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An Investigation of Artificial Intelligence in the Agricultural Sector

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ABSTRACT
The Agriculture and associated matters contribute significantly in a country's economy. Population expansion, shrinking acreage, resource shortages, unpredictable global warming, but also evolving consumer wants are all enabling agriculture into a new era. Agriculture's procedures are increasingly combining innovative creative techniques. Artificial Intelligence (AI) and its related sectors have demonstrated great potential in the crop fields. Because agriculture is the backbone of a rising economy, farmers are concentrating on precision farming. In way to acquire the most output from their crops, farmers must be equipped with the most advanced technology and techniques. In agriculture, farming techniques to offer accurate data on seed, soil, weather, disease, and all other factors that affect farming. The motive of this paper is to present vital knowledge about how farmers could use creativity to grow a variety of crops that meet global requirements and increase their profitability. AI is now being utilized in agriculture, with a focus on the uses, benefits, and drawbacks, as well as how to employ expert resources to increase farming production rates. As a result, the latest agricultural scheme should become high manufacture in production, well planned in operation, climate strong, long-term sustainability.

Keywords: **-** Agriculture, Artificial Intelligence, Digital Marketing, Farming Machinery

I. INTRODUCTION

Artificial Intelligence is having a major effect around all organizations. It has been progressing at a breakneck pace recently. Through limiting environment pollution, AI was able to solve several issues while also protecting a valuable resource. AI is revolutionizing agriculture by combining inefficient traditional ways with more effective approaches that help the world become a desirable location [1]. The ratio of people is rapidly growing, and with it comes an increase in interest in food & business. AI involvement in agriculture is boosting farmers in retrieving their farming planning & reducing harmful atmospheric impacts [2].

Artificial Intelligence in Agriculture

With its quick scientific growth & vast application area, AI is one of the most important areas of study in SE [3]. AI-based software assists to enhance productivity in all parts & handles the issues that many industries face, such crop harvesting, irrigation, crop observing, weed, harvest, foundation in the agricultural sector. On farms, AI sensors could monitor and classify weeds, as well as diagnose plant diseases, pests, and malnutrition. Illness detection beliefs, segmentation of the diseased part, & disease categorization mythologies [4]. ML and DL are two types of artificial intelligence which provide an efficient and practical solution to the issue. Using ML to train enormous data sets made publically available gives us a definite method to identify disease in plants on a massive range. ML-based algorithms would be utilized to detect and categories diseases on agricultural items such as plant. Identify leaf illness.

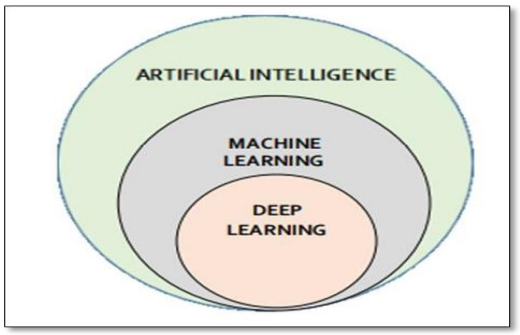

Figure 1: Subsets of AI [2]

The survey of CNN-based agricultural recent studies [6]. Using CNN (convolution neural networks) to identify illnesses and pests in plant photos. In digital agriculture, AI has emerged as a potential technology. In figure 1 show that the Deep learning and machine learning are the subsets of the Artificial Intelligence. AI DL and ML are interconnected area.

AI Technologies to transform the Agriculture

[1] Soil and Irrigation Scheduling

It is one of the extremely critical features of famous agriculture, as it contains water, nitrogen, phosphorous, potassium, proteins, all of which are essential for good crop growth and development [8].

Table 1: Comparison Table of Soil Management in Agriculture.

