AGRICULTURAL APPLICATIONS OF ARTIFICIAL INTELLIGENCE (AI)

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Received: February 27, 2024, **Accepted**: March 03, 2024, **Online Published**: March 10, 2024

ABSTRACT

By 2050 Abstract, only 40% of the additional land will be utilized for agriculture, according to predictions made by the Food and Agriculture Organization of the United Nations, which indicates that there will be an additional 2 billion people on the planet. Under such circumstances, more productive farming methods could be developed by leveraging the latest technical developments and finding solutions to the problems the farming industry is confronted with. Applying artificial intelligence (AI) could cause a paradigm shift in the agriculture industry. An overview of the practices employed by the various industries within agriculture is that AI-powered farming solutions guarantee a timely go-to-market strategy, improve crop quality, and enable farmers to do more with less.

Keywords: Agriculture, Artificial Intelligence, Robotics, Farming and Crop

Introduction

Human labour was reduced or eliminated during the nineteenth-century industrial revolution thanks to the employment of machines. The concept of artificial intelligence (AI) devices originated with the advancement of computers and information technology during the 20th century. It's a fact that AI is progressively replacing human jobs.

Artificial intelligence is quickly finding its way into many farming technologies. Cognitive computing aims to use a computer model to simulate human thought processes. As a result, disruptive AI technology for agriculture is created,

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which aids in understanding, obtaining, and responding to diverse scenarios (based on the information acquired) to handle various conditions. To increase output. By remaining informed about the most recent developments in the farming industry, chatterbot platforms help farmers increase their income in the field.

At the moment, Microsoft Corporation offers services and solutions for clearing land, planting, applying fertiliser, and supplying another fictitious agricultural additive to the 155 farmers in the Indian state of Andhra Pradesh. The knowledge agricultural production per acre has already improved by thirty per cent over previous harvests. The several fields that provide knowledge-based remedies for agriculture's benefits are listed below.

The Internet of Things is driving development.

Massive volumes of both structured and unstructured data are generated daily. Reports on soil conditions, involvement, insect attack susceptibility, meteorological patterns, and camera and drone footage are some of the data that make up this collection. Cognitive IoT systems could sense, recognise, and generate clever strategies for raising crop yields.

In intelligent data fusion, the primary technologies utilised are proximity and remote sensing. A significant application of this high-resolution data includes meeting the specific requirements of soil analysis. It only needs sensors close to the ground; sensors from an aircraft or spacecraft are unnecessary. Because of this, analysing the soil beneath the surface makes it simpler to describe the soil in a given location.

To increase agricultural productivity, hardware solutions such as Robot have already begun integrating data collection software and robotics to give optional fertiliser for corn growing.

Generating insights using images

Precision farming is one of the controversial aspects of modern farming. Field scanning, crop monitoring, and field analysis can all benefit from drone photography. Computer vision technology, drone data, and human interest will enable farmers to respond quickly.

Using drone picture data to feed alarms in real time could speed up precision farming. Aerialtronics and other commercial drone manufacturers require real-time image processing through visual reorganisation APIs and the IBM Watson IoT platform. A few applications for computer vision technologies include the following;

Illness identification

Using image sensing and analysis, plant leaf photographs can be surface segmented into the background, diseased, and non-diseased leaf portions. The afflicted or diseased area is then severed and sent to a laboratory for further examination. This is far more helpful in identifying pests and nutrient deficits. Figure I is a comprehensive flowchart.

Determine the crop's level of preparedness.

Using the results of this investigation, farmers will be able to determine the level of maturity of the green fruits by taking pictures of them in UVA and white light. Based on these images, before sending the fruits to the market, they can stack them differently.

Field Guidance

Real calculations may be completed throughout the growing season using high-definition photos from drone and copter systems to identify the areas on a field map where crops need water, fertiliser, and pesticides.

This greatly facilitates the process of resource optimisation.

Finding the best combination of agronomic goods

Farmers that use cognitive solutions receive a personalised proposal that considers their unique demands, the surrounding environment, and previous data pertinent to agricultural success. Numerous external aspects, like agricultural prices, market trends, customer wants, requirements, and aesthetics, are also taken, including weather forecasts, insect infestation in a particular area, seed type, and soil quality; farmers are given suggestions for the best crop and hybrid seeds.

Surveillance of crop health

Building agricultural metrics across hundreds of acres of cultivable land requires hyperspectral photography, three-dimensional laser scanning, and remote sensing (RS) techniques. Farmers' land monitoring practices can, therefore, need a substantial time and effort investment.

Additionally, this system will monitor crops at every turn, indicating abnormalities and identifying their source.

Methods for automating irrigation that give farmers more power

One of the labour-intensive parts of farming is irrigation. Watering can be automated using artificial intelligence) AI-trained devices that comprehend historical weather patterns, the sort of crop to be grown, and soil conditions. As a result, production will increase. With solutions like these, farmers may reduce their water-related concerns and save water, as irrigation accounts for more than 70% of the freshwater resources on Earth.

