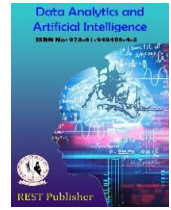


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Implementation of artificial intelligence in agriculture for optimisation- Literature review

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Abstract: *In daily life, the role of agriculture is crucial. The population is growing rapidly, and with it, is the need for food and work. Farmers employed conventional techniques, but they were unable to meet these demands. As a result, new automated techniques were introduced. These innovative techniques supplied the world's food needs while simultaneously creating jobs for billions of people. With the help of artificial intelligence (AI), agriculture has drastically reformed. This technique has safeguarded crop yields from a variety of conditions including climate change, population increase, job troubles, and food security concerns. The purpose of this literature review research is to examine the different uses of artificial intelligence in agricultural, such as irrigation, weeding and spraying, using sensors and other techniques implanted in robots and drones. These technologies reduce the use of water, pesticides and herbicides, preserve soil fertility and aid in the effective use of labour to increase production and quality. This report analyses the work of several scholars in order to provide a concise summary of the present state of automation in agriculture.*

Keywords: *Artificial Intelligence, Precision agriculture, Smart agriculture, Robots*

1. INTRODUCTION

With the introduction of technology, several sectors throughout the world have seen major transformations. Surprisingly, while being the least digital, agriculture has experienced a surge in the development and commercialization of agricultural technology. Artificial intelligence (AI) has begun to play a significant part in our daily lives, expanding our perceptions and abilities to influence the world around us. This paper discusses various strategies used for smart harvest planning based on the coupling of crop assignment with vehicle routing. With these growing technologies, the labour that was formerly limited to only a few industrial sectors is now contributing to a wide range of industries. Agriculture is a difficult industry to operate and confronts several difficulties every day. From planting seeds through harvesting crops, farmers confront a number of challenges, including crop disease infestations, poor storage management, pesticide control, weed management, and a lack of irrigation and drainage systems. Every day, farms generate lots of statistics about temperature, soil, water consumption, weather conditions, and so on. This data is used in real-time by artificial intelligence and machine learning models to get important insights such as predicting the best time to plant seeds, selecting crop varieties, hybrid seed selection to increase yields, and so on.

Research in agriculture: As per IEEE, the number of research published from 2016 till 2022 are shown in the figure 1.1

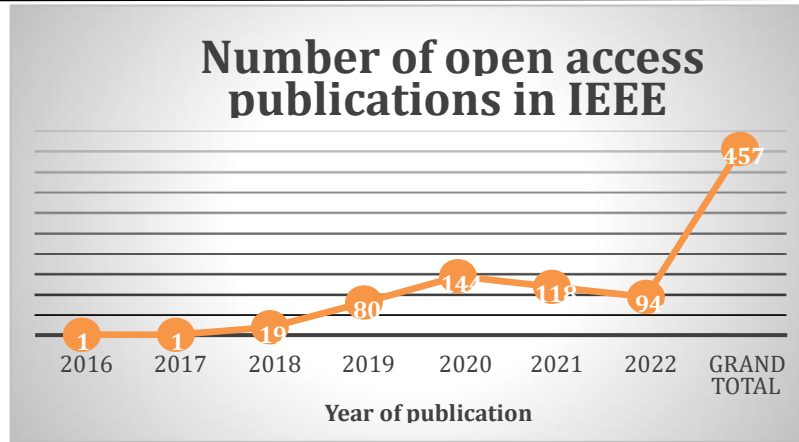


FIGURE 1. Number of Publication as per IEEE

As per science direct publication number of research done are depicted in the figure 1.2