Author Name / References No.	Technique	Strength	Limitation
D. H. Chang /[9]	ANN	Expensive, time-saving, accurate to 92 percent.	Needs huge database.
E. M. Lopez /[10]	FL:SRC-DSS	Might categorize soilbased on the risks it presents.	Huge data is required.Some examples were investigated.
Chaudhary et al.,(2019)/[11]	PLSR & manyregression approaches	Productivity & financial viability have both increased.	-
Al-Ali et al. (2015)/[12]	Fuzzy Logic	Validation of results obtained It could be used on lawns at home.	-

[2] Weed Management

AI weed detection techniques have been proven in experiments to estimate the appropriate spray dosage as well as to spray accurately on the target spot, saving costs & reducing the risk of crop damage [13].

Table 2: Comparison Table of Weed Management in Agriculture

Application	Technique	Strength	Limitation
A. M. Tobal /[14]	ANN, GA	More Production. Decrease trial &Error.	Needs big data.
Y. Karimi /[15]	SVM,ANN	Rapidly identifiescrop damage, allowing for rapid site– specific solutions.	Only found low Stages of nitrogen.
M. P. Ortiz / [16]	UAV, GA	Can keep track of weeds fast and effectively.	Has low or no control on weeds. Ex pensive.
M. Brazeau /[17]	Mechanical Controlof Weeds. ROBOTICS. SensorML	Helps in savingtime and minimize weed resistance.	Cost effective, Constant use of heavy machine will de-crease soil Manufacturing.

[3] Disease Management

Crop diseases are another major source of issue for farmers. To diagnose an ailing plant and conduct the appropriate recovery actions, you'll need a great deal of experience. Computer-assisted methods are employed all over the world to detect ailments & recommend treatment options.

The Use of IoT Technology

IoT is a system of interconnected smart systems, mechanical machinery, diverse items, each of which has its own unique identification and data exchange capacity. As a result, interactions between humans and computers could be minimized. WSNs, cloud computing, radio frequency recognition are all examples of IoT advancements. Examination, Accurate agriculture, tracking & tracing, greenhouse manufacture, agricultural machinery are just a few examples of where IoT might be used [24].

Table 3: Comparison Table of Disease Management in Agriculture.

Authors Name/Reference	Aim/Crop	Technique	Accuracy
Kumar et al.,(2021) /[18]	Mango An-thracnose dis-ease	New deep learn-ing CNN architecture	Classification Accuracy-96.16 percent.
Ikorasaki et al.,(2018)/[19]	Recognize disease in cornplants	Bayes theorem	Accurcay-90%.
Pushpa et al.,(2021)/[20]	Detect plant diseases.	Different phases of DIP	92.06 percent.
Chouhan et al.,(2019)/[21]	Plant leaf images.	Multilayer CNN	Classification accuracy - 98.24 percent.
Trang et al.,(2019)/[22]	Mango leaves	Deep Neural Network	Accurcay-88.46 percent
Akshay et al.,(2020)/[23]	Mango images	CNN	Accuracy-93-94 percent.

Yield Prediction

Crop yield forecast is extremely useful for marketing & crop cost prediction. Furthermore, in the age of accurate agriculture, prediction models could be used to analyze key elements that significantly impact yield.

Drones in Agriculture:

Crop health observing, irrigation equipment observing, weed recognition, livestock, animal tracking, or disaster management are all uses for drones in agriculture [25].

Area of AI in Agricultural Sector

AI is a growing trend in agriculture. Agricultural production as well as the quality of real-time surveillance, picking, preparation, & selling have all improved [3].

Development based on the IoT

IoT is used to provide farmers with decision-making tools & automation approaches that absolutely combine devices, information, activities for improved organization, quality, and profit.

Image-based insight generation

Drone photos could aid in crop monitoring, field scanning, other tasks. Farmers could combine them with PC method & the IoT to establish rapid actions. As a result of these inputs, farmers might well be subjected to repeated environmental alerts.

Disease Detection

Image sensing & analysis separate plant leaf photos to surface regions such as back- ground, diseased region, non-diseased region of the leaf. After that, the soil or sick region is submitted & sent to a laboratory for further analysis.

