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Role of AI in Agriculture

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Abstract

The United Nations Food and Agriculture Organization (FAO) predicts that the world's population will grow by an additional 2 billion people in 2050, while agricultural land will only increase by 4%. In the above situation, there is a need to implement more consistent agricultural practices by taking advantage of modern technological advances and removing persistent obstacles in agriculture. The consistent use of artificial intelligence and its subsets in agriculture could serve as a manifestation of a change in modern farming practices. The agricultural sector faces myriad obstacles such as disease, inadequate soil analysis, pest infestation, irrigation and inadequate drainage. These challenges lead to dangerous environmental hazards and massive crop losses as a result of using excess chemicals. The field of artificial intelligence, along with meticulous learning skills, has become an important approach to addressing various agricultural problems. This whitepaper focuses on the application of artificial intelligence practices in various areas of agricultural science, industry insights, and the challenges of adopting AI in agriculture.

1.1 Introduction

Artificial intelligence refers to the imitation of human intelligence in machines that are supposed to think like humans and emulate behaviors such as learning and problem solving. Machine learning is a subset of artificial intelligence as shown in Figure 1. Machine learning is a tool used to identify, understand, and analyze patterns in

data. One of the most important research areas in this highly technical world of computer science is artificial intelligence. The technology becomes robust very quickly due to its rapid technological progress and its robust applicability to problems that are largely unsolvable even by traditional computing constructs and humans [1].

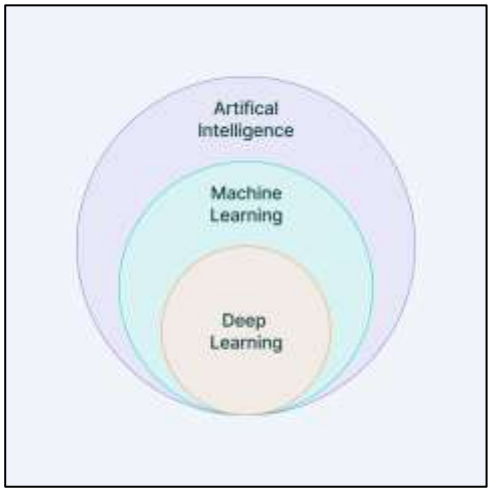

Fig. 1. Subsets of AI

1.2 Motivation

AI systems can help improve overall crop quality and accuracy, known as precision agriculture. AI technology can help detect crop diseases, pests and nutrient deficiencies on farms. AI sensors can detect and target weeds and determine which herbicides to apply to the area. Contributes to reducing herbicide usage and costs. Many technology companies are using computer vision and artificial intelligence to develop robots that accurately monitor and spread weeds. These robots can eliminate 80% of the amount of chemicals normally applied to crops and reduce herbicide use by 90%. These intelligent AI sprayers can significantly reduce the use of chemicals in the field, resulting in better quality produce and greater cost efficiency.

1.3 Aim and Objective(s) of the work

The use of artificial intelligence in agriculture helps farmers understand data insights such as temperature, precipitation, wind speed and solar radiation. Data analysis of past values provides a better comparison of desired outcomes. The best thing about implementing AI in agriculture is that it improves processes, not destroys the work of human farmers.

Project objectives:

To Overcome:

• **Confusion**. It happens when AI software vendors don't clearly explain their implementation and maintenance.

• **Lack of experience**. Continuing education and training is required to enable farmers to successfully implement AI software and hardware.

• **Outdated digital infrastructure**. Even the latest AI solutions can often be integrated into existing infrastructure (farm management software, tractors, spreaders, etc.).

• **Risk**. It is associated with dangerous chemicals, medicines for people who work with fertilizers.

