retrieving information, makes the decision-making process easier for managers. In other words, business intelligence can be considered as a data refinery where the aggregation and integration of data will add value to the organization (Vamsi, 2017). The ability to collect, process, and analyze data for business management purposes, also known as business intelligence, is rapidly becoming a necessity for businesses. However, it is difficult for most organizations to reap the benefits of data analytics without specific tools and procedures (Hosseini & Pasadast, 2018).

Companies need to better understand the connections between satisfaction and loyalty in the online environment in order to allocate their online marketing efforts to satisfaction and loyalty programs. Brand evaluation is certainly possible on social media more than in other media. Customers in e-businesses share a lot of information with organizations, and analyzing this information using business intelligence tools can play an important role in improving e-businesses in various sectors, such as e-business marketing. The problem that the researcher seeks to answer in this study is to investigate the role of business intelligence in analyzing customer shopping carts and how it can lead to shaping e-marketing in businesses.

Theoretical Framework

Business Intelligence

Business intelligence is the ability of an organization to explain, plan, predict, solve problems, and learn in order to increase organizational knowledge, and therefore it is a solution that is responsible for converting data into information and knowledge needed by the organization for decision-making and actions. This knowledge may be about customers, competitors, other factors outside the organization, and the organization's internal environment. Customer knowledge has two basic concepts: first, collecting information that the organization needs to

know about the customer, and second, collecting information and insight that the organization needs to create strong relationships with the customer, both of which require proper management of customer knowledge (Akhgari et al., 2020).

Customer Relationships

The word CRM stands for Customer, Relationships, and Management. Here, we mean the customer, the end consumer, who plays a supporting role in value-creating relationships. Relationships are about creating more loyal and profitable customers through "learning relationships". Management, creativity, and leadership are the processes of customer-centric business and putting the customer at the center of an organization's processes and experiences. CRM is fundamentally driven by marketing and begins with an in-depth analysis of customer behavior. CRM is a continuous process that involves creating and applying market knowledge and intelligence to maintain a portfolio of customer relationships that is most productive (Shefiei et al., 2019).

Data Mining

Data mining is the process of discovering patterns, relationships, and hidden knowledge from big data using statistical techniques, machine learning, and artificial intelligence. Data mining is the analysis and discovery of large amounts of data in order to discover new, valid patterns, in order to understand the data. Data mining is the process of extracting hidden, understandable, and actionable information from large databases and using it in important business decisions (Sadaf & Yilmaz, 2019).

Azadikha (2022) stated in a study that implementing a method that can help each individual diagnose or prevent behavioral disorders can be considered an important step towards preventing and controlling these disorders, especially in their early stages. The results of the evaluations showed that the decision tree algorithm achieved higher accuracy compared to other algorithms with an accuracy of 99.16 percent. Also, by running the created models on each question of the 71-question Minnesota test, the effect of each question in the evaluation was determined.

Rahimi et al., (2021) in a study aimed at discovering the behavioral patterns of customers of a chain restaurant using data mining techniques stated that they achieved interesting results by analyzing 1.5 million customer records in five branches of a chain restaurant. In this study, first clustering was performed using the RFM method, and then data classification. The results helped identify loyal and profitable customers and ultimately led to improved restaurant profitability. One of the innovations of this study is the connection between clustering and data classification to extract customer behavioral rules

Research Methodology

This study is applicable in terms of purpose, and uses data mining analysis and business intelligence to identify hidden patterns in the shopping carts of customers of an Iranian online store. Data was collected from 30,000 customers and after preprocessing, data mining analyses were performed using IBM SPSS Modeler software.

Research Findings

The findings of this study show that online store customers are, by means of the K-means clustering algorithm, divided into five clusters, of which the third cluster has the largest number of customers and the first cluster covers the smallest number. Also, the results show that among the algorithms used, the multilayer perceptron neural network has the best performance, and high accuracy in data analysis has been achieved with Mean Precision and Mean Recall criteria of 0.745 and 0.72, respectively, and an overall accuracy of 99.9 percent.

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These results also emphasize that by using the RFM method, businesses can divide their customers into different clusters and optimize their marketing strategies based on the specific characteristics of each cluster.

Conclusion

The results of this study show that the multilayer perceptron (MLP) neural network algorithm performs better than other algorithms such as K-means and decision trees in analyzing the behavior of online store customers. The 99.9% accuracy of this algorithm shows that it can accurately simulate complex behavioral patterns and provide accurate predictions. Also, using the RFM model to cluster customers and focus on the specific characteristics of each cluster can help optimize marketing strategies and respond to diverse customer needs. Compared to previous studies, such as the study by Azadikha (2022) that used decision trees and achieved an accuracy of 99.16%, the multilayer perceptron neural network algorithm provides more accurate and stable performance. The study by Rahimi et al., (2021) also emphasizes the importance of data mining in restaurants, while the present study, using more advanced algorithms and analyzing data from a larger population, has been able to provide more accurate insights into online customer behavior. Also, the research of Aghazadeh et al., (2019) has combined the RFM model and data mining to increase customer loyalty, which is similar to the present study, but this study pays more attention to analyzing demographic characteristics and predicting the behavior of new customers. According to the results of the study, the following suggestions are made:

•Using a multilayer perceptron (MLP) neural network to analyze customer data.
•Using the RFM model for more accurate customer clustering and designing targeted advertising campaigns.
•Designing a marketing strategy tailored to each customer cluster.
•Special focus on attracting young and educated customers by designing products and advertisements suitable for this group.