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Drones' significance

Agriculture accounts for 32.4 dollars of the 127.3-billion-dollar global market for drone-based solutions. Precision farming, increased productivity, weather-related management, and crop production management are just a few agricultural uses for drone-based solutions.

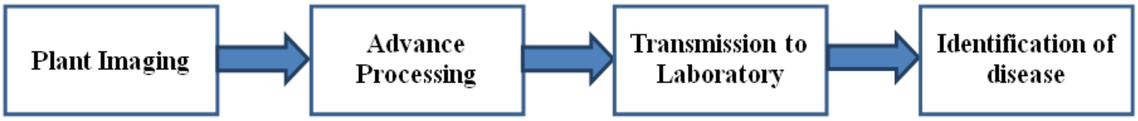

Figure – I. Disease detection

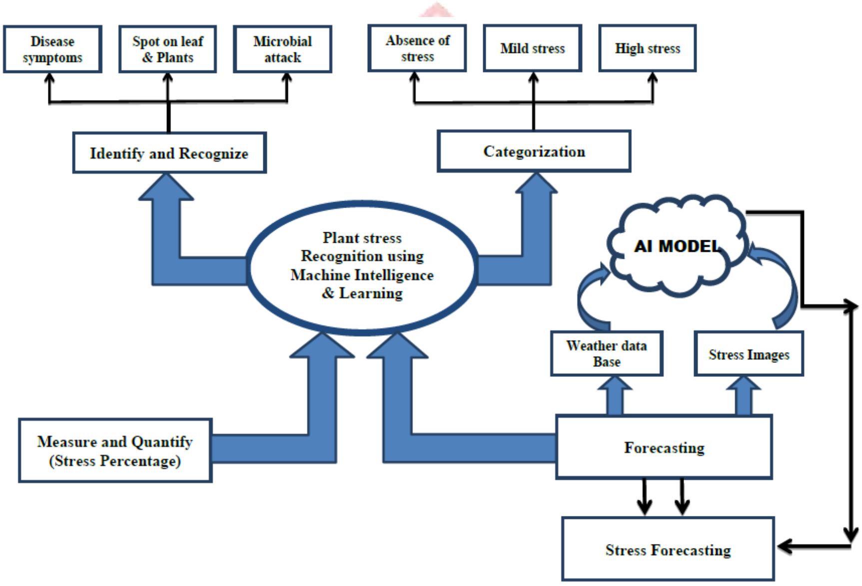

Figure – II. Identifying plant stress with machine learning and intelligence

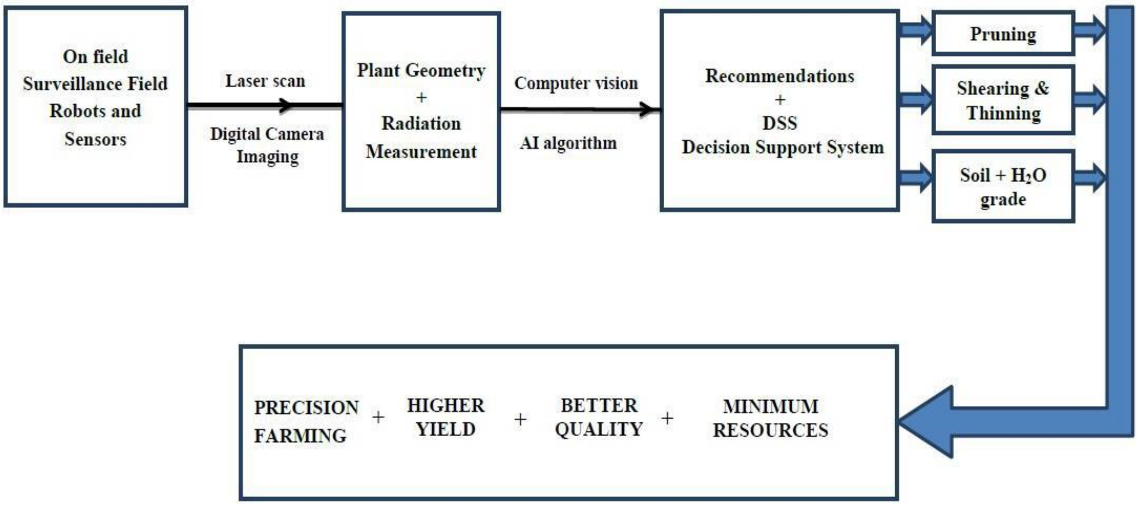

Figure – III. Digital Farming Using Robotics

The drone must create a thorough three-dimensional map of the field's topography, irrigation and drainage systems, and soil viability. Before the beginning of the crop cycle, it must be finished. The N1 levels in the soil can also be controlled with drone-powered systems. Using a drone to spray seeds and plant fertilisers into the soil, pods containing seeds can provide plants with the necessary supplements. Depending on the geography, the drones can also be configured to atomise liquids by changing their attitude above the ground.

