

Applications of Artificial Intelligence in Agriculture Production

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ARTICLE ID: 06

Abstract:

The agricultural industry is using artificial intelligence (AI) technology to improve various food supply chain management tasks, monitor soil and growth conditions, control pests, grow better crops, and analyze data for farmers. With the use of AI, farmers can select the best seed for a given weather scenario, produce more with fewer resources, improve crop quality, and accelerate the time it takes for their products to reach consumers. AI and machine learning (ML) have revolutionized several industries, and the agricultural sector is the next to feel the impact of this trend. Businesses are creating several technologies to facilitate farmers' crop and soil health monitoring. The top AI-based tools for ensuring crop health are hyperspectral imaging and 3D laser scanning. This artificial intelligence (AI) driven solutions gather more accurate and detailed crop health data for study.

Keywords: Artificial intelligence, Healthier crops, Machine learning,

Introduction:

The need for food and jobs is rising due to the world's population growth. Because farmers' traditional methods are insufficient to satisfy food requirements while also creating jobs for billions of people globally, new automated methods are being created to meet these demands. A lack of manpower, tighter regulations, a growing world population, and a diminishing number of farms are forcing farmers to look for new solutions. Nearly every sector is impacted by technologies like the Internet of Things, Big Data & Analytics, Artificial Intelligence (AI), and Machine Learning (ML). In order to boost product pricing and decrease



waste, farmers need to precisely identify and categorize crop quality aspects. AI and ML-based surveillance systems in agriculture offer insights to track crops, identify pests, and identify soil imperfections, enabling farmers to sow seeds at the best possible time for optimum yield. Many agricultural operations are threatened by weeds. They suffocate pastures, invade crops, reduce agricultural productivity, and, in rare instances, put animals in risk. AI sensors are able to identify locations where weeds are present and identify the most effective pesticide to apply there. Artificial intelligence (AI) can predict weather patterns, evaluate crop health, and find pests, illnesses, or undernourished plants.

Artificial Intelligence

Artificial intelligence is an interdisciplinary field of research that attempts to imitate human intelligence in robots by modeling human behaviors and cognition, such as problem-solving and learning. AI technology is currently being used by research scientists and extension workers to address issues related to agricultural production. Digital agriculture is unimaginable, despite the fact AI systems and machine learning skills have significantly increased production in other industries. Unexpectedly, agriculture and artificial intelligence (AI) are closely related. Its basic tenet is that the human brain may be encapsulated in a form that simplifies machine replication and job execution for any size of operation. Perception, thinking, and learning are among AI's goals. Artificial intelligence is an interdisciplinary branch of study that models human behaviors and cognition, such as learning and problem-solving, in an effort to replicate human intelligence in machines. Research experts and extension agents are currently using AI technology to address difficulties pertaining to agricultural output. Digital agriculture is unimaginable, despite the fact AI systems and machine learning skills have significantly increased production in other industries. Unexpectedly, agriculture and artificial intelligence (AI) are closely related. Its basic tenet is that the human brain may be encapsulated in a form that simplifies machine replication and job execution for any size of operation. Perception, thinking, and learning are among AI's goals.

Artificial Intelligence applications in agriculture

- 1. Prediction of weather:** The use of AI technology simplifies the critical issues of weather forecast and other agricultural elements like crop cycle, groundwater, soil quality, and plant disease detection. Crop health can be tracked using multispectral photos taken by satellites or drones, as well as sensors in plants and soil. Using this data, AI systems are able to



determine whether or not more sophisticated unsupervised machine learning methods are being applied. Artificial Intelligence (AI) in agriculture makes use of data and devices such as smart drones, autonomous tractors, soil sensors, and other technology to help farmers become more productive. The majority of agricultural startups are using AI-enabled strategies to boost agricultural output efficiency, a shift that has altered the overall performance of farming operations due to the industry's rapid adoption of AI.

2. **Allowing farmers to achieve efficient results:** Artificial Intelligence (AI) has the potential to revolutionize agriculture by providing farmers with greater benefits and enabling them to produce more with less work. AI could be useful in agriculture when it transitions from traditional to creative farming. Growth-driven crops are covered by AI through cognitive IoT, which also includes imaging, soil testing, remote sensing, and proximity and proximity sensing. AI will be able to comprehend, remember, and learn from vast amounts of data with ease, allowing it to respond to it in a way that optimizes efficiency. AI can provide insightful analysis of cognitive IoT data to boost crop productivity. Hardware solutions combine robotics and data collection software to prepare the best fertilizer for certain crops in order to increase production.
3. **Help yield healthier crop:** Farmers can predict what kind of crop may be cultivated and when to plant seeds by combining weather forecasts with artificial intelligence (AI) to analyze meteorological conditions. By streamlining the crop selection process, AI can assist farmers in determining which crops will bring in the most money. Farmers can prevent errors in business operations and lower the probability of crop failure by utilizing forecasting and predictive analytics. By gathering information on plant growth, artificial intelligence (AI) can assist in the production of crops that are more resistant to disease and climate change. Artificial intelligence systems can do chemical analyses of soil and produce precise estimates of the nutrients that are deficient.
4. **Predict plant diseases:** Farmers can predict what kind of crop may be cultivated and when to plant seeds by combining weather forecasts with artificial intelligence (AI) to analyze meteorological conditions. By streamlining the crop selection process, AI can assist farmers in determining which crops will bring in the most money. Farmers can prevent errors in business operations and lower the probability of crop failure by utilizing forecasting and predictive analytics. By gathering information on plant growth, artificial intelligence (AI)



