# Study Based Artificial Intelligence (A.I.) Agriculture: A Review

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*Author's contribution*

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## ABSTRACT

The world is dynamic in nature as Agriculture remains the backbone of human existence. Human being surely depends on agriculture for existence and the way agriculture is carried out keep on changing from traditional to modern method. Presently, machines are being used to carry out almost all agricultural activities. The most recently introduced method in agriculture and other related fields is the used of Artificial Intelligence. Artificial Intelligence is recently introduced in the field of agriculture because of its wide use and importance related to our daily life. The problems faced by farmers are enormous which include, low output, soil treatment, diseases and pest management couple with big data requirements, and many others. AI is applied in agriculture in four (4) dimension ways, in crop management, weed management, disease management and soil management. This application helps to manage the cost effectiveness, accuracy and high performance in a more efficient and better ways. The paper makes a review on the application of AI in the field of agriculture for more productivity in the present teeming population. The benefits, dangers and solutions to Artificial Intelligence created problems were suggested. Automated farm machinery like driverless tractors, smart irrigation, fertilization systems, IoT-powered agricultural drones, smart

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spraying, vertical farming software, and AI-based greenhouse robots for harvesting are just some examples. Compared with any human farm worker, AI-driven tools are far more efficient and accurate.

## 1. INTRODUCTION

### 1.1 What is Artificial Intelligence?

Artificial Intelligence is a Machine Intelligence which has the ability and capacity to detect, identify, process and remember relevant variables from an environment. The Artificial Intelligence is also known as the Machine Intelligence or the Machine Learning. A machine can be taught exactly how to behave or it can be taught to decide its own behaviour depending on the objectives of the operator given. It is the building blocks of the robotic mind or a machine built to carry out some complex task. These are the areas where Machine Intelligence /Learning are used to mimic human intelligence. Goutham [1].

Robot is a machine built to carry out some complex tasks especially one which can be programmed. it is an intelligent machine being designed to look like a human or other creature usually made from metal and can perform some agricultural activities.

Drones in agriculture are a remotely controlled aircraft which perform some specific functions in agriculture. Examples are showed in Appendix. In India, a country with one of the most prominent Agtech startups, enhancing 15 agriculture datasets, such as soil health records, crop yields, weather, remote sensing, warehousing, land records, agriculture markets, and pest images, could lead to a $65 billion opportunity, according to research conducted by NASSCOM and McKinsey. Wikipedia, [2]. Artificial Intelligence (AI) in agriculture is poised to grow significantly in the coming years, as it has the potential to revolutionize the sector by improving crop yields, reducing waste, and increasing efficiency. According to a report by MarketsandMarkets, the AI in agriculture market is predicted to experience explosive growth, with the market size expected to grow from $2.35 billion in 2020 to $10.83 billion by 2025 at a Compound Annual Growth Rate (CAGR) of 35.6% during the forecast period.

## 2. OBJECTIVES OF ARTIFICIAL INTELLIGENCE

Some of the objectives of Artificial intelligence include the following amongst others:

- To make possible the automation of everything needed to run a business.
- To minimize distrust, because humans are prone to emotion, fatigue and sickness.
- To maintain cost effectiveness with high productivity.
- To attains efficient learning, reasoning and perception.
- To obtain adequate use of drones, and robots in agricultural activities.

## 3. USE OF AI IN AGRICULTURE

AI technology is being used in a variety of ways in agriculture, including crop monitoring, soil analysis, irrigation management, disease and pest control. By collecting and analyzing data from various sources, such as sensors, drones, robots and satellites, AI algorithms can provide real-time insights and recommendations to farmers. This allows for more accurate decision-making, reduced risk, and improved crop yields, Jiva's AI, [3]. overview of recent studies using Machine Learning and, more broadly, Artificial Intelligence, to tackle many aspects of the COVID19 crisis. Fabio M. Z. [4]. The growth of the global population, which is projected to reach 10 billion by 2050, is placing significant pressure on the agricultural sector to increase crop production and maximize yields. To address looming food shortages, two potential approaches have emerged: expanding land use and adopting large-scale farming, or embracing innovative practices and leveraging technological advancements to enhance productivity on existing farmland. The modern world is all about data. Organizations in the agricultural sector use data to obtain meticulous insights into every detail of the farming process, from understanding each acre of a field to monitoring the entire produce supply chain to gaining deep inputs on yields generation process. AI-powered predictive analytics is already paving the way into agribusinesses. Farmers can gather, then

