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BIG DATA PROCESSING METHODS IN CONSUMER BEHAVIOR ANALYSIS

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МЕТОДЫ ОБРАБОТКИ БОЛЬШИХ ДАННЫХ ПРИ АНАЛИЗЕ ПОВЕДЕНИЯ ПОТРЕБИТЕЛЕЙ

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Abstract

This article examines modern big data processing methods applied to consumer behavior analysis. The primary focus is on machine learning and deep learning techniques for consumer segmentation, text data analysis, and result visualization. Advantages of using these methods in marketing research, such as increased prediction accuracy and cost optimization, are discussed. The challenges associated with data quality and the need for skilled professionals are also highlighted. It is concluded that applying big data processing methods allows companies to adapt marketing strategies and enhance customer service, providing a long-term competitive advantage.

Keywords: big data, consumer behavior, machine learning, segmentation, marketing.

Аннотация

В данной статье рассматриваются современные методы обработки больших данных, используемые для анализа потребительского поведения. Основное внимание уделяется применению машинного обучения и глубокого обучения для сегментации потребителей, анализа текстовых данных и визуализации результатов. Рассматриваются преимущества использования этих методов в маркетинговых исследованиях, такие как повышение точности прогнозов и оптимизация затрат. Также обсуждаются вызовы, связанные с качеством исходных данных и необходимостью высокой квалификации специалистов. Выявлено, что использование методов обработки больших данных позволяет компаниям адаптировать маркетинговые стратегии и улучшать клиентский сервис, обеспечивая долгосрочное конкурентное преимущество.

Ключевые слова: большие данные, потребительское поведение, машинное обучение, сегментация, маркетинг.

Introduction

Modern big data processing technologies play a crucial role in analyzing consumer behavior, providing companies with the ability to understand and predict customer preferences based on large volumes of heterogeneous information. Consumer data can include structured information, such as purchase history, as well as unstructured data from social networks, reviews, and other sources, making analysis particularly complex. As a result, it becomes essential for companies to apply advanced methods and algorithms that enable efficient processing of large datasets and the identification of patterns in consumer behavior.

Big data processing methods not only accelerate analysis processes but also provide more accurate forecasts through machine learning (ML) and deep learning (DL) algorithms. These technologies help uncover hidden relationships in data, predict user preferences, and adapt marketing

strategies to individual needs. For instance, ML algorithms can analyze textual data from social media, extracting keywords and sentiments associated with a particular product or brand.

The purpose of this article is to review the methods of big data processing used in analyzing consumer behavior and assess their effectiveness. The article will analyze modern approaches, including ML and DL, as well as techniques for data segmentation and clustering that help marketing specialists gain deeper insights into target audience behavior and make more informed business decisions.

Main part

Machine learning methods play a central role in processing and analyzing consumer data. One popular approach is to use clustering algorithms to segment users based on various characteristics, such as preferences, demographic data, and purchase frequency. For example, the K-means algorithm allows for partitioning data into clusters, grouping users with similar characteristics. Figure 1 shows an example of using clustering for consumer segmentation [1].

