

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/368543766>

Artificial Intelligence in Agriculture

Chapter · January 2023

CITATIONS

0

READS

400

3 authors, including:



[Kavithambika Shanmugam](#)

Tamil Nadu Fisheries University (TNFU)

10 PUBLICATIONS 1 CITATION

SEE PROFILE

14. Artificial Intelligence in Agriculture

¹*T. S. Senthil Nathan, ²S. Kavithambika and ³Dr. N. Venkatesa Palanichamy

Abstract

Artificial intelligence is based on the idea that human intelligence can be described in such a way that a computer can simply duplicate it and carry out activities. A large sector of the economy that is crucial to a nation's economy is agriculture. Technology is currently more necessary than fertilisers due to population expansion, food quality requirements, and other environmental considerations. The best technical option to deal with the expanding population and the changing climate of the world is artificial intelligence. Artificial intelligence in agriculture will contribute to resolving these practical issues by reducing time commitment and virtually eliminating labour-intensive tasks. Artificial intelligence in agriculture aids in pest management, data organisation, healthier crop production, workload reduction, and many other tasks. The ability to address needs with cutting-edge solutions like robotics, smartphone applications, and imagery technology is crucial. Numerous businesses are attempting to advance agricultural technology development so that it can be used to preserve crop output from environmental changes and population expansion in addition to introducing automated ways. Numerous job opportunities have also been made available by these recent AI-based breakthroughs. Artificial intelligence enabled technologies support industry competition, and the agricultural sector will steadily incorporate artificial intelligence in the future. In order to achieve larger yields and higher quality with fewer resources, agricultural artificial intelligence can not only assist farmers in automating their operations but also help them move to precise harvesting techniques.

Keywords: Artificial Intelligence (AI), agriculture, technology, automation

¹Assistant Professor, Dhanalakshmi Srinivasan Agriculture College, Perambalur- 12

²Assistant Professor, TNJFU – Fisheries Business School, Tamil Nadu Dr. J. Jayalalitha Fisheries University, DIVA Campus, Muttukadu, Chennai – 603 112

³Dean, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore

*Corresponding author's e-mail: ts.senthil1993@gmail.com

INTRODUCTION

Artificial intelligence is based on the idea that human intelligence can be described in such a way that a computer can simply duplicate it and carry out activities, from the basic to the most complicated (Talaviya et. al, 2020). One of the oldest and most important profession in the world is agriculture and farming. In the economic sense, agriculture sector is essential for growth of the country. By 2050, it is predicted that there would be nearly 9 billion people in the globe. To meet this demand, agricultural production need to be increased by 70 per cent (Bannerjee et. al., 2018). This is because as the world's population rises, land, water, and other resources become scarce, threatening to disrupt the demand-supply chain. People desire to become more creative and environmentally conscious about how agriculture is performed as the world's population continues to grow and land becomes scarce. This might necessitate employing less acreage to cultivate more plants while increasing productivity and yield. In addition, Indian agriculture suffers from some difficulties such as over-dependence on the

monsoon, a strong reliance on natural resources, deterioration of the land and a lack of soil fertility, and irregular yields per hectare etc. In this context, artificial intelligence can play a catalytic role in improving crop productivity despite having weather fluctuations, population increase, employment issues, and food safety issues (Khandelwal and Chavhan, 2019). Artificial intelligence in agriculture would contribute to resolve these practical issues by reducing time commitment and virtually eliminating labour-intensive tasks. Agriculture-based economies benefit greatly from artificial intelligence, which plays a key role in advancing agriculture and farming. Emerging technologies like AI-based Automated Robotic Systems can be used in agriculture to improve irrigation, crop monitoring, farming, automate spraying, and pesticide and herbicide application. There are numerous smartphone apps available that use artificial intelligence to help farmers by providing a range of services, from improved trading options to regulating and increasing the field's productivity.

Artificial Intelligence

Artificial intelligence applied to agriculture refers to all of the highly precise tasks that a machine, sensor, monitor, or computer is capable of carrying out. AI also refers to the collection of data that enables us to alter and optimise any operation or crop to the fullest extent. Artificial intelligence is used in many ways in agriculture to collect data and enable better decision-making by analysing the various situations that may happen.

The proper application of artificial intelligence will undoubtedly result in a larger yield, more uniform plantation, and the right rise in vegetation, all of which will improve farmers' quality of life. Compared to other areas, development in the agriculture sector is far more effective at increasing wages for the poor. A large sector of the economy that is crucial to a nation's economy is

agriculture. Technology is currently more necessary than fertilisers due to population expansion, food quality requirements, and other environmental considerations. The best technical option to deal with the expanding population and the changing climate of the world is artificial intelligence.

Agriculture is the most important industry in the world, and artificial intelligence is having a huge impact there as well. AI has been shown to be a cutting-edge technology in agriculture for achieving high productivity and greater agricultural output. In order to create farms in confined spaces and produce high yields of top-notch goods, people should be more inventive. Artificial intelligence in agriculture aids in pest management, data organisation, healthier crop production, workload reduction, and many other tasks.

