UDC 004.65

METHODS OF BIG DATA ANALYSIS TO IMPROVE DECISION ACCURACY

Yunusov M.

*master's degree, Tashkent University of Information Technologies
named after Muhammad al-Khwarizmi (Tashkent, Uzbekistan)*

МЕТОДЫ АНАЛИЗА БОЛЬШИХ ДАННЫХ ДЛЯ ПОВЫШЕНИЯ ТОЧНОСТИ РЕШЕНИЙ

Юнусов М.

*магистр, Ташкентский университет информационных
технологий имени Мухаммада аль-Хорезми
(Ташкент, Узбекистан)*

Abstract

Big Data analysis has become an integral part of modern business and scientific research. This article explores various Big Data analysis methods that can enhance decision-making accuracy in sectors such as healthcare, finance, and e-commerce. Special attention is given to the use of machine learning, artificial intelligence, and blockchain-based approaches to improve analytics quality and develop more informed strategies. The article also discusses the challenges organizations face when integrating these technologies into existing decision-making frameworks. A comparative analysis of traditional data analysis methods and Big Data techniques is presented, along with real-world examples of their successful applications. This provides a deeper understanding of how data analysis technologies can improve decision accuracy and responsiveness across different industries.

Keywords: Big Data analysis, machine learning, artificial intelligence, decision accuracy, data, blockchain.

Аннотация

Анализ больших данных (Big Data) стал неотъемлемой частью современного бизнеса и научных исследований. В статье рассматриваются различные методы анализа больших данных, которые могут быть использованы для повышения точности принятия решений в таких отраслях, как здравоохранение, финансы, и электронная коммерция. Особое внимание уделено использованию методов машинного обучения, искусственного интеллекта и блокчейн-технологий для улучшения качества аналитики и разработки более информированных стратегий. Также рассматриваются вызовы, с которыми сталкиваются организации при внедрении этих технологий в существующие системы принятия решений. В статье приводится сравнительный анализ традиционных методов анализа данных и методов Big Data, а также примеры успешного применения этих технологий в реальных отраслях. Это позволяет глубже понять, как технологии анализа данных могут улучшить точность и оперативность принятия решений в различных сферах.

Ключевые слова: анализ больших данных, машинное обучение, искусственный интеллект, точность принятия решений, данные, блокчейн.

Introduction

Big Data analysis has become an integral part of modern business and scientific research. With advancements in data processing technologies, along with the exponential growth in the volume of data being collected, organizations are faced with the challenge of improving decision-making

accuracy. In recent years, the use of Big Data analysis methods has enabled more accurate predictions, enhanced responsiveness to changes in business environments, and increased operational efficiency. However, despite significant progress in this area, several issues remain regarding the selection of the most effective data analysis methods and their integration into existing decision-making systems.

The aim of this article is to explore various Big Data analysis methods that can be employed to enhance decision-making accuracy across different sectors. This study examines both traditional data processing techniques and emerging approaches, such as machine learning, artificial intelligence, and blockchain-based methods. Special attention is given to the effectiveness of these methods in improving the quality of analytics, as well as their real-world applications in industries such as healthcare, finance, and e-commerce. By reviewing the state of the art in Big Data analytics, this article provides insights into how these technologies can be leveraged for better decision outcomes.

Given the vast potential of Big Data in improving decision accuracy, the article will discuss both the theoretical underpinnings of these techniques and the practical challenges associated with their implementation. The objective is to highlight how businesses and organizations can utilize Big Data analysis not only to optimize their operations but also to create more informed, data-driven strategies. Through this, the article aims to contribute to a deeper understanding of the evolving role of Big Data in shaping the future of decision-making processes.

Main part

Big Data analysis is transforming decision-making processes by providing valuable insights derived from vast amounts of information [1]. These insights help organizations anticipate market trends, optimize resource allocation, and improve customer experience. Traditional data analysis techniques, such as statistical modeling and regression analysis, have been foundational in decision-making. However, as the volume and complexity of data grow, organizations are increasingly turning to more sophisticated approaches, such as machine learning and artificial intelligence. These techniques allow for the automation of decision-making processes and provide more precise predictions, ultimately improving the accuracy of decisions [2].