2. LITERATURE SURVEY OF ROLE OF AI IN AGRICULTURE

Table 1. Literature Survey

	Paper 1	Paper 2
Topic Name	Artificial Intelligence in Agriculture: A Review	Artificial Intelligence (AI) in Agriculture
Author Name	Robin Sharma	Simon Y. Liu
Journal Name	Institute of Electrical and Electronics Engineers	Institute of Electrical and Electronics Engineers
Publication Year	2021	2020
Introduction	The machines were deployed during the industrial revolution as a substitute for human labour in the 19th century. Eventually, with the growth in Information Technology in the 20th century, after the advent of computers, the innovation of Artificial Intelligence powered machines were initiated. In the ongoing era, it is an actuality that Artificial Intelligence is slowly but strongly replacing human labour.	AI offers sweeping transformation with advanced approaches that will redefine the traditional pattern and limits of agriculture. AI will drive an agricultural revolution at a time when the world must produce more food using fewer resources. ARS scientists have applied AI technologies in various laboratories to advance agricultural research and speed up scientific discovery. Unfortunately, a lot of AI-based agricultural research projects in ARS could not be mentioned in this limited space. This Special Section has been prepared to make it as informative as possible with details of various AI techniques employed in ARS.

3. Scope of AI in Agriculture

Agriculture is witnessing rapid adoption of artificial intelligence (AI) and machine learning (ML) in relation to both agricultural products and farming techniques in the field. Cognitive computing, in particular, is becoming the most disruptive technology for agricultural services due to its ability to understand, learn, and react to different situations (based on learning) to improve efficiency. By making some of these solutions available to all farmers as services, such as chatbots and other conversational platforms, farmers can keep up with technological advances and apply the same to their day-to-day farming.

3.1. Growth Driven by IOT

Huge amounts of data are generated every day in both structured and unstructured formats. These relate to data on historical weather patterns, ground reports, new research, rainfall, pest infestations, drone and camera imagery, and more. A cognitive IOT solution can collect all this data and provide actionable insights to improve yield. Proximity sensing and remote sensing are two technologies primarily used for intelligent data fusion. One application for this high-resolution data is soil surveys. Remote sensing requires the sensor to be embedded in an airborne or satellite system, while proximity sensing requires the sensor to be in contact with the ground or in very close proximity. This is useful for soil characterization based on the subsurface soil at a

specific location. Hardware solutions like Rowbot (which refers to corn) combine data collection software and robotics to prepare the best fertilizer for growing corn, among other activities to maximize performance.

3.2. Identification of optimal mix for agronomic products

Cognitive solutions recommend the best crop and hybrid seed choices for farmers based on multiple parameters such as soil conditions, weather forecast, seed type and prevalence in a particular area. Recommendations can be further personalized based on farm needs, local conditions and data on past farming success. External factors such as market trends, prices and consumer needs can also be considered, helping farmers make informed decisions.

3.3. Health monitoring of crops

In addition to hyperspectral imaging and 3D laser scanning, remote sensing techniques are essential for creating harvest indicators across thousands of acres. It has the potential to revolutionize the way farmers monitor their fields, both in terms of time and effort [2]. The technology is also used to monitor the entire plant life cycle, including generating reports if anomalies occur.

3.4. Automation techniques in irrigation and enabling farmers

Related to human-intensive processes in agriculture, irrigation is one such process. Machines trained based on past weather patterns, soil quality and the types of crops grown can automate irrigation and increase overall yields. About 70% of the world's freshwater is used for irrigation, so automation can help farmers better manage their water challenges.

3.5. Image-based insight generation

Precision agriculture is one of the most debated areas in agriculture today. Drone-based imagery is useful for detailed field analysis, crop monitoring, field scanning, and more. Combining computer vision technology, IoT and drone data to help farmers act faster. Feeds from drone imagery can generate real-time alerts to accelerate precision agriculture.

CONCLUSION

Artificial intelligence has the potential to become relevant and viable in agribusiness as it improves asset utilization and efficiency. It largely explains the lack of wealth and jobs. Acquiring AI is very valuable in agriculture. Artificial knowledge could lead to a revolutionary transformation and explosion in the agricultural industry to keep up with the growing world population. Artificial arguments complement farmers and challenge them to make the right choices. Artificial intelligence-based technologies such as remote sensors that detect soil moisture levels and automatic irrigation using GPS. The problem farmers faced was that precision weed control technology would overcome the large number of crops lost during the weed control process. These autonomous robots not only improve efficiency, but also reduce the need for unnecessary pesticides and herbicides. Additionally, farmers can use drones to effectively spray pesticides and herbicides on their farms, eliminating the need for crop monitoring. First of all, resource shortages and employment shortages can be understood with the help of artificial intelligence in agribusiness problems.

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