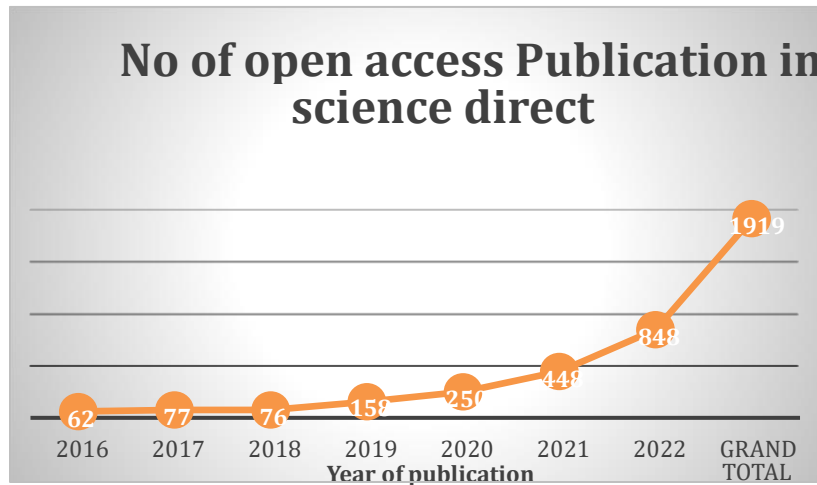


FIGURE 2. Number of Publication as per ScienceDirect

Implementation of AI: The use of AI-based technology helps to increase productivity across all industries, including the agricultural sector, and to address difficulties such as crop yield, irrigation, soil content sensing, crop monitoring, weeding, and crop establishment. In order to supply high-value AI applications in the aforementioned industry, agricultural robots are constructed. The agricultural industry is in crisis due to the rising global population, according to T. Talaviya et al. [1] in Artificial Intelligence in Agriculture, but AI has the ability to provide a much-needed solution. AI-based technical advancements have allowed farmers to increase output while using less resources, enhance output quality, and ensure a quicker go-to-market for the produced crops.

2. IMAGE RECOGNITION AND PERCEPTION

Monitoring crop: In general, computer vision technology may be utilised extensively during the whole process of plant growth, monitoring plant growth and development, and if abnormal conditions are identified, it is useful to solve the problem as soon as possible. Crop leaf thickness, rhizome length, and water content are the key monitoring targets, and all relevant information is precisely captured to use for prediction.

Disease diagnosis: In addition to giving crops the nutrients, they require to develop properly. It is also essential to deal with the diseases, pests, and weeds that impede crop growth. In the past, this component of work was greatly

influenced by agriculture's poor production value. With the development of image processing technology, its use in agricultural work has continued. In order for the personnel to carry out preventative work, image processing along with the machine learning and deep learning may be used to forecast potential issues that could arise during the early stages of crop growth or the disease detection.

Monitoring nutritional status: Real-time photographs of crop leaves and rhizomes may be captured using image processing technology throughout the growing process, allowing for the monitoring of crop leaf size and rhizome thickness. Through the monitoring data, crop-related data can be compared to the average state to determine whether there are any nutritional deficiencies or other problems. This allows for the timely development of an effective remediation plan, which ensures that crops grow normally and receive enough water and nutrition.

Monitoring maturity: The crop fruit picture points may be gathered from a wide range using browser image and other relevant analysis technologies, and the crop growth and maturity can be precisely estimated by the acquired parameters. These technologies allow us to assess the fruit's ripeness and create efficient defences.

Identify crop colours: The visual characteristic of colour makes it simple to assess the quality of crops. Digital imaging technology's gathering and analysis of colour traits transform into a detection method to determine whether the crops are of excellent quality. A theoretical basis was established for the systematic and uniform development of maize quality inspection by using the detection of corn quality as an example. The analysis of multiple image indicators, such as colour saturation and sensitivity of corn kernels, can be used as the quality grading standard of corn kernel sweetness and fineness.[2]

Maximize the output: Two expert systems were created over a three-year period to boost cotton crop productivity. First and foremost, COMAX. Lemmon made a successful attempt to construct an expert system named Comax in 1986. (COTton Management eXpert). Lemmon, a pioneer in AI in agriculture, created Gossym, a microcomputer-friendly application that promotes the usage of Comax (Lemmon, 1986). The expert system (Comax) was successfully combined with a computer model (Gossym) and simulated for the first time for the growth of cotton crops. This expert system was created to run continuously in cotton crop fields throughout the year. Comax takes three field aspects into account: irrigation schedule, nitrogen concentration in the field, and growth.[3] Chandra Prakash et. al[4] developed Fuzzy based Agriculture expert system for Soyabean . It uses MATLAB and consist of 5 modules. This system was created to assist farmers in providing professional knowledge about the soybean crop to users prior to seeding the soybean crop. 2.3. Chatbots for farmers Chatbots are virtual assistants that automate user interactions. Chatbots driven by artificial intelligence and machine learning techniques have allowed us to interpret natural language and connect with people in a more customised way. Agriculture has made advantage of this capacity by supporting farmers in receiving answers to unanswered queries, as well as guidance and recommendations.

