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Artificial Intelligence in Indian Agriculture

Kritika
UIAS, Chandigarh University, Mohali (Punjab)
Corresponding author:- kritihooda0018@gmail.com
ARTICLE ID: 048

Abstract

Agriculture plays a major role in the economic sector. Automation in agriculture is a major concern and a topic that is emerging around the world. The population is growing and with this increase in demand for food and work is increasing. The traditional methods used by farmers were not sufficient to meet these needs. Therefore, new automated methods are introduced. These new methods have met the needs of the diet and provided jobs for billions of people. Artificial Intelligence in agriculture has brought about change in agriculture. These technologies have protected crop yields from a variety of factors such as climate change, population growth, employment issues and food security issues. Of particular concern to this paper is the research into various uses of Artificial intelligence in agriculture such as irrigation, weed control, sensory spraying and other methods installed on robots and drones. This technology saves excess water use, pesticides, weed control, maintains soil fertility, and aids in the efficient use of human energy and increases productivity and improves quality. This paper examines the work of many researchers to get a brief overview of the current use of automated agriculture, robotic weed systems and robots. Various methods of absorbing water from the soil are discussed as well as two automatic methods of weed control. The implementation of drones is discussed, and the various methods used by drones for spraying and monitoring plants are also discussed in this paper.

Introduction

In India, agriculture and the common sector contribute less than 17% to its US $ 3 trillion economy today (Sunder, 2018). Farmers' average income remains equally low at ₹ 77,976 (or US $ 1,128; Financial Express, 2018). In terms of land acquisition and labor, about 50% of India's agricultural land is farmed (Agriculture Census, 2015-16), while agriculture directly employs 41.1% of India's working population (World Bank, 2018).

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This low emission limitation points to major agronomy errors in India that bring great hardship to farmers and agricultural workers, who bear the burden of rising import costs, rising productivity, climate change, water shortages, poor market access, technical suspensions, and so on. Although the problem of agriculture in India needs to be addressed at many levels, this article discusses the role of technology - in particular, artificial intelligence (AI) - in increasing agricultural production, and therefore, the income of farmers in India.

So how can AI help in agriculture?

Improving crop productivity –Climate change has led to the obsolescence of traditional agricultural knowledge, especially in predicting weather patterns that determine seasonal farming methods. The use of AI forecasting analysis can be very helpful to farmers. It can help determine which plants are suitable for growing in a favorable climate in a productive environment and how to plant to increase productivity and reduce costs. Soil health monitoring – As well as favorable climatic conditions, soil health with an adequate level of moisture and nutrients holds the key to getting the best yields. Distributed soil monitoring done with image recognition and in-depth learning models can be used to take remedial measures to restore soil health.

Historical data on heavy rainfall, local farm summaries, crop extraction information, soil health history, and more serve as methods for the construction of AI models. These species provide important information about the farm, assisting farmers in planning activities related to soil restitution, crop growth, irrigation on farms, etc. Optimization of pest and weed management – AI can be used to predict insect activity that can help with advanced pest control planning. Proper pest management leads to crop failure and environmental degradation. A combination of remote sensitive data, effective image classification tools, weather data, and other relevant data points can be used to separate weeds and crop. This will prevent the use of the drug only in areas that need treatment.

Remote satellites can monitor plant health and warn of pests. AI-supported technology called 'See & Spray' developed by a US company is a weed control technology that can reduce the cost of herbicides by 90%. Water Management –Proper water management in agriculture could have a significant impact on the coming water crisis. Water use in agricultural land can

be improved by using thermal imaging cameras that continue to monitor if plants receive a sufficient amount of water.

AI, combined with appropriate image classification models, when used in agriculture can lead to improved crop production; reduce manual intervention, and a reduction in plant diseases. Price realization for farmers –Only about 6% of farmers in India receive the benefits of Small Sales (MSP). Finding better prices for farmers is possible by using an effective pricing model. Expected modeling using AI can be very helpful in presenting accurate demographic data and predicting the demand for agricultural production for farmers.