Application of AI in Agriculture

Sensors: All kinds of tools, vehicles, machinery, etc., use sensors. In this way, sensors are used in agriculture to enhance the operation of tractors, equipment, and tanks. They are also employed on a climatological level, with weather stations

placed at strategic agricultural locations and soil sensors that show soil fertility indicators such as humidity.

Satellite and Aerial Pictures: Artificial intelligence in agriculture, used in the field of aerial and satellite photos, allows knowing the state of a crop, the

number of weeds, or creating layers with the areas drier and more humid to adjust to the maximum the dose of irrigation necessary for the crop and within the same plot. This is in addition to time management, organisation, and some technical parameters. Drone aerial photography, including the use of satellite imagery, is one way that artificial intelligence is applied.

Agricultural Robots: In comparison to humans, this type of robotic is capable of handling weeds and harvesting vegetation at a faster pace and with higher volumes. These robots are capable of inspecting the quality of plants, finding weeds, and simultaneously choosing and packing plants. These robots are also effective at handling challenging scenarios that arise from agricultural pressure labour.

Identification of Disease: Development of the image ensures that the leaf images are divided into areas like the backdrop, healthy element, and diseased element. The affected component is then removed and sent to distant labs for a second diagnosis. It also aids in the detection of pests and vitamin deficiencies, among other things.

Crop Health Monitoring: To build crop metrics across hundreds of acres, remote sensing techniques are essential combined with hyper spectral photography and 3D laser scanning. It has the potential to bring about a progressive change in terms of how farmlands are managed by farmers, both from a time and effort viewpoint. This generation can also be used to check for anomalies in vegetation during their whole existence, including the record era.

Field Control: Real-time estimates can be created during the cultivation period using high-definition images from airborne devices. This is done by creating an area map and identifying the areas where plants need water, fertiliser, or pesticides. This greatly facilitates aid in optimization.

Automation in Irrigation: Machines that are trained in the characteristics of the soil, the flora to be cultivated, and the ancient climate pattern can automate irrigation and increase global productivity. Automation might help farmers better manage their water difficulties because irrigation uses almost 70 per cent of the world's fresh water.

Market Demand Analysis and Risk Management: AI can make crop selection easier and assist farmers in determining the most profitable product. Forecasting and predictive analytics can be used by farmers to lessen operational errors and crop failure risk.

Crop Protection and Nurturing Plants: Artificial intelligence can keep an eye on a plant's health to detect and even predict diseases, find and get rid of weeds, and suggest effective pest control

Advantages of Artificial Intelligence

Improves Decision-making: With artificial intelligence, farmers can process and gather a vastly increased amount of data than they could without it. Farmers may use artificial intelligence to address several major issues, including market demand analysis, pricing predictions, and choosing the best window for planting and harvesting. Artificial intelligence can also monitor the weather, track the readiness of crops, make fertiliser suggestions, and acquire insights into the condition of the land. All of that enables farmers to choose wisely during the entire process of crop cultivation.

Reduces Costs: Precision agriculture is one type of farm management strategy that can assist farmers in

measures. AI is beneficial for determining the best irrigation schedules, when to apply nutrients, and how to blend agronomic goods together.

Soil Health Monitoring and Harvesting: AI systems are able to analyse soil chemically and calculate the amounts of nutrients that are missing with high accuracy. Artificial intelligence can be used to automate harvesting and even predict when it will be most effective.

producing more crops with fewer resources. Artificial intelligence powered precision agriculture has the potential to revolutionise the agricultural industry. To assist farmers, maximise yields and cut costs, precision farming combines the best soil management techniques, variable rate technologies, and most efficient data management processes. Farmers may identify fields that require irrigation, fertiliser, or pesticide application by using real-time insights from artificial intelligence.

Additionally, cutting-edge farming techniques like vertical agriculture may assist boost food production while using fewer resources. Herbicide use is reduced, harvest quality is im-

proved, earnings are increased, and there are significant cost savings as a result.

Helps for the Labour Shortage: Agricultural work is demanding, and there have always been labour shortages in this sector. This issue can be resolved by farmers using automation. Farmers can do the work without adding additional employees by using driverless tractors, intelligent irrigation and fertilisation systems, smart spraying, vertical farming software, and AI-based harvesting robots, as some examples. AI-driven machines are faster, tougher, and more precise than any human farm worker.

Uses of Data: Collecting data using artificial intelligence gives decision-makers more authority in a certain circumstance.

Challenges for adapting AI

Implementation Cost: The cost of implementing artificial intelligence outweighs the potential financial gains. Although technology has made enormous strides recently, there are still some technologies that cannot be used because their costs outweigh their benefits, which can have a negative impact on agricultural firms' financial statements.

Agriculture depends on a wide range of variables, and the more knowledge we have, the more control, decision-making authority, and forecasting ability we will have.

Economic and Environmental Sustainability: Artificial intelligence in agriculture can adjust the doses of fertilisers, irrigation, phytosanitary goods, and sowing, which also enables us to significantly reduce the cost of phytosanitary products. These benefit both the ecosystem and our farm economically.