process more data in less time with AI. Additionally, AI can analyze market demand, forecast prices as well as determine optimal times for sowing and harvesting, Intellias, [5], Ryan et al., [6]. Improving farm yields is a constant goal for farmers. Combined with AI, precision agriculture can help farmers grow more crops with fewer resources. AI in farming combines the best soil management practices, variable rate technology, and the most effective data management practices to maximize yields while minimizing spending.

## 4. APPLICATION OF ARTIFICIAL INTELLIGENCE IN CROPS, WEEDS, DISEASES AND SOIL MANAGEMENT

### 4.1 Crop Management

The use of AI help in managing crop properly for better yield and production It is used in crop and soil monitoring, insect pest and plant disease, detection, livestock health monitoring, intelligence spraying, automatic weeding, aerial survey and imaging, likewise produce grading and sorting [7]. All these activities are made easy with the help of automated machines. These technologies save the excess use of water, pesticides, herbicides, maintain the soil fertility. Also helps in efficient use of manpower and elevate the productivity and improve the quality. Crop Monitoring, Insect, Pest and Disease detection and control, Livestock health monitoring, Intelligent spraying, Aerial survey mapping and imaging and also produce grading and sorting.

An overview about the current implementation of automation in agriculture, the weeding system through the robots and drones are the major concerned about the write up of this paper.

In crop production, AI based equipment and machines has taken todays agriculture systems to a different level. This technology has enhanced crop production and improve real-time monitoring, harvesting, processing and marketing [8]. The latest technologies of automated systems using agricultural robots and drones have made a tremendous contribution in the agro-based sector. Version hi-tech computer-based systems are designed to determine various important parameters like weed detection and crop quality and many other techniques [9].

The technologies save the excess use of water, pesticides, herbicides, maintains the fertility of the soil, also helps in the efficient use of man power and improve the productivity and quality of products. The current implementation of automation in agriculture, the weeding systems through the use of robots and drones in agriculture particularly the developing nations is at the minimal level.

### 4.2 Weed Management

Automatic weeding, Herbicides utilization, Mechanical weeding are major activities under artificial intelligence weed management, it is the contemporary world, many automated systems are developed but various physical methods were used which relied on the physical interaction with the weeds. This depend in the position and the number of weeds. In developing and using a weed control automated system, the different between the crop seedlings and the weeds should be established. A method was applied for recognition of carrot seedlings from those of ryegrass. Manivannan, [10]. Implemented this method by the simple morphological characteristics measurements of leaf shape. This method is between 52 and 75 percent effectiveness in discriminating between the plants and weeds by determining the variation in size of the leaf.

### 4.3 Disease Management

Disease detection through image sensing and analysis, Laboratory detection of disease and pest, also the detection of nutrient destruction by pest are areas of concern here. various automations in a mechanical setting can be remotely controlled to detect and manage diseases in agriculture. They work in confluence with the GPS and other sensors mounted on them. Drones are being implemented in agriculture for crops health monitoring, irrigation equipment monitoring, weed identification, herd and wildlife monitoring and disaster management (veroustracte, 2015). Remote sensing with the use of UAVs (unmanned aeronautical vehicles) for image capturing, processing and analysis in making a huge impact on agriculture [11].

### 4.4 Soil Management

Laboratory testing of soil in terms of disease and nutrient content [12-14]. Predict the activities of soil enzymes, predict monthly mean soil temperature, Predict soil texture and soil moisture, Estimate soil nutrient, minimize lost, saves time and almost 92% accuracy. For soil

managements through the help of AI, drones are use in detecting the nature of soil, either it is polluted or not [15,16]. The plantation of fruits, vegetable and edible crops can be affected by several soils borne pathogens which requires the control through the soil managements.

