

APPLICATION OF ARTIFICIAL INTELLIGENCE

(A.I.) IN AGRICULTURE: A REVIEW

ABSTRACT

The world is dynamic in nature as Agriculture remains the backbone of human existence. Human being surely depend 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 wideness in 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.

key words: Artificial intelligence, agriculture, management. robots and drones

INTRODUCTION

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.

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.

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.

How AI is used 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.

Application of Artificial Intelligence in Crops, Weeds, Diseases and Soil Management

- (i) **Crop management:** the use of AI help in managing crop properly for better yield 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. 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 today's agriculture systems to a different level. This technology has enhanced crop production and improve real-time monitoring, harvesting, processing and marketing (Yan et al., 2007). The latest technologies of automated systems using agricultural robots and drones have made a tremendous contribution in the agro-based sector. Various hi-tech computer-based systems are designed to determine various important parameters like weed detection and crop quality and many other techniques (Liakos et al., 2018).

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.

(ii) 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 depends on the position and the number of weeds. In developing and using a weed control automated system, the difference between the crop seedlings and the weeds should be established. A method was applied for recognition of carrot seedlings from those of ryegrass. (Aitkenhead et al., 2003), 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.

(iii) 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 (Abdullahi et al., 2015).

(iv) Soil Management

Laboratory testing of soil in terms of disease and nutrient content. 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. 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 (Kim et al., 2008). 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, 2016).

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

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.

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.

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

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.

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.

References

1. Abdullah, H.S., Mahieddine,F.,Sheriff,R.E.,(2015). Technology Impact on Agricultural Productivity: A Review of Precision Agriculture using Unmanned Aerial Vehicles(UAV) . Lecture Notes of the Institute for Computer Sciences. Social Informatics and Telecommunications Engineering. pp 388- 400.
2. Aitkenhead, M.J., Mcdonald, A.J.,(2003). A Novel Method for Training Neural Networks for Time-series Prediction in Environmental Systems. *Ecol.model.*162(1-2), 87-95.
3. Application of Artificial Intelligence in Construction Waste Management-IEEE Conference Publication (2020). Retrieved 22 March 2021, from <https://ieeexplore.ieee.org/document/8710680>
4. Dharamraj, V. Vijyanand C. (2018): Artificial Intelligence in Agriculture” International Journal of Current Microbiology and Applied Sciences (italic),2319-7706, Vol. 7 No. 12.
5. Goutham, M. (2023). Artificial Intelligence and its role in economic development <https://eprcug.org/blog/artificial-intelligence-and-its-role-in-economic-development/> accessed 2/2/2024.
6. Intellias, B (2023). AI in Agriculture—The Future of Farming. <https://intellias.com/artificial-intelligence-in-agriculture/> accessed 11/3/2024.
7. Kim, M., Gilley, J.E. (2008) ‘Artificial Neural Network Estimation of Soil Erosion. Computers and Electronics in Agriculture, Vol. 64, No. 2. PP 268-275.
8. Lealos,K., Busato,P., (2018). Machine Learning in Agriculture: a Review. Sensors 18(8) 2674. <https://doi.org/10.3390>
9. Linda, T. (2024): A guide to artificial intelligence in the enterprise<https://www.techtarget.com/searchenterpriseai/definition/AI-Artificial-Intelligence/> Accessed 5/2/2024.
10. Manivannan,I., Pryyadharshini,M.S., (2016). Agricultural Robots. International Journal of Advance Research in Electrical, Electronics and Instrumentation Engineering. 153-156.
11. Syrquin, M. (1988) “Patterns on Structural Change” in: Handbook of Development Economics Vol. 1, Elsevier.

12. Wikipedia (2024): Artificial intelligence -
https://en.m.wikipedia.org/wiki/Artificial_intelligence

13. Yang, H., Liushineng, W., (2007). Wireless Sensor Networks for Intensive Irrigated Agriculture, Consumer Communications and Networking Conference. pp 197- 201 Las vegas, Nevada.

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Appendix
Images of Some Agricultural Robots and Drones

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