

## Artificial Intelligence in Farming

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### Introduction

Compared to other industries, the agricultural sector has been slow to implement and take advantage of the variety of technologies that are powering the Fourth Industrial Revolution. Fragmented rural markets, poor infrastructure and heavy regulatory burdens have raised costs for food systems, while revenue has been constrained by market dynamics and the increasing disparity between commercial farming and small farm owners. According to the UN Food and Agricultural Organization (FAO), the global population is set to reach 9.2 billion by the year 2050. – This means that the global agriculture sector is under more strain than ever with 2 billion more mouths to feed within the next 29 years. With available acreage estimated at just an additional 4%, it seems it is no longer an option to simply plant more crop fields or breed more cattle. What is needed, therefore, is a greater efficiency within current farming methods as farmers will be required to ‘do more with less’.

Artificial Intelligence powered solutions enable farmers to do more with less. It will also improve quality and yield. Agriculture is seeing rapid adoption of Artificial Intelligence both in terms of Agricultural products and In-field farming techniques. Farm enterprises require new and innovative technologies to face and overcome these challenges. By using Artificial Intelligence we can resolve these challenges.





Artificial Intelligence is a branch of computer science dealing with the simulation of intelligent behaviour in computers. ' "Artificial Intelligence is not a Man versus Machine saga; it's in fact, Man with Machine synergy." Artificial Intelligence has a lot of direct application across agriculture sectors. Artificial Intelligence can also bring a paradigm shift in farming.

### **Challenges in traditional methods of farming**

In farming climatic factors such as rainfall, temperature and humidity play an important role in the agriculture lifecycle. Increasing deforestation and pollution result in climatic changes, so it's difficult for farmers to take decisions to prepare the soil, sow seeds, and harvest.

Every crop requires specific nutrition in the soil. There are 3 main nutrients nitrogen (N), phosphorous (P) and potassium (K) required in soil. The deficiency of nutrients can lead to poor quality of crops. As we can see from the agriculture lifecycle that weed protection plays an important role. If not controlled it can lead to an increase in production cost and also it absorbs nutrients from the soil which can cause nutrition deficiency in the soil.

### **Applications of Artificial Intelligence in Agriculture**

The industry is turning to Artificial Intelligence technologies to help yield healthier crops, control pests, monitor soil, and growing conditions, organize data for farmers, help with the workload, and improve a wide range of agriculture-related tasks in the entire food supply chain. Artificial Intelligence applications in agriculture have developed applications and tools which help farmers for inaccurate and controlled farming by providing them proper guidance to farmers about water management, crop rotation, timely harvesting, type of crop to be grown, optimum planting, pest attacks, nutrition management.

#### ➤ **Use of weather forecasting**

With the change in climatic condition and increasing pollution it's difficult for farmers to determine the right time for sowing seed, with help of Artificial Intelligence farmers can analyse weather conditions by using weather forecasting which helps they plan the type of crop can be grown and when should seeds be sown.

#### ➤ **Soil and crop health monitoring system**

The type of soil and nutrition of soil plays an important factor in the type of crop is grown and the quality of the crop. Due to increasing, deforestation soil quality is

degrading and it's hard to determine the quality of the soil. AI-enabled technologies predict weather conditions, analyse crop sustainability and evaluate farms for the presence of diseases or pests and poor plant nutrition on farms with data like temperature, precipitation, wind speed, and solar radiation. Hyper spectral imaging and 3D Laser Scanning, are capable of rapidly providing enhanced information and plant metrics across thousands of acres with the spatial resolution to delineate individual plots and/or plants and the temporal advantage.



➤ **Artificial Intelligence enabled system to detect pests**

Pests are one of the worst enemies of the farmers which damages crops. Artificial Intelligence systems use satellite images and compare them with historical data using Artificial Intelligence algorithms and detect that if any insect has landed and which type of insect has landed like the locust, grasshopper, etc. And send alerts to farmers to their smart phones so that farmers can take required precautions and use required pest control thus Artificial Intelligence helps farmers to fight against pests.

