Artificial Intelligence in Agriculture

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ABSTRACT

The increase in world's population and respective food demand has brought the global concern. The climate change alone has put a tremendous burden on the farming communities, and has become the major challenge to feed the burgeoning population. The traditional method of agricultural practices are not sufficient enough to meet the rising food demand. Thus, new automated/ AI systems have been introduced into the agriculture sector to ensure precision farming. These systems are quick in action, and satisfying the requirements along with generation of billions of employment worldwide. It has proven emerging technology in smart agriculture that increases the gain from soil precisely and strengthens the soil fertility also.

INTRODUCTION

Artificial Intelligence (AI) applications have emerged as a promising solution to enhance agricultural productivity (Goralski and Tan, 2022). AI powered techniques empower farmers to perform more tasks with fewer resources, improving crop quality and ensuring a speedy go-to-market strategy (Manonmani *et al*., 2024). These AI approaches mimic traits and behaviors comparable to human intelligence, enabling AI systems to reason, learn, and carry out critical agricultural tasks. (Masasi *et al*.,2024). The artificial intelligence aims at programming intelligence into machines by learning from

experiences and adapting to changes in the environment to simulate human decision making and reasoning processes. The machine learning (ML) a part of AI, could be programmed with a set of agricultural data to perform various farm operations without human interference, which enable to solve various complex tasks. Meanwhile, Al could not work until, a hardware-software interface is embedded, which processes these algorithms and logic-based concepts.

Artificial intelligence:

Artificial intelligence is a tool that mimics human intelligence and ability processes by machines, advanced computer systems, robots and digital equipment's. AI has many uses, including natural language processing (NLP) to understand spoken human language, computer vision to view analog-to-digital conversions like video, and speech recognition and expert systems to mimic judgement.

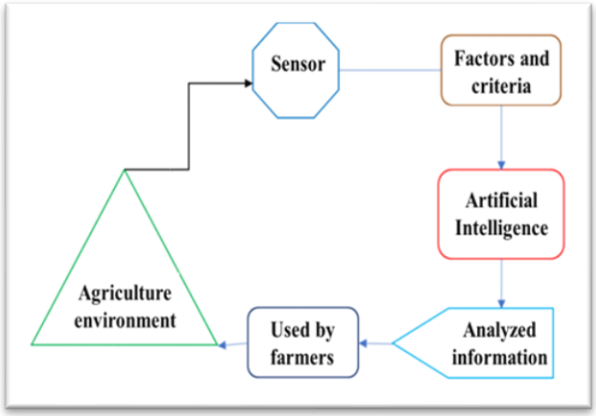

Fig 1. Illustration of significance of AI in agriculture

Why AI in Farm is Necessary?

To overcome from obstacles in traditional agriculture we have need to use some innovative techniques. The difficulties in cultivation are as follows when using conventional methods.

Decision making: When it comes to improved agriculture, traditionally we haven't been able to make wise decisions regarding the timing of sowing, crop variety selection based on field characteristics, irrigation timing, soil nutrient deficiency, spraying area, or dosage calculation.

Weather factors: Agriculture is highly susceptible to weather conditions, and accurate climate predictions are crucial for minimizing weather-related losses (Premachandra and Kumara, 2021).

Accuracy in data collection and analysis: It is impossible to gather accurate data on insect pests, diseases, and weeds without the use of cutting-edge technologies. We can decrease the amount and applications of pesticides by using accurate data for better crop production.

Labour challenges: It will be challenging to use enough labour for farm practices due to expensive labour costs. This issue immediately affects the income and output of the agricultural sector.

Applications of Artificial Intelligence in Agriculture: Artificial Intelligence (AI) applications have emerged as a promising solution to enhance agricultural productivity (Goralski and Tan, 2022)

Fig 2. Applications of Artificial Intelligence in Agriculture

Use of AI in Agriculture:

There are many approaches to leveraging AI to enhance efficiency and productivity in

agriculture. AI benefits farmers in a variety of ways, which are detailed below.

Crop Monitoring and Disease Detection

- ✓ Drones and Satellites: Watch fields from above to spot pests, diseases, or water problems early.
- ✓ Image Recognition: AI studies plant pictures to find issues and suggest fixes.

Precision Farming

- ✓ Smart Predictions: Use data about soil, weather, and also about crops to plan planting, watering, and harvesting.
- ✓ Sensors and IoT: Devices give live updates to use resources like water and fertilizer better.

Smart Irrigation

- ✓ Water Control: Machine learning algorithms have been shown to improve the accuracy of short-term weather predictions for agricultural planning, which is critical for making informed irrigation decisions and integrating weather forecasts into optimized crop management strategies (Javaid *et al*., 2023; Vandal *et al*., 2019).
- ✓ Automation: With the help of AI for agriculture we can start irrigation only when necessary. It will also lead to saving water and this is called smart irrigation technique.

Yield Prediction

- ✓ AI guesses how much crop farmers will get by studying past and current data. In addition, this also indicates that is why the role of AI in agriculture is important in today's world.

Weed and Pest Management

- ✓ Robots: AI-powered machines remove weeds without hurting crops.
- ✓ Pest Alerts: AI predicts pest problems to help farmers act in time.

Supply Chain Help

- ✓ Market Insights: AI predicts demand to avoid wasting crops.
- ✓ Transport Efficiency: AI plans storage and delivery to save time and money.

Climate Protection

- ✓ AI helps farmers deal with droughts, floods, or temperature changes better.

Livestock Care

- ✓ Health Monitoring: AI watches animals for signs of illness.
- ✓ Better Breeding: AI studies genetics to improve livestock quality.

CONCLUSION:

Artificial intelligence is an emerging field in agriculture. Automation of agricultural machineries and its key control through mobile application is enabling the users to cultivate crops in a sustainable way. Al as an interface making all the farming activities reliable and sustainable. The increase in crop production, efficient pest control, and automation in irrigation system and fertilizer application without human intervention has brought the farming to its next level.

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