With over 500+ AgriTech start-ups in India, agri-tech momentum is gaining momentum in India. Many of these start-ups use technologies such as AI, learning equipment, etc. to improve efficiency, yield, speed up agricultural financing, and other important activities for agricultural growth in India**.**

Applications of AI in Agriculture

The world needs to produce 50% more food by 2050. However, only 4% of additional land will come under cultivation to meet this demand. AI holds the promise of driving an agricultural revolution at a time when the world must produce more food using fewer resources. This essay briefly discusses key applications of AI in agriculture along different stages of the cropping cycle that have the potential to pay dividends to farmers in efficiency gains and higher incomes.

- **Soil Analysis and Monitoring**

  AI can be used to monitor soil health with the help of sensors, cameras, and infrared radiation that tests the soil for its nutrients. This also helps to understand the reaction of certain organisms to different soils, the impact of climate change on the soil, and the potential for the spread of diseases and pests. With such data in hand, the efficiency of crop production is improved, leading to cost savings and product profitability for farmers. Currently, an average of 207.56 kg of chemical fertilizer is used per hectare in Haryana annually (one of the highest in the Indian subcontinent). In addition to being costly for farmers, fertilizers also import harmful substances into

the food and plant food chain .

Therefore, AI in analyzing and monitoring soil health helps to improve the sustainability of a given piece of arable land.

- **Crop Sowing**

  AI in plant planting is mainly used to drive speculative analytics to find out when and how to plant it. It helps to make predictions at the right time for planting, fertilizing, harvesting, barley, up to, etc. depending on weather data, historical conditions, market conditions for inputs and outputs, personal details, and so on. Plants can also be sown using AI-assisted equipment at equidistant times and at the right depth.

Therefore, AI in crop sowing has the potential to increase per acre crop output as well as decrease input costs for farmers.

- **Weed and Pest Control**

  An average loss of up to 90% of total crop production has been reported due to weed infections. Similarly, an average loss of up to 19% has been reported due to pests. This leads to increased use of pesticides, which further pollute the soil and groundwater.

Therefore, AI finds great application in precision weed and pest management.

- **Crop Harvesting**

  Approximately 40% of annual agricultural costs are incurred, mainly for sowing and harvesting (Sennaar, 2019). Harvested robots can lead to significant cost savings by reducing the need for approximately 4 agricultural workers per acre of land (Panpatte, 2018). In addition, the plants can be sorted according to the pre-identified distances at harvest time, saving time and improving crop quality. However, AI is likely to change the way workers are employed in agriculture. While traditional handicrafts will change, AI presents new opportunities for job creation.

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Therefore, AI-enabled robots for crop harvesting save the resources of labour and time for farmers.

- **Supply Chain Management**

  Policymakers have never been able to meet the challenge of agricultural acquisition. On the other hand, farmers do not get the right amount of their product that continues to rot in the mandis (or market), on the other hand, food consumers end up paying higher prices or malnutrition. Although AI in agricultural procurement management is still in its infancy, its efficient use in planning and marketing, including demand forecasting and asset performance, can lead to significant cost savings for farmers, and solve the consumer asymmetry problem.

Therefore, AI has the potential to improve the agricultural supply chain efficiency and reduce spoilage.

Conclusion

There is no doubt that the agricultural sector needs a lot of impetus for policy makers to address the challenges listed above. This article promotes AI as a possible way to promote economic and environmental sustainability in agriculture. Of course, AI has its flaws. For example, there are temporary data collection challenges that exist. To this day, AI in Indian agriculture is still in the hands of a small and illegal farmer. AI is at risk of further widening economic inequalities between large and small landowners and landless workers. Therefore, any policy measure in this regard needs to be carefully constructed and implemented. It is important that the private and public sectors work together to make AI and other agricultural technologies more affordable and understandable to end users - the farmer.