➤ **Autonomous early warning system for pest and disease outbreaks**

This autonomous early warning system, built upon the basis of wireless sensor networks and GSM networks effectively captures long term and up to the minute natural environmental fluctuations in fruit farms. In addition, two machine learning techniques, self-organizing maps and support vector machines, are incorporated to perform adaptive learning and automatically issue a warning message to farmers and government officials via GSM networks about pest and disease outbreaks.

➤ **Automated Irrigation systems**

This technique reduces production costs of vegetables, making the industry more competitive and sustainable and increases average vegetable yields. This technique minimize environmental impacts caused by excess applied water and subsequent agrichemical leaching. It maintain a desired soil water range in the root zone that is optimal for plant growth. Requires low labour input for irrigation process maintenance. This technique is useful for substantial water saving compared to irrigation management based on average historical weather conditions.

➤ **Driver less tractor**

Using ever-more sophisticated software coupled with off-the-shelf technology including sensors, radar, and GPS, the system allows an operator working a combine to set the course of a driverless tractor pulling a grain cart, position the cart to receive the grain from the combine, and then send the fully loaded cart to be unloaded.

➤ **Artificial Intelligence for weeding**

The automatic machine used for control of weed is called 'Hortibot'. It is about 3 x 3 foot. It is self-propelled, and uses global positioning system (GPS). It can recognize 25 different kinds of weeds and eliminate them by using its weed removing attachments. HortiBotis are eco-friendly, because it sprays exactly above the weeds. It is also cheaper than the tools currently used for weed-elimination as it can work during extended periods of time. The weight of machine is light (between 200-300 kg), so it will not hurt the soil behind it.



➤ **For harvesting vine crops**

For harvesting vine crops like strawberry, conventional methods are often time consuming and generally categorical in contrast to what can be analysed through automated digital detection and analysis technologies categorized as remote sensing tools. The trained use of hyperspectral imaging, spectroscopy and 3D mapping allows for the substantial increase in the number of scalable physical observables in the field. In effect, the multi sensor collection approach creates a virtual world of phenotype data in which all the crop observables become mathematical values.



➤ **Drones as Artificial Intelligence.**

Drones are being used in agriculture for precision fertilizer programme planning. Nitrogen deficient areas in a crop can be clearly identified from above using drones fitted with cameras that have enhanced sensors. Also using similar techniques to the fertilizer planning, drone operators can accurately assess weed and disease infestation levels in arable crops. Orchard fruit growers can benefit from reports on tree and row spacing with accurate calculations of canopy coverage. Crop Spraying Larger drones are already capable of applying small quantities of pesticide or fertilizer to crops, orchards and forested areas. Drone use in agriculture is growing as more farmers realise the technology's ability to perform key tasks and its fast-developing potential to take on bigger roles in the future.



## Conclusion

The agricultural industry have various challenges such as lack of effective irrigation systems, weeds, and issues with plant monitoring due to crop height and extreme weather conditions. With the aid of technology the performance can be increased and thus these problems can be solved. It can be improved with different Artificial Intelligence driven techniques like remote sensors for soil moisture content detection and automated irrigation with the help of GPS. The problem faced by farmers was that precision weeding techniques overcome the large amount of crops being lost during the weeding process. Not only do these autonomous robots improve efficiency, they also reduce the need for unnecessary pesticides and herbicides. Besides this, farmers can spray pesticides and herbicides effectively in their farms with the aid of drones, and plant monitoring is also no longer a burden. For starters, shortages of resources and jobs can be understood with the aid of man-made brain power in agribusiness issues. In conventional strategies huge amount of labour was required for getting crop characteristics like plant height, soil texture and content, in this manner manual testing occurred which was tedious. With the assistance of various systems examined, quick and non-damaging high throughput phenotyping would occur with the upside of adaptable and advantageous activity, on-request access to information and spatial goals.