Food Safety: The thorough control of the crops' traceability and food safety is made possible by the control of all processes, both in the field and after harvest.

Maintenance of Technology: Any industry has a frequent need for maintenance. In the case of agriculture, technology is frequently exposed to various weather conditions, challenging circumstances, and bad weather, thus it needs more care and upkeep.

Training: A basic understanding of technology is necessary to employ artificial intelligence.

Lengthy Adoption of New Technology: Farmers need to be aware that artificial intelligence (AI) is really a more sophisticated version used to analyse, collect, and monitor field data. For AI to function, the appropriate technological infrastructure is needed. Because of this, even farms with some technology in place can struggle to advance. Farmers should be introduced to technology gradually, starting with simpler tools. After farmers become accustomed to a simpler solution, it will be appropriate to advance and provide something else, such as AI functions.

Inexperience with Cutting-edge Technologies: Artificial intelligence in agriculture may be advantageous in some areas, where agricultural technology is

CONCLUSION

The only answer to the rising need for dependable and high-quality food suppliers is artificial intelligence. The ability to address needs with cutting-edge solutions like robotics, smartphone applications, and imagery technology is crucial. Farmers' old methods are no longer effective in meeting demand and supply.

uncommon. Farmers will probably require assistance implementing it. Therefore, IT companies may need to adopt a proactive strategy if they want to conduct business in areas with developing agricultural economies. They will need to offer training and continuous assistance for farmers and agribusiness owners who are prepared to adopt innovative solutions in addition to their products.

Security and Privacy Concerns: Precision agriculture and smart farming create a number of legal questions that frequently go unresolved because there are no defined norms and regulations surrounding the use of AI in general, not just in agriculture. Farmers may experience severe issues as a result of privacy and security threats like cyberattacks and data leaks. Unfortunately, these dangers can affect a lot of farms.

Agriculture has benefited greatly from AI's automation, which enables farmers to monitor their produce even while they are not in the fields. Numerous businesses are attempting to advance agricultural technology development so that it can be used to preserve crop output from environmental changes and

population expansion in addition to introducing automated ways. Numerous job opportunities have also been made available by these recent AI-based breakthroughs. Traditional tactics have been reimagined by AI in order to increase crop productivity and efficiency. Software is available for crop picking and harvesting, battling weeds and pests, and assessing weather and soil conditions in smart agriculture. Investment in this innovative field increases the likelihood of increased output while balancing the need for high-quality food. Artificial intelligence enabled technologies support industry

competition, and the agricultural sector will steadily incorporate artificial intelligence in the future. In order to achieve larger yields and higher quality with fewer resources, agricultural artificial intelligence can not only assist farmers in automating their operations but also help them move to precise harvesting techniques. The development of unmanned aircraft and self-driving vehicles will lead to scientific advancements, more practical uses, and will assist in resolving the issues with food supply brought on by population expansion.

REFERENCES

1. Balleda, K., Satyanvesh, D., Sampath, N. V. S. S. P., Varma, K. T. N., & Baruah, P. K. (2014, January). Agpest: An efficient rule-based expert system to prevent pest diseases of rice & wheat crops. In *2014 IEEE 8th International Conference on Intelligent Systems and Control (ISCO)* (pp. 262-268). IEEE.
2. Bannerjee, G., Sarkar, U., Das, S., & Ghosh, I. (2018). Artificial intelligence in agriculture: A literature survey. *International Journal of Scientific Research in Computer Science Applications and Management Studies*, 7(3), 1-6.
3. Dharmaraj, V., & Vijayanand, C. (2018). Artificial intelligence (AI) in agriculture. *International Journal of Current Microbiology and Applied Sciences*, 7(12), 2122-2128.
4. Eli-Chukwu, N. C. (2019). Applications of artificial intelligence in agriculture: A review. *Engineering, Technology & Applied Science Research*, 9(4), 4377-4383.

5. Hridoy, R. H., Habib, T., Rahman, S., & Uddin, M. S. (2022). Deep Neural Networks-Based Recognition of Betel Plant Diseases by Leaf Image Classification. In *Evolutionary Computing and Mobile Sustainable Networks* (pp. 227-241). Springer, Singapore.
6. Khandelwal, P. M., & Chauhan, H. (2019). Artificial intelligence in agriculture: An emerging era of research. *Research Gate Publication*.
7. Misra, N. N., Dixit, Y., Al-Mallahi, A., Bhullar, M. S., Upadhyay, R., & Martynenko, A. (2020). IoT, big data and artificial intelligence in agriculture and food industry. *IEEE Internet of Things Journal*.
8. Murase, H. (2000). Artificial intelligence in agriculture. *Computers and Electronics in Agriculture*, 29(1/2).
9. Talaviya, T., Shah, D., Patel, N., Yagnik, H., & Shah, M. (2020). Implementation of artificial intelligence in agriculture for optimisation of irrigation and application of pesticides and herbicides. *Artificial Intelligence in Agriculture*, 4, 58-73.