Drone-based solutions are particularly valuable in computer vision, artificial intelligence, and crop health evaluations and monitoring.

Drones with high-resolution cameras can take precise field shots. They are subsequently fed into a convolution neural network to identify weed-filled areas, specific crops that need extra water, and plant stress levels at various growth stages.

Drones that scan crops using RGB (Red, Green, and blue) and infrared light may capture multispectral photographs of diseased plants. Detecting and curing any portion of the diseased plants in the field immediately using this specific and narrowly focused group is possible.

The multispectral images captured by the drone cameras are processed into hyperspectral images and integrated with three-dimensional scanning methods to create a spatial information system that covers acres of farmland. For the rest of its life, the plant receives instruction from this.

Accurate farming

Precision farming offers information on crop rotation and replaces labour-intensive and repetitive farming practices with a more controlled and accurate approach. High-precision positioning systems, geological mapping, remote sensing, integrated electronic communication, variable rate technology, optimal planting and harvesting time estimators, water resource management, plant and soil nutrient management, and pest and rodent attacks are some of the technologies that make precision farming possible.

Goals for ultra-precision agriculture

Financial performance

Determine which crops to grow, market them wisely, and use cost and gross profit to forecast ROI (Return on Investment)

Effectiveness

Use an accurate algorithm to Take advantage of more favourable, quicker, and less costly agricultural opportunities. The total effective use of resources is made possible by this.

Durability

Improvements to the environment and socioeconomic system ensure annual

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gains in all performance parameters for each season.

Instances of coordinated precision agriculture

Using a range of sensor data sets and high-quality photos to use AI to identify various plant stress levels. Using the data produced by various sources as input is necessary for AI machine learning. This provides plant stress diagnostic criteria and facilitates the integration of diverse data (Figure II).

Due to extensive training in a wide range of plant pictures, the developed AI machine-learning models can distinguish between different plant stress levels. The forecasting, quantification, classification, and recognition phases are the four sequential steps that this process can be broken down into to make better and more informed judgments (Figure II)

AI-based yield management

Smart farming is becoming increasingly complex, efficient, and sustainable because of emerging technologies, including artificial intelligence (AI), cloud machine learning (MI), satellite imaging, and advanced analytics. Combining these technologies will allow farmers to preserve profitability through increased average yields per hectare and improved pricing control over food grains. Microsoft Corporation offers agriculture advisory services to farmers in Andhra Pradesh, an Indian state. Data transformation into intelligent actions is possible thanks to the Cortina intelligence suite, which incorporates machine learning and power BU.

In the pilot project, an AI-based sowing application increased average crop yields per hectare by 30%. Farmers received guidance on cultivable land preparation, fustigation based on soil analysis, FYM requirement and application, seed treatment and deflection, and sowing depth optimisation.

To create forecast charts and advise farmers on when to plant, AI models can also determine the best time to sow in various seasons, statistical climate data, and real-time Moisture Adequacy Data (MAI) from daily rainfall statistics and soil moisture.

To anticipate future pest attacks and alert people in advance of those hazards. United Phosphorous Limited and Microsoft are developing an Application Programming Interface (API) for pest prediction (Figure III). The crop's growth stage and the weather will determine if an insect attack is high, medium, or low in the field.

Adoption Barriers to AI in Agriculture

Despite the enormous potential artificial intelligence (AI) offers for application in agriculture, farmers worldwide still lack expertise with cutting-edge, high-tech machine learning technologies. Farming involves significant exposure to environmental elements, such as weather, soil, and susceptibility to pest infestations. When harvesting starts, a crop-raising plan decided upon early in the season might not appear like the ideal course of action due to external circumstances.

AI systems to train their computers and produce precise forecasts and predictions require a lot of data. It is challenging to obtain temporal data, but gathering geographical data in a vast agricultural land area is simple.

The collection of crop-specific data was limited to a single growing season. Since the database needs time to grow, developing a solid AI machine-learning model takes time. This is a major factor in deploying AI in agronomic goods instead of precision agricultural goods like pesticides, fertilisers, and seeds.

Conclusion

In summary, implementing cognitive solutions will be crucial to farming's future. Thus, the farming industry is still neglected and receives inadequate service despite many publicly available applications and substantial continuing research. While AI farming is still in its early stages, it involves using predictive algorithms and AI decision–making systems to address real-world issues and difficulties that farmers encounter.

Applications must become more dependable for agriculture to benefit fully from artificial intelligence. Until then, its surroundings will change too quickly for it to adjust to. As a result, making decisions in real-time and choosing the best model or program to collect contextual data effectively would be made easier.

Another significant obstacle is the high cost of the many cognitive farming technologies available.

More practical AI solutions are needed for this technology to be adopted by the farming sector. If AI cognitive solutions are made more widely available and more reasonably priced on an open-source platform, farmers will eventually adopt them with greater speed and insight.

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