

Artificial Intelligence in Agriculture – Paving Way Towards Future Farming

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ABSTRACT

In every nation, agriculture is a vital component of the economy. It is anticipated that by 2050, there will be 10 billion people on the planet, putting tremendous pressure on the agricultural industry to boost crop yields and productivity (Eli chukwu N.C., 2019). There are two possible ways to deal with the impending food shortages: either embracing innovative practices and using technology to increase productivity on existing farmland, or increasing land use and implementing large-scale farming. Artificial Intelligence (AI) is becoming one of the most significant technologies, having a major impact on the agriculture sector. AI protects the agriculture industry from a variety of threats, including population growth, climate change, job shortages in this industry, and food safety. AI has enabled the agricultural system of today to operate at a new level. Crop productivity has increased along with real-time monitoring, harvesting, processing, and marketing thanks to artificial intelligence. Numerous advanced computer based systems are intended to identify numerous crucial parameters, including crop quality, yield detection, weed identification, and many others.

INTRODUCTION

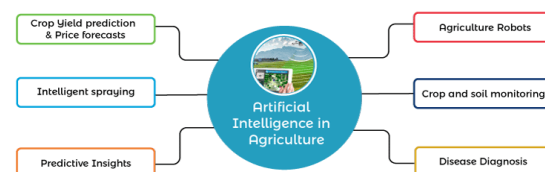
The foundation of artificial intelligence is the idea that human intelligence can be described in a way that makes it simple for a machine to replicate and carry out tasks, from the most basic to the most complicated.

Artificial intelligence (AI) aims to accomplish the following: perception, reasoning, and learning. There is currently insufficient supply to meet the need using the farmers' traditional methods. Therefore, in order to meet these needs and give many people in these industry fantastic job opportunities, some new automation techniques are introduced. The modern agricultural landscape is changing and branching out in various innovative directions as a result of numerous obstacles to achieving desired farming productivity, including limited land holdings, labor shortages, climate change, environmental issues, and declining soil fertility, to name a few. Farming has undoubtedly advanced since the days of hand plows and horse-drawn equipment. New technologies are introduced every season with the aim of increasing productivity and optimizing the yield. However, the opportunities that artificial intelligence in agriculture can offer to their farming methods are often missed by both small-scale farmers and large international agribusinesses.

Over time, technology has changed farming, and advancements in this field have had a multifaceted impact on the agricultural sector. In many nations across the world, agriculture is the primary source of income. However, as the world's population grows—the UN predicts that it will rise from 7.5 billion to 9.7 billion in 2050—only 4% more land will be under cultivation by that time, placing further strain on the land. Farmers will therefore need to do more with less. The same survey states that in order to feed an extra two billion

people, food production must rise by 60%. Traditional approaches, however, are insufficient to meet this enormous demand. This is pushing farmers and agricultural businesses to look for fresh approaches to boost output and cut waste. As a result, as technology in the agriculture sector advances, artificial intelligence is becoming more and more prevalent. The task at hand is to feed an extra two billion people by doubling the world's food production by 50% by the year 2050. AI-powered solutions will help farmers increase yield, quality, and speed of crop delivery in addition to helping them become more efficient.

Practical applications of Artificial Intelligence in the Agriculture sector:



Weather and price forecasting:

As we've covered in previous challenges, climate change makes it harder for farmers to make the best decisions regarding harvesting, seeding, and sowing. However, farmers can plan for the type of crop to grow, the seeds to sow, and the crop harvesting process with the aid of AI weather forecasting, which provides information on weather analysis (Kumar, A. and Vats, V., 2018). Price forecasting can help farmers maximize their profits by giving them a better idea of the price of crops over the next few weeks.

Health Monitoring of Crops:

The type and nutrition of the soil have a significant impact on crop quality. However, the quality of the soil is deteriorating daily due

to the increasing rate of deforestation, and this is difficult to measure. Artificial intelligence has developed a new program called Plantix to address this problem. PEAT created it to detect soil deficiencies, such as illnesses and pests that affect plants. Farmers can use this application to get ideas on how to apply better fertilizer, which will raise the quality of the harvest. Through the use of AI's image recognition technology in this app, farmers can take pictures of their plants and obtain quality information (Harwood and Trevor, 2019).

Agriculture Robotics:

Many industries, primarily the manufacturing sector, use robotics extensively to carry out difficult tasks. Currently, a number of AI startups are creating robots for use in the agricultural industry. These AI robots are designed to be capable of carrying out various farming tasks. AI robots are also trained to inspect the quality of crops, identify and manage weeds, and harvest crops more quickly than a human.

Intelligent Spraying:

Weed is easily detected by AI sensors, which can also identify areas where weed growth has occurred. Herbicides can be precisely sprayed in these areas to minimize their use and save time and crop damage. Numerous artificial intelligence companies are developing robots that combine artificial intelligence and computer vision to precisely spray weeds. AI sprayers have the potential to significantly reduce the amount of chemicals applied to fields, improving crop quality and resulting in cost savings.

Disease Diagnosis:

With AI forecasts, farmers can easily learn about illnesses. With this, they can quickly and accurately diagnose illnesses using the right approach. It can spare farmers' time and save

the lives of plants. First, computer vision technology is used to pre-process plant images in order to achieve this. This guarantees that plant photos are correctly segmented into sections that are diseased and sections that are not. The diseased portion is cut after it is discovered and sent to the lab for additional diagnosis. In addition, this method aids in the identification of pests, nutrient deficiencies, and many other issues (Bush.K, 2017).

