



## Role of Artificial Intelligence in Agriculture: An Overview

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### Introduction:

The development of computer systems that can carry out tasks that traditionally require human intelligence is called artificial intelligence (AI). Artificial intelligence comprises several subfields and approaches, like machine learning, linguistic processing, computer vision, robotics, specialized systems and brain networks. Artificial Intelligence (AI) has been gradually introduced in agriculture over the past decade, with increasing adoption in recent years. The concept of precision agriculture, which involves the use of technology for site-specific management of crops, emerged in the early 2000s. This laid the foundation for the integration of AI technologies in agriculture by utilizing data collection methods like remote sensing, GPS, and yield monitoring. In the 2010s, AI-powered imaging and sensing technologies began to be applied in agriculture. Machine learning algorithms were used to analyze aerial and satellite imagery, enabling farmers to monitor crop health, detect diseases, and assess yield potential more accurately. In the same year AI-powered robots and automated

systems were introduced to perform various agricultural tasks. These systems utilized computer vision, machine learning, and robotic automation to handle activities such as planting, weeding, and harvesting. Autonomous drones also became valuable tools for monitoring crops and collecting data. The introduction of AI in agriculture is an ongoing process, and advancements continue to be made in areas such as robotics, computer vision, machine learning, and data analytics. AI is expected to play an increasingly prominent role in transforming agriculture by enabling more efficient and sustainable farming practices.

### Artificial Intelligence in Agriculture

Agriculture plays a crucial role in the economic sector of each country. Population around the world is increasing day by day, and so is the demand for food. The traditional methods that the farmers use are not sufficient to fulfil the need at the current stage. Hence, some new automation methods are introduced to satisfy these requirements and to provide excellent job opportunities to many people in

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this sector. Artificial Intelligence has become one of the most important technologies in every sector, including education, banking, robotics, agriculture, etc. In the agriculture sector, it is playing a very crucial role, and it is transforming the agriculture industry. AI saves the agriculture sector from different factors such as climate change, population growth, employment issues in this field, and food safety. Today's agriculture system has reached at a different level due to AI. Artificial Intelligence has improved crop production and real-time monitoring, harvesting, processing and marketing. Different hi-tech computer-based systems are designed to determine various important parameters such as weed detection, yield detection, crop quality, etc.

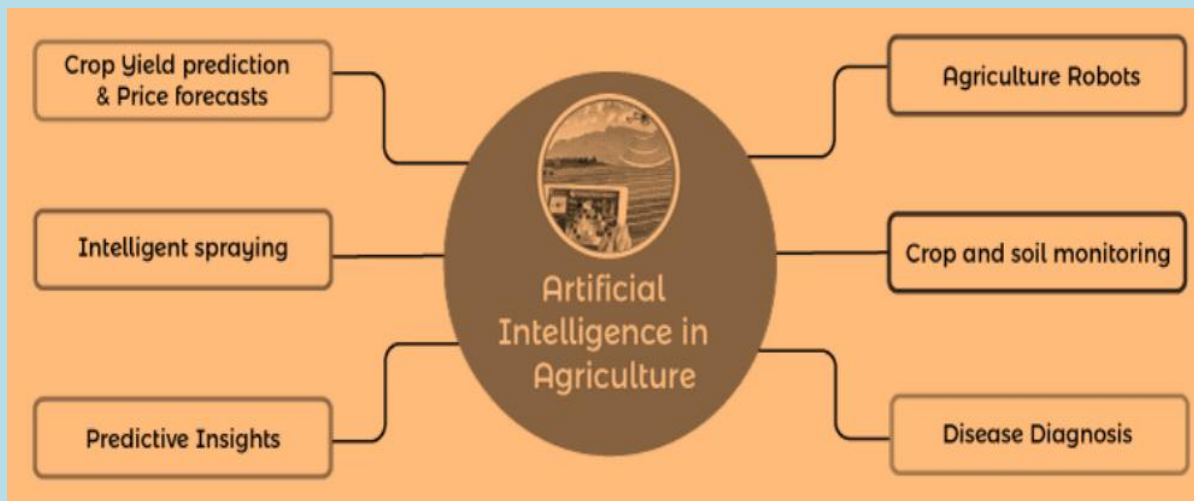
### Role of AI (Artificial Intelligence)

Artificial intelligence can play a significant role in the field of agriculture. Here are some major roles that AI can play in agriculture:

Below are some key applications of Artificial Intelligence in the Agriculture sector:

**1. Weather & Price Forecasting:** Many times it is difficult for the farmers to make the right decision for harvesting, sowing seeds, and soil preparing due to climate change. But with the help of AI weather forecasting, farmers can have information on weather analysis, and accordingly, they can plan for the type of crop to grow seeds to sow and harvest the crop. With price forecasting, farmers can get an accurate knowledge about the price of crops for the next few weeks, which can help them to get maximize their profit.