Machine learning, in particular, has shown great promise in enhancing decision accuracy. By applying algorithms to massive datasets, machine learning models can uncover patterns and trends that may not be immediately apparent through conventional analysis methods. These models are capable of learning from historical data and making real-time predictions, which is crucial for industries like finance, where market fluctuations demand quick and accurate decision-making. Furthermore, machine learning techniques, such as supervised learning, unsupervised learning, and deep learning, are continuously evolving to address the growing complexities of Big Data [3]. As these algorithms improve, they offer more reliable and scalable solutions for data-driven decision-making. Another emerging approach is the use of artificial intelligence, particularly in the form of neural networks and natural language processing, which enhances decision-making by analyzing unstructured data [4]. AI systems can process vast quantities of data at speeds far beyond human capability, enabling organizations to make quicker and more accurate decisions. AI-driven decision-making has been particularly beneficial in industries like healthcare, where it helps in diagnosing diseases, recommending treatments, and predicting patient outcomes. The integration of AI with Big Data analytics can significantly improve both the efficiency and the precision of decisions, making it a powerful tool for organizations seeking to stay competitive in the digital age.

Despite the potential advantages of these methods, implementing Big Data analysis solutions in decision-making processes is not without challenges. One significant barrier is the quality of data. Inaccurate, incomplete, or biased data can lead to erroneous conclusions and poor decision outcomes. Data preprocessing techniques, such as data cleaning and normalization, play a crucial role in ensuring the integrity of the data before it is analyzed [5]. Additionally, the integration of Big Data analytics into existing decision-making frameworks often requires substantial investments in infrastructure and specialized personnel. Organizations must be prepared to overcome these challenges to fully harness the power of Big Data for accurate decision-making.

A comparative analysis of traditional data analysis techniques and Big Data methods reveals key differences in their applications and effectiveness [6]. Traditional methods are typically more

limited in terms of data volume and complexity, while Big Data methods, such as machine learning and artificial intelligence, can handle much larger and more intricate datasets, offering greater precision and speed in decision-making. The table 1 summarizes these differences, providing a clearer picture of the advantages and challenges of each approach.

Table 1

Comparison of traditional data analysis and big data analysis techniques

Technique	Traditional data analysis	Big Data analysis
Data volume	Small to medium	Large to extremely large
Data complexity	Relatively simple	Highly complex and multidimensional
Processing time	Short	Long
Techniques used	Statistical analysis, regression	Machine learning, AI, NLP, Deep learning
Decision-making speed	Slower	Faster
Accuracy	Moderate to high	High, with proper data quality
Data sources	Structured, relatively homogeneous	Structured, semi-structured, unstructured
Application industry	Banking, manufacturing	Healthcare, E-commerce, finance, IoT
Real-time decision	Limited	Available with AI and ML

The table above highlights the fundamental differences between traditional data analysis methods and Big Data analysis techniques. As can be seen, Big Data methods excel in handling larger, more complex datasets, offering faster and more accurate decision-making. This is particularly important in industries like healthcare and e-commerce, where timely and precise decisions are crucial [7]. Moreover, the integration of AI and machine learning algorithms allows Big Data methods to operate in real-time, whereas traditional methods often fall short in fast-paced environments.

The figure 1 below illustrates the typical framework used for Big Data analysis. The framework begins with data collection from various sources, followed by the preprocessing stage, where data is cleaned and normalized. The analysis stage then applies machine learning models or AI algorithms to extract valuable insights.
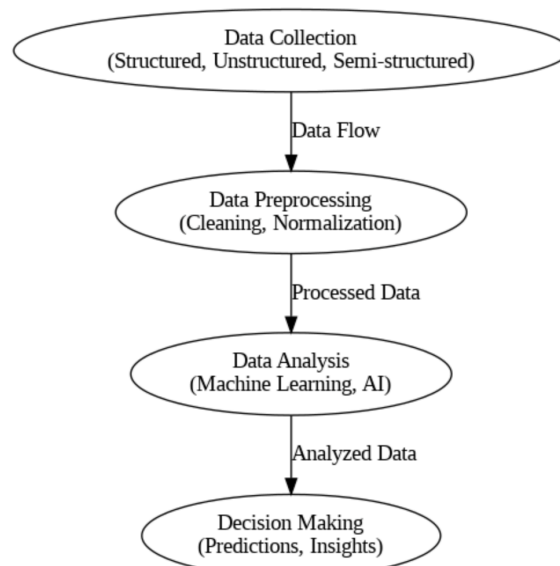

Figure 1. Overview of Big Data analysis framework

Figure 1 illustrates a step-by-step breakdown of the Big Data analysis framework. The data collection process is a crucial first step, as it ensures that the right information is gathered from a variety of sources. Preprocessing plays an equally important role in improving the quality of data by removing noise and inconsistencies. The machine learning and AI techniques applied during the

analysis phase allow for advanced pattern recognition and predictive analytics, which ultimately enable better decision-making outcomes.

By examining the stages outlined in the framework, it becomes clear that Big Data analysis is a continuous process that involves constant iteration and refinement [8]. As organizations adapt to rapidly changing market conditions, the insights generated by this process can help them stay ahead of the competition and make decisions that are not only timely but also highly accurate.

