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Big data & ML in contemporary education

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Introduction. In the context of digitalization and globalization, education is experiencing significant transformations that demand new approaches to teaching, learning, and administration. Conventional methods often cannot adequately address the complexity of educational processes, the variety of learners' needs, and the rising expectations for quality and adaptability. Big Data technologies provide a powerful framework for tackling these challenges by enabling the collection, integration, and analysis of vast and diverse datasets [1], [2]. Through advanced analytics, Big Data supports the identification of hidden correlations, forecasting performance, and the development of personalized and flexible models [3], [4]. In addition, it drives educational innovation, supports research activities, and strengthens institutional competitiveness in a knowledge-driven economy. Consequently, the application of Big Data in education signifies not only the adoption of a modern technological tool but also a shift in educational philosophy, where data-driven insights become the foundation for effective knowledge management and progressive pedagogical practices.

As stated above, the modern education system is in a state of rapid digital transformation, which requires the use of innovative methods of analysis and management of educational processes. The growing volumes of information created by students, teachers and educational platforms create the need to use Big Data for effective analysis and making informed decisions. Machine learning methods, both classical [5], [6] and based on neural networks [7], [8], allow processing this data, predicting results, assessing effectiveness and creating personalized trajectories of nf proposals. The

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integration of Big Data with various machine learning approaches opens up new prospects for increasing the adaptability and competitiveness of the modern economy and public administration within the framework of the further creation of appropriate knowledge-based & data-driven artificial intelligence systems [9], [10].

Main Part. The modern educational space is evolving in the context of digital transformation, global competition, and the need to constantly adapt to dynamic changes. Classic methods of administering and organizing the educational process are increasingly proving insufficient for analyzing and forecasting trends. In this reality, Big Data and neural network learning technologies are becoming crucial, opening up new opportunities in education. Processing massive amounts of information obtained from electronic systems, online platforms, testing, social media, and scientific resources allows us to create more accurate predictive models of student behavior, evaluate academic performance, and tailor educational programs to individual student needs. Now we structure the main scientific and practical recommendations within the framework of the following topics:

1. Individualization of the educational process. Neural networks trained on large-scale data sets create personalized learning paths that take into account the abilities, interests, and cognitive characteristics of students.

2. Prediction of academic success. The combination of Big Data and machine intelligence makes it possible to predict outcomes, identify the risks of academic failure, and propose preventative measures.

3. Analysis of educational activities. Neural network models provide comprehensive analysis of large data sets, allowing educational institution management to make tactical and strategic decisions based on objective data.

4. Innovation and competitive advantages. The use of Big Data and ANN technologies creates an innovative educational ecosystem, enhancing the competitiveness of educational institutions in the global market.

Conclusions.

1. In conclusion, Big Data has become a decisive factor in reshaping contemporary education, offering new opportunities for personalization, optimization, and evidence-based governance. Its integration allows educators to predict risks, adapt curricula, and design individualized learning pathways, while administrators can utilize analytics

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to improve decision-making and ensure institutional resilience. On a broader scale, Big Data contributes to building more innovative, transparent, and competitive educational ecosystems capable of responding to global challenges. Thus, adopting Big Data in the educational sector is not simply a technological improvement, but a strategic necessity for ensuring flexibility, sustainability, and excellence in the educational systems of the future.

2. Big data in combination with classical and neural network machine learning algorithms are becoming a key resource for the modernization of modern education. They provide effective analysis of large volumes of information, prediction of learning outcomes, adaptation of educational programs and optimization of management decisions. The use of these technologies contributes to increasing the personalization, flexibility and effectiveness of the educational process, and also strengthens the competitive position of educational institutions in the global educational environment. Thus, the integration of Big Data and machine learning creates the basis for building an adaptive, innovative and sustainable management system through the creation of specialized artificial intelligence systems [11], [12].

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