**2. Health Monitoring of Crops:** The crop quality widely depends on the soil type and nutrition of the soil. Various factors degrading the soil quality day by day and it is hard to determine it. To resolve this issue, AI based mobile application **Plantix** was developed to identify deficiencies in soil, including plant pests and diseases. With the help of this



application, farmers can get an idea to use better fertilizer to improve the harvest quality.

**3. Agriculture Robotics:** Robotics is being widely used in different sectors, mainly in manufacturing, to perform complex tasks. These AI robots are developed in such a way that they can perform multiple tasks in farming. AI robots are also trained in checking the quality of crops, detecting and controlling weeds, and harvesting the crop faster than a human.

**4. Intelligent Spraying:** With AI sensors, weeds can be detected quickly and detects weed-affected areas. On finding such areas, herbicides can be precisely sprayed to reduce the use of herbicides and also saves time and crop. The use of AI sprayers can reduce the number of chemicals to be used on fields, improving the quality of crops and saving money.

**5. Disease Diagnosis:** With AI predictions, farmers can get knowledge about quick diseases reorganization and easy diagnose strategy. Primarily images of plants are pre-processed using computer vision technology. After detection, the diseased part is cropped and sent to the labs for further diagnosis. This technique also helps in the detection of pests, deficiency of nutrients, and many more.

**6. Precision Farming:** With the help of artificial intelligence (AI), farmers can collect and analyze massive volumes of data from

various sources, including sensors, satellites, and drones. By combining this data with AI algorithms, precision farming methods can improve resource use, boost agricultural yields, and lessen their adverse environmental effects.

**7. Water and resource management:** Keeping track of soil moisture levels, weather patterns, and crop water requirements, AI can help to maximize water use—irrigation systems powered by AI can deliver water exactly when and where it is needed, preserving water supplies and increasing water use Effectiveness.

**8. Supply chain optimization:** AI can improve the agricultural supply chain by looking at inventory control, transportation logistics, and demand forecasting. By doing this, waste can be decreased, distribution efficiency can be increased, and agricultural products can be delivered to consumers on schedule.

**9. Harvesting and Sorting:** AI-powered robots and machines can be trained to carry out fruit picking, sorting, and packaging. These systems precisely identify and handle crops using computer vision and machine learning algorithms, increasing efficiency and lowering labour costs.

**Advantages of Artificial Intelligence in agriculture:**

### **AI enables better decision-making:**

Predictive analytics is a boon for the agriculture industry. It helps the farmers solve key farming challenges, such as analysing the market demands, price forecasting, and finding optimal times for sowing and harvesting the crop.

**AI brings cost savings:** AI provides real-time insights to farmers, enabling them to make proper decisions at each farming stage. With this correct decision, there is less loss of products and chemicals and efficient use of time and money.

**AI reduces labour shortage:** There has always been an issue of labour shortage in the agriculture industry. Driverless tractors, smart irrigation and fertilizing systems, smart spraying, vertical farming software, and AI-based robots for harvesting solve the labour shortage issue.

### **Challenges of Artificial Intelligence in Agriculture**

By seeing the advantages of AI for sustainable farming, implementing this technology may seem like a logical step for every farmer. However, there are still some serious challenges associated with it.

### **Lack of familiarity with AI machines:**

Although there are many benefits of using AI in agriculture, people are not familiar with the use of AI-enabled solutions and equipment across most of the world. To solve the issues,

AI companies should provide the basic equipment to farmers, and once they get familiar with them, and then provide them with advanced machines.

### **Lack of experience with emerging technologies:**

Adopting AI and emerging technologies in agriculture for developing countries can be challenging. It will be challenging to sell such technologies in areas where no such agricultural technology is being used. In such areas, to use these technologies, farmers need someone's help.

### **Privacy and security issues:**

As there are still no clear regulations and policies for using AI, it may raise various legal issues. Further, due to the use of software and the internet, privacy and security issues such as cyber attacks and data leaks may also exist. All these issues can create a big problem for farm owners or farmers.

### **Conclusion:**

Artificial Intelligence plays a significant role in transforming and optimizing various aspects of agriculture. The impact of AI is highly noticeable in sectors like precision agriculture, crop and soil monitoring, autonomous farming, livestock management, supply chain optimization, disease and pest control. AI in agriculture offers the potential to improve productivity, reduce resource wastage, increase sustainability, and enhance food security by providing farmers with

valuable insights and decision support tools. The future of AI in farming largely depends on adopting AI solutions. Although some large-scale researches are in progress and some applications are already in the market, the agriculture industry is underserved. There are numerous loopholes for adoption of such advanced technologies. Moreover, creating predictive solutions to solve real challenges of farming make the Artificial Intelligence successful.