Application of Big Data methods to enhance decision-making accuracy across industries

Big Data analysis has a broad range of applications across various industries, with each sector leveraging specific methods to improve decision-making accuracy. In the **healthcare sector**, ML and AI are widely used for disease diagnosis, treatment outcome prediction, and optimizing medical processes [9]. These methods enable the analysis of vast amounts of medical data, such as images, genetic information, and electronic health records, leading to more accurate and timely decision-making by healthcare professionals.

In the **financial sector**, Big Data significantly enhances predictions and automates decision-making processes. By analyzing large datasets, financial institutions can evaluate risks in real-time, predict market fluctuations, and detect fraudulent transactions. These capabilities allow companies and investors to make more informed and timely decisions in a rapidly changing financial landscape.

Similarly, in **e-commerce**, Big Data plays a crucial role in customer behavior analysis and personalization. Companies can use Big Data tools to track customer preferences, analyze purchasing trends, and predict future demands. This allows e-commerce businesses to optimize their marketing strategies, offer personalized product recommendations, and enhance the overall customer experience [10].

Another key area where Big Data methods are improving decision accuracy is in **supply chain management**. By analyzing data from various sources – such as inventory systems, weather forecasts, and real-time shipping data – companies can better predict demand, optimize inventory levels, and streamline logistics. This leads to more efficient supply chain operations and helps businesses avoid stockouts or overstocking, which can lead to significant financial losses.

To illustrate these applications, the following figure 2 shows the industries where Big Data methods have been successfully implemented and the corresponding decision-making improvements.
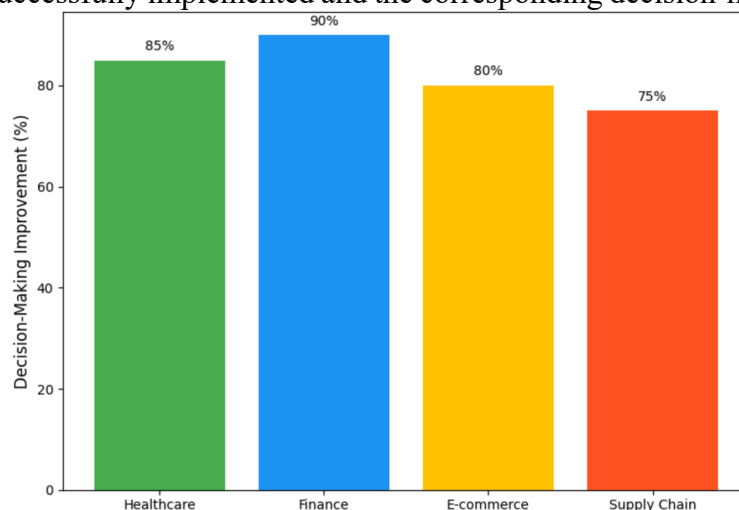

Figure 2. Big Data applications across industries

Figure 2 illustrates the diverse applications of Big Data methods across key industries and their impact on decision-making accuracy. As depicted, industries such as healthcare and finance have achieved significant improvements in decision-making capabilities due to the ability to analyze large volumes of complex data. For example, in healthcare, the integration of Big Data analytics has enabled more accurate disease diagnosis, treatment recommendations, and improved patient outcomes, all of which are crucial for better healthcare delivery [11].

In contrast, sectors like e-commerce and supply chain management have benefited from enhanced operational efficiencies, such as optimized inventory management and personalized customer experiences. In e-commerce, the use of Big Data allows businesses to tailor marketing

strategies, predict customer behavior, and provide real-time recommendations, which ultimately boost sales and customer satisfaction. Similarly, supply chain companies can leverage real-time data analytics to forecast demand more accurately, ensuring efficient stock management and timely deliveries.

Conclusion

Big Data analysis is transforming decision-making processes across various industries, offering the potential for more accurate and timely decisions. Through the application of advanced techniques such as machine learning, artificial intelligence, and deep learning, organizations can process vast amounts of data to uncover valuable insights. These insights can significantly improve operational efficiency, customer satisfaction, and strategic decision-making. However, despite the numerous benefits, challenges remain in integrating Big Data solutions into existing decision-making frameworks. Organizations must invest in robust infrastructure, ensure data quality, and address the complexity of data preprocessing. The successful implementation of Big Data methods requires a comprehensive understanding of both technological tools and the domain-specific requirements of each industry. In conclusion, Big Data analysis holds immense potential for revolutionizing decision-making. As organizations continue to leverage these methods, they can unlock more accurate, data-driven strategies that not only optimize operations but also provide a competitive advantage in an increasingly data-driven world.

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