The technologies used for the automated irrigation, weeding and spraying to enhance the productivity and reduced the work load on the farmers. Various automated soil sensing techniques are used (wall and king, 2004). The impact of AI includes improving efficiency in all the fields and also manage the challenges faced by various industries. it also takes care of crop yield, irrigation, soil contents sensing, crop monitoring, weeding, crop establishment [17]. The main purpose of coming up with this technology is to replace human labour and produce effective benefits on small as well as large scale productions. Manivannan [10,18-20].

Other impacts of AI on agriculture include image recognition and perception, skill and workforce management, maximising the output and creating chatbots for farmers [21-24].

## 5. HOW DOES ARTIFICIAL INTELLIGENCE FUNCTION?

**Probabilistic Learning:** deals with inferring plausible models to explain observed data. It is a model of compilation and then data is fed into it.

**Model Based Learning:** Designed with a model which takes data as input and processes it to make decisions, it implement algorithms based on mathematics and statistics. It can also be referred to as model-based machine learning.

**Critical Response to Small Changes:** Make use of random behavior if there is a slight variation in mathematical and statistical approximation such as speech recognition.

## 6. BENEFITS OF ARTIFICIAL INTELLIGENCE TO AGRICULTURE

AI programming focuses on cognitive skills that include learning, reasoning, self-correction and creativity which help in the following:

1) Automation of work, no fatigue, bore-dome or human emotion and analyzes massive data within a short time

2) In medical industry, it is use in automated diagnostics, Clinical decision making and Automated surgery
3) It saves labour and increases productivity
4) It delivers consistent results since everything is computerised
5) AI powered virtual agents are always available, the programs do not need to sleep or take a break which makes it possible to provide 24 hours services per week.

## 7. IMPLICATIONS / DANGERS OF ARTIFICIAL INTELLIGENCE

- Reduce brain usages by human and create new jobs by taking over old jobs
- Threatening human intelligence and replaces human mind itself
- Enhance powerful nation and exploit under developed nations.
- Militarization of AI poses a great threat against humanity
- Bring about a revolution in perfecting human apathy/emotion
- It is expensive and requires deep technical expertise
- Eliminates human job and increase unemployment

## 8. SOLUTIONS TO ARTIFICIAL INTELLIGENCE CREATED PROBLEMS

- Creation of welfare packages for unemployed people and taxation of AI operating agencies
- Managers, owners and developers of AI should be held responsible for any challenges brought by AI
- Shutting down all malfunctioning AI for replacement by human intelligence.
- Any vulnerability and threats posed by AI should be log particularly in compilation and decision making.
- AI should be monitored by international bodies to ensure accountability and justice to human existence.

## 9. CONCLUSION

Artificial Intelligence is a technology that allows machines and computers applications to mimic (imitate) human intelligence, learning from experience through processing and algorithmic training. It is a form of intelligence used to solve problems, come up with solutions, answer questions, make predictions and offer strategic

suggestions. Looking at the relevance of AI in present day situations it becomes imperative that it should be employed in almost all fields of life particularly agriculture, business and technology for efficient operation.

AI technology is transforming the way we approach farming and agriculture, with precision farming, automation, and customized data models. By utilizing AI tools and technologies, farmers can make more informed decisions and improve their overall productivity and sustainability. AI algorithms enable autonomous crop management. When combined with IoT (Internet of Things) sensors that monitor soil moisture levels and weather conditions, algorithms can decide in real-time how much water to provide to crops. An autonomous crop irrigation system is designed to conserve water while promoting sustainable agriculture and farming practices. AI in smart greenhouses optimizes plant growth by automatically adjusting temperature, humidity, and light levels based on real-time data.

## DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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## APPENDIX

## Images of Some Agricultural Robots and Drones

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*Peer-review history:*
*The peer review history for this paper can be accessed here:*
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