3. ROBOTS IN AGRICULTURE

Harvesting robots: Energid Citrus Picking System, Harvest Automation HV-100, Agrobot E-Series, Dogtooth – Harvesting Soft Fruits, Agrobot SW6010 are some examples of harvesting robots.

Irrigation: Using AI in irrigation helping a lot specially in dry or draught areas. Various type of irrigation methods has been developed.

Weeding: R2Weed2, TED, Tertil, Horti Bot, The Asterix project, LaserWeeder are used for weed control.

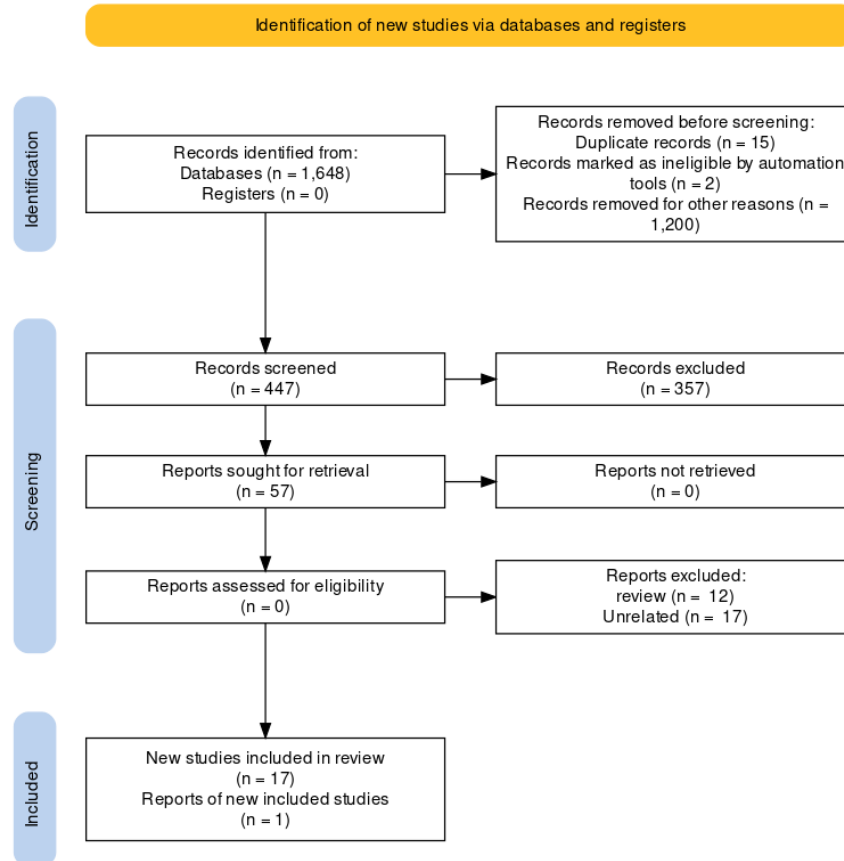
Mowing, pruning and seeding: Kompano, Bee Bot, The Spirit, Prospero, LettuceBot are helpful in Robotic mowing, pruning, seeding, spraying and thinning.

Drones in agriculture: In precision agriculture drones are more popular. Drones are used in monitoring crops, using sensors and capturing required information.

Crop spraying: Precision agriculture is aided by AI systems in improving overall harvest quality and accuracy. AI sensors can identify and target weeds before determining which herbicide to use in the area. This results in less herbicide use and cost savings. Many technical businesses have created robots that monitor and accurately spray weeds using computer vision and artificial intelligence. These robots can remove 80% of the chemicals that are routinely sprayed on crops and reduce herbicide cost by 90%. These sophisticated AI sprayers can substantially reduce the quantity of pesticides needed in the fields, hence improving agricultural quality.[5]

4. METHODOLOGY

This study aims to gather knowledge about various artificial intelligence and remote sensing techniques implemented in agriculture sector to resolve existing problems. This study was done through a systematic review of the peer-reviewed journal papers and Meta-Analysis (PRISMA) approach [6]



5. RESULT AND DISCUSSION

Use of Artificial intelligence along with other automated technology has proven beneficial to the agricultural sector. Specially in some complex regions. But during studies some limitations also observed.

1. Need of more data for accuracy
2. Limitations of use in remote areas
3. Expensive technology Conclusion:

In this study we have examine the current use cases of AI in agriculture sector. The use of different algorithms is improving accuracy of the technology. But more in- depth research and methods can be devised to implement AI in agriculture for optimization which will ultimately help the to reduce cost and remove limitations

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