A Concise Evaluation of Artificial Intelligence in Agriculture

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Abstract

The premise underlying artificial intelligence is that it is possible to characterise human intelligence in a way that enables a computer to readily reproduce it and carry out tasks. These duties might range from the most elementary to those with far more complex business implications. Any industry dependent on certain tasks would profit from the adoption of intelligent machines. Agriculture and livestock husbandry are among the most important and oldest occupations in the world. It is essential to the overall functioning of the economic system. The agricultural industry comprises a global market of $5 trillion dollars. It is estimated that the global population will surpass nine billion by 2050; therefore, agricultural production would need to expand by 70 percent to meet demand. As a result of population growth, the existing land and water resources will no longer be sufficient to maintain the demand supply chain. As a result, we must design a more insightful plan, become more productive in our growth, and become more efficient in our growth. In this paper, I will explore the challenges that farmers face while adopting traditional farming practises, as well as the ways in which AI is revolutionising agriculture by replacing traditional methods with more effective methods, so contributing to the global improvement.

Index Terms: Artificial Intelligence(AI), Agriculture.

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1. Introduction

Environmental factors, such as precipitation, temperature, and humidity, are crucial to the growth and development of crops throughout their life cycles. The increasing levels of deforestation and pollution are causing climate change, which is making it difficult for farmers to make decisions on soil preparation, planting, and harvesting. The following are some of the challenges faced by farmers:

- ✓ Infestations caused by crop illnesses lack of adequate storage management,
- ✓ pesticide control, weed management,
- ✓ irrigation and drainage infrastructure, and
- ✓ suitable storage management.

Agriculture's lifecycle demonstrates that weed prevention plays a key role in preventing unwanted plant growth. If it is not handled, it may lead to an increase in production costs and a nutrient deficiency in the soil since it drains nutrients from the ground[1].

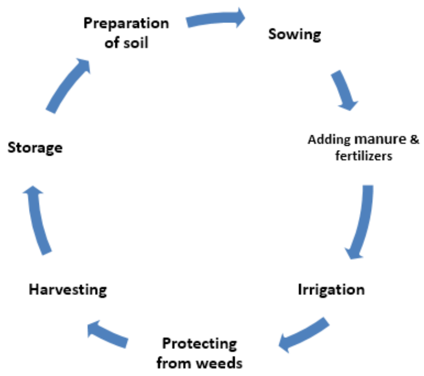

Fig.1 Life cycle of Agriculture

i. **Preparation of Soil:** In the initial step of agricultural production, farmers prepare the soil for planting by aerating and amending it. During this process, large clods of earth are broken up and debris including sticks, stones, and roots are removed from the site. The addition of fertilisers and other organic compounds, which serve to create an optimal environment for the plants, is also dependent on the type of crop being cultivated.

ii. **Sowing of Seeds:** At this point, it is essential to pay close attention to the gap between seeds and the depth at which they are planted. At this point in the process, climate conditions such as temperature, humidity, and precipitation play a vital role.

iii. **Adding Fertilizers:** Taking care of the soil so that it remains fruitful is one of the most essential things a farmer can do to continue producing healthy vegetables. Fertilizers contain phytonutrients such as nitrogen, phosphorus, and potassium, which supplement the soil's naturally occurring essential elements. In order to meet their needs, farmers are increasingly turning to fertilisers. This stage is also crucial for assessing the harvest's overall quality.

iv. **Irrigation:** This phase will assist in keeping the soil moist and in preserving that moisture. Inappropriately watering a plant may hinder its growth and cause damage if the process is not carried out correctly.

v. **Weed Protection:** Weeds are unwanted plants that grow around crops or along agricultural borders. It is crucial to consider weed control strategies since weeds reduce agricultural yields, increase production costs, impede harvesting, and degrade crop quality.

vi. **Harvesting:** It is the process of harvesting and storing mature crops from their farms. This endeavour is categorised as labour-intensive due to the quantity of effort required. Included in this portion of the business are postharvest operations such as cleaning, sorting, packaging, and refrigeration.

vii. **Storage:** The period of the post-harvest system in which items are held to ensure food safety even while agriculture is not occurring. In addition, it includes the packaging and transport of the plants.