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5. **Improve decision making:** AI technologies are increasingly being used in the agriculture industry to enhance decision-making. The greater use of sensors, quicker access to satellite images, less expensive data loggers, expanded usage of drones, and easier access to data archives are a few examples of industrial advancements that have made irrigation possible. By understanding historical weather trends and soil quality, machine learning can offer valuable insights into how to increase total production. Data on soil conditions, water use, local temperature, and other farm-related elements can be assessed to help make better agricultural decisions.
6. **Crop and soil monitoring:** Drones, the Internet of Things, and field satellite images can all collect data, which AI-based apps can then track and analyze to identify the best solutions. Applications of AI aid in our understanding of plant pests, diseases, and bad soil. Algorithms for machine learning make data analysis easy and fast. Farmers may find applications for mobile agriculture helpful in assessing crop data, monitoring their operations, monitoring weather trends, and operating their farms more profitably.
7. **Identifying locations for sowing specific crops:** Artificial intelligence (AI) may assist agricultural workers in selecting the best locations for crops based on the topography of the region, the composition of the soil, or any other criterion by evaluating images captured by drones. The current crops and seed quality will be determined using a supervised machine learning system. Using robotics, machine learning, and computer vision, farmers utilize AI to manage weeds. AI is used to gather data in order to monitor the weed. This makes it possible for farmers to squirt them with chemicals. AI is becoming more popular in a variety of scientific domains. The primary objective is to develop flexible and precise models that will automate the prediction of extremely complicated processes in order to identify a crucial objective.
8. **Provide proper guidance on water management:** Applications that give farmers the best guidance on bug infestations, crop rotation, water management, timely harvesting, and other subjects are the result of using AI in agriculture. We can assess agricultural



sustainability, control nutrition, and predict weather patterns with machine learning algorithms and images from satellites and drones.

- 9. Detect the smallest insects:** Artificial intelligence algorithms find tiny insects. Farmers may take the appropriate safeguards because notifications are provided straight to their smartphones when an incursion is detected. AI is a more productive way to grow, harvest, and market important crops in agriculture. Using AI-powered farming techniques can help farmers adapt to climate change in a strategic way. To increase agricultural health and productivity, artificial intelligence (AI) focuses on examining faulty crops and identifying pests. The use of technology is helping to improve crop management techniques. By employing less resources, farmers can boost crop productivity without sacrificing quality. Artificial Intelligence (AI) technology expedites the food transformation process by automating manual labor and reducing labor challenges. Big data, AI, and ML can be used to build models that identify pests and illnesses and provide real-time analysis to improve crop health.
- 10. Increase agricultural yield and productivity:** The productivity and yield of agriculture can be raised by using AI technology. In agriculture, artificial intelligence (AI) technology can help with supply chain management, better crop production, soil monitoring, insect control, and data analysis. In order to safeguard crops, farmers eliminate undesired plants and pests at this point. Weed killers and pesticides are in use. Utilizing machine learning (ML), farmers can examine vast quantities of field data to gain insights into crop performance over time and the emergence of novel traits.
- 11. Helps crop cultivation and harvesting:** Drones and robots developed using AI help farmers cultivate and harvest crops. Field efficiency is increased by crop management, weed control, and targeted irrigation. Early problem detection in the field is aided by predictive analysis. Early detection helps organizations and farmers identify the problem and avoid serious crop loss or damage. Artificial intelligence can be used to anticipate drought or flood situations. This technology helps with the analysis of the field's weedicide and pesticide requirements. AI software helps identify plant health problems and pest infestations. Additionally, it lessens the usage of pesticides and herbicides in particular fields and enhances the preservation of soil fertility. AI also helps with crop monitoring and field application of pesticides and weedicides.

12. Increase farmer profitability: AI helps farmers become more profitable and increases food production. One of the biggest dangers to crop health is pests. Thankfully, AI systems are able to identify insects that land on crops by utilizing satellite photography. The location of the pest can then be sent to farmers via smartphone alerts from AI. Then, farmers can take prompt action to get rid of pests and protect their crops. AI will enable farmers to grow more crops with less water. It is crucial in drought-prone areas since it saves farmers money on resources. Workers also frequently worry that AI will eventually replace them. Digital agents and AI are probably going to be in high demand in the future. It's not predicted that AI will create more employment than it will destroy.

13. Improve agricultural efficiency: In an effort to increase agricultural productivity, numerous agrotech and agricultural companies are creating gadgets that combine AI models with sensor fusion to find the best harvestable produce and help choose it. Thanks to AI and ML algorithms, video analytics is advancing quickly and helping to secure remote locations like fields and yields. Drone and ground-based sensors' infrared camera data could be used to track the health of plants. Indeed, artificial intelligence has captivated every business, even agriculture. It is opening up new opportunities for farmers and other agriculture industry players to develop and flourish. In the near future, farmers who were searching for tractor components will be searching for AI robots to assist them in running their farms.

Conclusion:

Artificial intelligence (AI)-enabled technologies use information such as temperature, precipitation, wind speed, and solar radiation along with machine learning (ML) algorithms and photos from satellites and drones to forecast weather patterns, assess crop sustainability, and assess farms for pests, diseases, and poor plant nutrition. Herbicide use is so reduced, harvest quality is enhanced, revenues rise, and considerable cost savings are realized. AI technologies gather data on irrigation systems required for the fields as well as high-resolution aerial photos. AI helps find problems with the soil, like leaks and blockages. It rates and evaluates how poor the soil is; artificial intelligence helps to boost agricultural output.

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