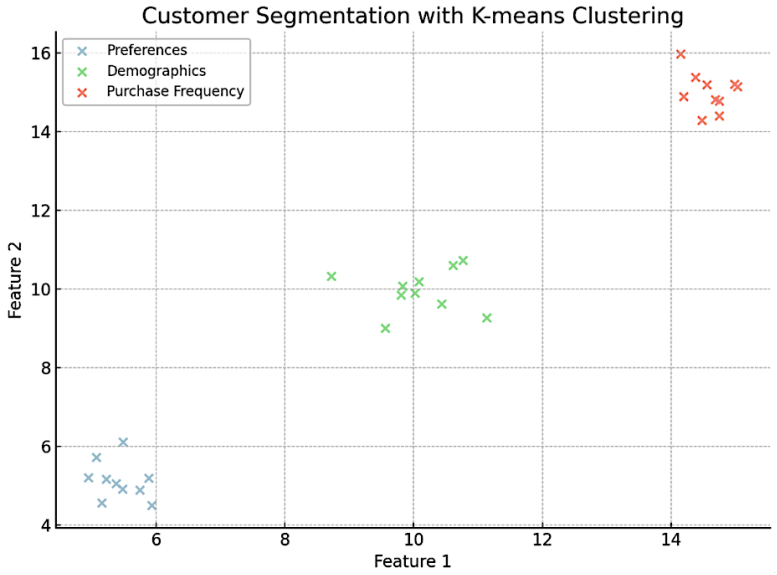

Figure 1. Consumer segmentation using K-means method

The figure illustrates the clustering process, where users are distributed into groups based on similar characteristics. Each group is highlighted in a specific color, allowing for a visual separation of consumers by preferences and other criteria. In addition to clustering, ML enables the application of text analysis methods for processing user reviews and comments. This includes algorithms such as topic modeling and sentiment analysis [2]. Topic modeling (e.g., the LDA algorithm) allows for identifying the main themes discussed in reviews, helping companies understand which aspects of products are most important to customers. Sentiment analysis, on the other hand, provides an assessment of the overall sentiment of the audience towards a product or brand.

Another data processing method is deep learning, which is especially effective for working with images and unstructured data. For instance, in analyzing consumer behavior, DL can be used for face and object recognition in photos, enabling the identification of user preferences. DL algorithms, such as convolutional neural networks, are employed in image analysis to uncover interests and preferences related to specific products or services.

A crucial stage in analyzing big data is the cleaning and preprocessing of information since data from different sources often contains errors, duplicates, and gaps. Processing methods include normalization and standardization of data, removing duplicate records, and filling in missing values. These actions are necessary to enhance the accuracy of ML and DL models, as the quality of the source data directly impacts the final analysis results [3].

To visualize data and present analysis results, a wide range of tools and methods is used. One approach is to create graphs and charts that visually represent the patterns discovered in the data. Table 1 shows the main stages of data analysis when applying ML and DL in marketing research.

Table 1 [4]

Stages of data analysis in marketing research using ML and DL

Stage	Description
Data collection	Obtaining data from various sources, such as social networks, CRM systems, online platforms
Data cleaning	Removing duplicate records, processing missing values
Data processing	Normalizing, standardizing data, and preparing it for analysis
Application of ML and DL	Using algorithms to identify patterns and segment consumers
Visualization and interpretation	Creating graphs and charts to present results

These methods and stages of data analysis enable companies to gain deeper insights into customer needs, improve product quality, and adapt marketing strategies based on data obtained from various sources [5-7].

Prospects for using big data processing methods in marketing

The use of big data processing methods provides marketers with the opportunity to more accurately tailor strategies and offer personalized solutions for each client. By analyzing vast amounts of data, companies can identify unique patterns in consumer behavior, anticipating their future needs. This not only enhances customer satisfaction but also increases business profitability through targeted offers and optimized advertising.

Another important aspect is optimizing marketing expenses. Machine learning and deep learning methods allow for predicting the effectiveness of various advertising channels, identifying the most productive strategies. Thus, companies can optimize their budgets by allocating resources to the most profitable market segments [8]. This is especially crucial in conditions of high competition and rapidly changing customer needs, where the accuracy of marketing decisions plays a key role.

Finally, the development of data processing technologies opens up prospects for a deeper understanding of the impact of external factors on consumer behavior. For example, algorithms can take into account seasonal fluctuations, economic changes, and social trends that affect demand. This enables companies to anticipate potential shifts in audience interests and adapt their offerings in advance, remaining competitive in the long term [9, 10].

Conclusion

Big data processing methods play a critically important role in analyzing and predicting consumer behavior, helping companies adapt their marketing strategies to changing audience preferences. The application of machine learning and deep learning technologies allows for uncovering hidden relationships and predicting future customer behavior, providing marketers with a significant advantage in a highly competitive environment. The results of data analysis help not only to better understand customer needs but also to optimize advertising costs.

Despite the clear advantages, the implementation of big data processing methods in marketing research requires significant resources and skills in working with analytical tools and algorithms. Additionally, the quality of the source data remains a determining factor for the successful application of machine learning and deep learning, as errors and gaps in the data can negatively affect the accuracy of results. However, with proper preparation and adherence to standards, companies can successfully leverage data to gain competitive advantages.

The use of big data methods to analyze consumer behavior represents a promising direction for marketing development. Further research in this area will contribute to the creation of more accurate and robust analysis models, allowing for a deeper exploration of customer behavior and the adaptation of offerings in line with their expectations.

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