2. Addressing Agricultural Issues with AI

2.1 **Precision Farming:** Applications of artificial intelligence in agriculture have produced applications and technologies that assist farmers with precise and regulated farming. These programmes and technologies give farmers with adequate recommendations regarding water management, crop rotation, timely harvesting, crop varieties, optimal crops, pest infestation, and nutrition management. Software of AI in agriculture have also contributed to the development of applications and technologies that facilitate precise and controlled farming. As part of precision agriculture, drones may perform scans of the soil's health, monitor plant health, assist in the design of irrigation programmes, apply fertilisers, estimate production statistics, and provide valuable data for the study of climate change[2].

2.2 **Examples of Precision Agriculture Management:** Analyzing data from several sensors and high-resolution images with artificial intelligence to determine a plant's level of stress. This full set of data, which was generated by a number of sources, must be used as input for AI machine learning. This allows for the combining of this data with the characteristics that indicate plant stress factors. The artificial intelligence machine learning models that were developed are trained on a broad variety of plant pictures and are capable of distinguishing between the various levels of plant stress. This complete technique can be broken down into the four sequential stages of identification, categorization, quantification, and forecasting in order to arrive at better and more effective findings. Utilizing weather predictions, Because weather conditions are always changing and pollution levels are increasing, it is difficult for farmers to determine the optimal times to grow crops and plant seeds[3].

2.3 **Soil Monitoring:** Analysis of Plant Health Performed by UAV Ariel-based imaging solutions for plant health monitoring have been developed by SkySquirrel Technologies. Via this strategy, the drone will initially collect data from the fields, which will then be sent to a computer using a USB drive and analysed by professionals. Because they can get so close to the crops, soil robots like Bonior can offer farmers with incredibly detailed insights. Some of these agricultural robots can also be used for a range of other tasks, such as fertilising and weeding algorithms, which analyse the gathered images and generate a comprehensive report on the field's current condition. It aids farmers in identifying pests and pathogens and in implementing pest management and other methods in a timely manner so that they can take the right action.

2.4 **Crop Seeding:** Combining geomapping and robotics will be aided by autonomous precision seeding. This will result in the development of a map that provides information on all of the soil's features, such as the quality of the soil, the density of the soil, and other such qualities, at every place on the planet. Agriculture is an economic sector A tractor fitted with a robotic seeding attachment will plant each individual seed. This will guarantee that the seeds are placed at the optimal depth and location, maximising their chances of developing into healthy plants[4].

2.5 **Pest Detection:** Pests are one of the most harmful forms of foes farmers confront. Artificial intelligence systems use satellite images and artificial intelligence algorithms to compare them with historical data and determine if an insect landed and what type of insect landed, such as grasshoppers, etc., and then send alerts to farmers' smartphones. With this information, farmers can take the necessary precautions and apply the necessary pest control. Artificial intelligence systems use satellite photos and artificial intelligence algorithms to compare them with previous data and determine if and what type of insect landed, such as grasshoppers, etc. This application of AI aids farmers in their fight against pests[5].

2.6 **Agricultural Robotics:** Companies specialising in artificial intelligence are now developing robots that are easily capable of performing a wide range of agricultural jobs. This type of robot can be designed to remove weeds and harvest crops faster than humans. This ability is learned by harvesting and packaging crops alongside humans and weeds. These robots can also overcome the challenges presented by forced labour in agricultural contexts. The robot patrols the farmland, utilising computer vision to spot weeds. When the robot recognises an invasive weed, it is able to spray herbicides straight onto the plant. According to the company's estimates, its precision spray technology has the ability to reduce by over 80 percent the amount of herbicides required on farms[6].

3. AI Limitations:

Costs associated with the implementation of robotics in agricultural contexts are extremely significant. If the controller does not take the necessary safeguards, the farm's complexity will increase, but the risk will remain unchanged. The labourers who will be employed on the farm must possess a high level of technological proficiency in order to be hired. As robotic generation requires electricity to function, India's initiatives to reduce energy use could prove to be a major source of concern for the country's agricultural sector[7].

4. Conclusion:

The application of artificial intelligence in agriculture will help farmers because it will boost agricultural output. The majority of AI-based agriculture enterprises analyse soil nutrients, diseases, crop health, and other elements of agricultural production using picture recognition. This technology lowers the need for human labour and produces the finest agricultural results possible. Future agriculture will incorporate modern technologies such as robotics, temperature and humidity sensors, aerial vision technology, and GPS technology. With the use of these novel technologies, precision farming techniques, and robotic systems, farmers will be able to both raise their income and reduce their environmental effect.

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