Precision Farming:

It is all about "Right place, Right time, and Right products" in precision farming. The labor-intensive portion of farming that involves carrying out repetitive tasks can be replaced with a much more precise and controlled method called precision farming. Plant stress level identification is one application of precision farming. High-resolution photos and various plant sensor data can be used to obtain this. After that, a machine learning model receives the sensor data as input to identify stress.

Benefits AI in agriculture

AI enables better decision-making:

The agricultural sector really benefits from predictive analytics. It assists farmers in resolving the major problems associated with farming, like analyzing market demands, projecting prices, and determining the best times to plant and harvest crops. Additionally, AI-powered devices can assess crop quality, monitor the weather, make recommendations for fertilizer, and assess the health of the soil and crops. Farmers are able to practice efficient farming and make better decisions thanks to all these advantages of AI in agriculture.

AI brings cost savings:

AI-enabled equipment for precision farming enables farmers to grow more crops with less

money and resources. AI gives farmers access to real-time information that helps them make informed decisions at every level of farming. This wise choice results in less product and chemical loss as well as cost and time savings. Additionally, it enables farmers to pinpoint the precise regions that require pesticide treatment, fertilization, and irrigation, thereby reducing the amount of chemicals used excessively on the crop. In summary, all of these factors lead to lower herbicide usage, higher crop quality, and greater profit with fewer resources.

AI reduces labour shortage:

The agriculture sector has long struggled with a labor shortage. AI can address this problem of farming automation. Examples of how farmers can increase productivity without hiring more staff include driverless tractors, intelligent spraying, intelligent irrigation and fertilizing systems, vertical farming software, and AI-powered harvesting robots. When compared to human farmhands, AI-driven machinery and equipment are significantly faster and more accurate.

Challenges of AI adoption in Agriculture

Lack of familiarity with AI machines

Even though applying AI to agriculture has many advantages, most people worldwide are not familiar with the use of AI-enabled tools and solutions. In order to address the problems, AI companies should first give farmers basic equipment, and then, as they become accustomed to it, more sophisticated machinery.

Insufficient familiarity with new technologies:

For developing nations, implementing AI and other cutting-edge technologies in agriculture can be difficult. In places where such

agricultural technology is not being used, it will be extremely difficult to sell such technologies. Farmers in these areas need assistance from someone in order to use these technologies.

Privacy and security issues:

AI may give rise to a number of legal concerns because there are currently no clear rules and guidelines for its use. Furthermore, there might be security and privacy problems like cyber-attacks and data leaks because of the usage of software and the internet. For farmers or farm owners, all of these problems could pose serious challenges.

AI startups in agriculture

- 1. Prospera:** Established in 2014, Prospera is an Israeli startup. This business develops clever methods for productive farming. It creates cloud-based solutions that gather all field data - soil and water, aerial photos, etc. and integrate it with a device used on the field. This device, dubbed the Prospera device, uses this data to generate insights. Numerous sensors and technologies, including computer vision, power the device.
- 2. Blue-River Technology:** In 2011, Blue-River Technology, a start-up located in California, was founded. It uses robotics, AI, and computer vision to create next-generation agricultural equipment. This apparatus uses computer vision to identify individual plants; machine learning determines the course of action, and robotics carries it out. This helps farmers save money and reduce their use of chemicals.
- 3. Farmbot:** It is an open-source CNC precision farming device and software that can be used by anybody at home to grow crops. With the purchase of \$4000, the entire "Farmbot" product allows

anyone to perform all aspects of farming themselves, from weed identification to seed planting, using an open-source software system and a physical bot. In addition, it offers a web application that can be downloaded onto any computer or smartphone, enabling us to oversee farming from anywhere at any time.

- 4. Fasal:** Across the globe, the application of AI in the agriculture sector is growing daily. However, compared to the rich region, the poorer region has fewer agricultural holdings per farmer. This is good for automated monitoring because fewer low-bandwidth and small-sized devices are needed to capture all of the agriculture data. The Indian startup Fasal is operating in this space. It gives farmers access to real-time data and insights through the use of inexpensive sensors and AI. Farmers can gain from this by having access to current, useful information about their farm's daily operations. The devices offered by the company are simple to use in small spaces. They are creating AI-enabled devices to enable accessible precision farming.
- 5. One Soil:** This application aims to assist farmers in making better decisions. For precision farming, this app makes use of computer vision and a machine learning algorithm. It calculates fertilizer rates for nitrogen, phosphorus, and potassium, detects issues in the fields, and keeps an eye on the crops remotely.

CONCLUSION:

The uptake of AI solutions will determine how farming uses AI in the future. Despite ongoing

large-scale research and some commercially available applications, the agricultural industry remains underserved. Furthermore, research is currently ongoing to develop predictive solutions to address a genuine problem that farmers face in their farming operations. AI largely addresses the labor and resource shortages and will be a potent instrument for assisting organizations in managing the growing complexity of contemporary agriculture. Large corporations should definitely make an investment in this area. Artificial intelligence will undoubtedly challenge and enhance human decision-making while also improving farming practices. These technological advancements should improve farming yields and practices while also improving farmers' lives on a qualitative level.

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