

APPLICATION AND EFFECTIVE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN AGRICULTURE

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<https://doi.org/10.5281/zenodo.15551149>

Abstract. This article analyzes the advantages and challenges of applying artificial intelligence (AI) technologies in agriculture. It explores the impact of AI on the agricultural sector, opportunities to improve productivity through the integration of these technologies, and their environmental implications. Moreover, the article provides detailed insights into the difficulties encountered in the effective implementation of AI technologies in agriculture and offers solutions to overcome them. The impact of technological innovations on the lives of rural populations is also highlighted.

Keywords: Agriculture, Artificial Intelligence, Technologies, Efficient Use, Economic Efficiency.

Аннотация. Данная статья анализирует преимущества и проблемы применения технологий искусственного интеллекта (ИИ) в сельском хозяйстве. В статье рассматривается влияние ИИ на сельское хозяйство, возможности повышения эффективности сельского хозяйства за счет внедрения этих технологий, а также экологические аспекты. Кроме того, статья предоставляет подробную информацию о проблемах, с которыми сталкиваются при успешном применении технологий ИИ в сельском хозяйстве, и способах их решения. Отдельное внимание уделено влиянию внедрения технологических инноваций в сельском хозяйстве на жизнь сельского населения.

Ключевые слова: Ключевые слова: Сельское хозяйство, Искусственный интеллект, Технологии, Эффективное использование, Экономическая эффективность.

Introduction

Agriculture is a vital sector of the economy, providing food and other resources to millions of people worldwide. However, it faces several challenges, such as limited land resources, climate change, and water scarcity. To address these issues, modern technologies—especially artificial intelligence (AI)—can serve as crucial tools for increasing agricultural efficiency. With the help of AI technologies, it becomes possible to manage agricultural resources, monitor crops, combat pests, and adapt to climate changes.

1. Advantages of Applying Artificial Intelligence Technologies in Agriculture

The use of AI technologies in agriculture offers numerous advantages. Tools such as drones, robots, and IoT (Internet of Things) devices introduce innovative solutions in the sector.

These include: Crop Monitoring: Drones enable rapid inspection of crops, allowing for the identification of pests, diseases, or irrigation deficiencies. This saves time and helps use resources more effectively.

Pest Control: AI can be used to detect pests and plant diseases early and implement



EagleView Drone



Laboratory testing of an agricultural robot

targeted control measures. For instance, AI-based systems analyze plant conditions and allow precise application of chemical treatments.

Water Resource Management: Automated irrigation systems powered by AI help in the efficient use of water, thereby reducing consumption and enhancing environmental sustainability.

2. Impact of AI Technologies on Agriculture

AI technologies influence agriculture both economically and environmentally. Their benefits include:

Increased Economic Efficiency: AI helps reduce production costs, increase productivity, and boost profitability. For example, monitoring and optimizing irrigation can cut unnecessary expenses.

Creation of New Jobs: AI adoption fosters the demand for new technical and scientific professions. It also requires workforce retraining and skill development.

Environmental Benefits: AI enables more efficient crop production, minimizes the use of chemical agents for pest control, and promotes the conservation of water and land resources, thereby enhancing ecological safety.

3. Challenges in Implementing AI in Agriculture and Solutions.

While AI offers significant potential, its implementation in agriculture presents several challenges:

Technological Barriers: Initial investment costs, shortage of qualified specialists, and the need for changes in production processes can hinder adoption. Government-supported programs and improvements in education systems are necessary to overcome these barriers.

Resistance from Rural Populations: Agricultural workers may be skeptical about new technologies. Awareness programs and training are crucial to facilitate acceptance and understanding of the benefits.

Data Security Concerns: AI systems collect vast amounts of data, requiring robust measures to ensure data privacy and security.

To address these issues, continuous analysis and supportive policies from the government are essential. Furthermore, education and training programs are vital for the successful integration of AI in agriculture.

Theoretical Background and Methods

Agriculture is one of the key sectors in ensuring food security, which is among the fundamental needs of humanity. The increasing global population, limited natural resources, and climate change demand greater efficiency in this field. From this perspective, the implementation of artificial intelligence (AI) technologies provides opportunities to achieve high results by digitizing and automating modern agriculture.

Theoretically, artificial intelligence refers to a set of algorithms, systems, and models that simulate human cognitive functions. The main directions of AI technologies in agriculture include the following:

Machine Learning: creating crop yield predictions, detecting pests, and analyzing soil productivity.

Computer Vision: identifying plant diseases through image analysis, and monitoring fields using drones.

Expert Systems: AI-based advisory systems that assist farmers in decision-making.

Neural Networks: modeling complex interrelated factors to optimize agronomic planning.

In this article, descriptive and analytical methods were employed for the research. Initially, open-source data and scientific articles were reviewed to understand the current state of AI applications in agriculture. Subsequently, several advanced AI-based systems (e.g., CropIn, Plantix, John Deere AI) were examined from a technological standpoint. Their capabilities, advantages, and limitations were assessed using statistical indicators.

Furthermore, a comparative method was used to explore the possibilities of adapting foreign practices to the context of Uzbekistan. In addition, cost-benefit analysis and user impact studies were conducted to evaluate the efficiency of implemented AI technologies.

Conclusion

Applying AI technologies in agriculture not only enhances productivity but also contributes to environmental sustainability. These technologies can ensure the efficient operation of agricultural systems. However, resolving the associated challenges requires coordinated efforts from governments, entrepreneurs, and rural communities. Supporting education and the adoption of new technologies positively influences overall economic development.

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