

Role and Application of Artificial Intelligence in Agriculture

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Abstract

Artificial intelligence operates on the principle that human intelligence can be replicated by computers to perform various tasks. Agriculture, a key sector in any nation's economy, now requires technology more urgently than fertilizers due to population growth, food quality standards, and environmental factors. AI is the optimal technological solution to address the challenges posed by a growing population and a changing climate. In agriculture, AI helps solve practical problems by saving time and reducing labour-intensive tasks. It aids in pest management, data organization, healthier crop production, and workload reduction, among other functions. Advanced solutions such as robotics, smartphone applications, and imaging technology are vital in meeting these needs. Many companies are working to advance agricultural technology to protect crop yields from environmental changes and population growth, and to introduce automation. These AI-driven innovations have also created numerous job opportunities. AI technologies foster industry competition, and the agricultural sector is gradually adopting AI. By helping farmers automate operations and adopt precise harvesting techniques, AI in agriculture can achieve higher yields and better quality with fewer resources.

Key words: Artificial intelligence, smartphone applications, Agriculture, harvesting techniques

Introduction

With the global population projected to reach 10 billion by 2050, the agricultural sector faces immense pressure to boost crop production and maximize yields. To combat potential food shortages, two main strategies have emerged: expanding land use and large-scale farming, or adopting innovative practices and leveraging technology to enhance productivity on existing farmland. Agriculture has

been the backbone of human civilization for millennia, providing sustenance and driving economic development. In contrast, AI only emerged a few decades ago. Yet, innovation is sweeping across every industry, including agriculture. Recent advancements in agricultural technology have revolutionized farming practices, addressing global challenges like climate change, population growth, and resource scarcity. AI, in particular, is proving essential in overcoming these challenges and mitigating the drawbacks of traditional farming.

Applications of artificial intelligence in agriculture

Traditional farming relies on numerous manual processes, but implementing AI models offers significant advantages. By integrating with existing technologies, an intelligent agriculture system can streamline many tasks. AI can gather and analyze big data, determining and executing the optimal actions. Here are some common use cases for AI in agriculture:

Optimizing automated irrigation systems

When integrated with IoT sensors that monitor soil moisture and weather conditions, algorithms can determine in real-time the precise amount of water crops need. Autonomous crop irrigation systems are designed to conserve water and promote sustainable agriculture. In smart greenhouses, AI optimizes plant growth by automatically adjusting temperature, humidity, and light levels based on real-time data.

Identifying leaks or damage in irrigation systems

AI is essential for detecting leaks in irrigation systems. By analysing data, algorithms can spot patterns and anomalies that suggest leaks. Machine learning models can be trained to identify specific leak indicators, such as changes in water flow or pressure. Real-time monitoring and analysis allow for early detection, preventing water waste and potential crop damage.

Crop and soil monitoring

Computer vision models can monitor soil conditions to collect precise data for combating crop diseases. This data on plant science is then used to assess crop health, predict yields, and identify specific issues. Sensors detect plant growth conditions, triggering AI systems to automatically adjust the environment as needed.

Smart pesticide application

AI-powered drones offer the benefits of both approaches while circumventing their limitations. By employing computer vision, drones can calculate the precise amount of pesticide needed for each area. Although still in its early stages, this technology is quickly advancing in accuracy.

Yield mapping

Utilizing ML algorithms, processes extensive datasets in real time to offer insights into crop patterns and characteristics, aiding farmers in improved planning. Integrating 3D mapping, sensor data, and drone technology allows for predicting soil yields for specific crops. Collected across multiple drone flights, this data facilitates increasingly accurate analysis through algorithmic processing.

Refining harvested produce

AI isn't just valuable for identifying issues with crops during their growth; it's also beneficial post-harvest. While most sorting tasks are typically manual, AI excels in accurately sorting produce. Using computer vision, AI can spot pests and diseases in harvested crops and grade produce based on attributes like shape, size, and colour. This allows farmers to efficiently categorize produce for different customers, potentially fetching varying prices. In contrast, traditional manual sorting methods are laborious and time-consuming.

Role of Artificial Intelligence

1. Risk management is improved through predictive analytics in farming processes.
2. AI leverages plant growth data to advise on crops resilient to extreme weather, diseases, or pests.
3. AI algorithms analyze soil samples to identify nutrient deficiencies and predict crop diseases.

4. AI in irrigation optimizes patterns and nutrient application, predicting the best agronomic product mix.
5. AI enhances crop yields and predicts optimal harvest times.

What is the future of AI in agriculture?

AI will undoubtedly have a growing impact on agriculture and food sustainability in the years ahead, continuing the tradition of technological advancements that have continuously improved farming efficiency and mitigated challenges.

The undeniable benefits of AI in agriculture are evident in its ability to streamline repetitive tasks, freeing up human labour for more strategic operations. The combination of affordable computer vision and agricultural robotics is poised to accelerate AI adoption in farming, promising improvements in efficiency, sustainability, resource management, and real-time monitoring for better-quality produce.

However, integrating AI into agriculture requires industry-wide changes. Farmers must be educated and trained to leverage AI-powered solutions effectively, shifting their roles from manual labours to smart agricultural system planners and overseers. This transformation also necessitates a robust technology infrastructure and collaboration with expert software development teams to maximize AI's potential benefits.

While AI and machine learning have the potential to revolutionize farming, they must work alongside other technologies in a synchronized manner. AgTech providers play a crucial role in enhancing tools, addressing challenges, and communicating the tangible benefits of AI and machine learning. With concerted efforts, the future of AI in agriculture promises to be prosperous and sustainable.

Conclusion

In AI and IoT Agriculture is considered important for human survival. Supporting current traditional agricultural practices with the latest AI technology can improve performance, quality and productivity capacity. In addition, it has identified intelligent, sustainable agricultural sectors, namely human resources; plants; weather; soil; insects;

pregnancy; agricultural products; irrigation; livestock; equipment; and fields. AI technology helps farmers to analyze soil/ soil/ plant life etc. and save time and allow farmers to plant the right crops in each season with the best yields. Direct planting can reduce water use, use land efficiently, and can be planted in urban areas on buildings. It can reduce the problems of unemployment. Allows predictions for next year's crop seasons/ weather/ weather/ rain etc. AI-based forecasts allow pesticide/ crop/ crop suggestion in the right place at the right time before major disease outbreaks occur. With so much untapped space in agriculture to intervene with automated response systems, there is a great opportunity for the agricultural industry to use emerging catboat technology to assist farmers with answers to all their questions and to provide appropriate advice and recommendations in their specific ideas. Farm-related problems. This encourages the growth of the AI market in agriculture.

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