Expert System

The necessity for specialist devices for the convey of technical knowledge in agricul- ture could be determined through examining difficulties in the existing approach transfer device & showing that professional devices could assist in overcoming those issues and are likely to boost.

Field Management

Utilizing high-detail images from drone & copter devices, real-time predictions may be made during the cultivation phase through constructing a field map & detecting places where crops includes water, fertilizer & pesticides.

Agriculture Robotics

An agricultural robotic is named as an Agribot or Agbot. It helps the producer in enhancing crop productivity while also minimizing the needed for manual labor. Authors could anticipate these agricultural robots to conduct personal tilling, sowing, harvesting, & many other farm activities in the coming generations. Actually, these agricultural robots would tackle weeding, pest management, disease prevention.

Irrigation automation methods & farmer empowerment.

AI-enabled technologies that are aware of previous climate designs, soil condition, and crop types could automate irrigation and boost overall productivity. Irrigation uses over 70% of the world's freshwater; such automation could save water & help farmers manage their water problems.

Crop health monitoring

Crop metrics must be constructed over thousands of acres of cultivable land using remote sensing (RS) methods such as hyper spectral imaging and 3D laser scanning.

Application of AI Techniques in Agricultural Sector

Following are some few AI uses in the agriculture sector:

Image Processing: It is an approach for measuring the diseased region and identifies color changes in the afflicted area. Image processing could be used to detect disease.

Machine Learning: In the modern era, machine learning AI applications have been developed for disease diagnosis. Machine learning algorithms can diagnose all disease quickly and accurately. ML & DL algorithms to enhance the identification proportion & reliability of the outcomes and identify plant illness. For disease identification, the SVM (Machine Learning Algorithm) is a preferable option [6].

Deep Learning: DL aids in the discovery of critical relationships in data as well as the recording data about existing customers that may aid patients with comparable symptoms or ailments. The suggested DL-based plant disease diagnosis model may reduce environmental issue and improve detection recognition [26].

CNNs: CNNs are imagined state-of-the-art in picture identification & have the capacity to include a quick & accurate recognition.

Expert System: In agriculture, an intelligent system might consist of combined Crop Management, irrigation, fertilization, weed control, cultivation.

Literature Survey

The findings demonstrated that the system gave a good performance, with an essentially linear connection among the expected or goal information as well as the network's response [30]. Murugan et al., (2017) proposed a mechanism for reducing the amount of time a drone is used repeatedly without impacting the smart agriculture monitoring findings. Following the development of the methodology, authors will be able to use satellite data without the need for drone data in similar fields [31].

Conclusions

Around 2050, the world's population will reach 9 billion growth, necessitating a 70% enhance in agricultural products to meet consumption. Only 10% of the extra production might come from undeveloped land, with the following modifications from current manufacturing advances. Using cutting-edge technical solutions to boost agricultural performance is a necessary in this atmosphere. In agriculture, farmers may simply reduce labour, farming tools and equipment, as well as investments, by implementing the AI farming industry. In comparison to traditional ways, the automated system will require fewer farmers and less time. Because AI optimizes the usage and power of resources, it could be accepted and useful in agriculture. It fixes the issue of re- source scarcity and abundant manpower. The current review study summarizes the introduction of AI applications in agriculture. The primary motive of this research was to provide a survey of AI applications and strategies that can help farmers achieve the desired yield. The paper also discusses several literatures that represent how agriculture improve by using different techniques. According to the literature, AI technologies are an excellent tool for a country's agronomics. As a result, future researchers should compile a comprehensive database spanning all aspects of agriculture as well as improve present technology to boost primary sector production.

Table 4: Comparison of Various techniques in Agriculture Sector

Authors Name/Reference	Aim/Crop	Technique	Re- sults/Accuracy
Dyrmann et al.,(2016)/[27]	Recognizing plant species in colorphotos.	CNN	Accuracy of 86.2percent
Khan et al.,(2021) /[28]	Recognized weeds and crops in croplands	Deep learning	Accuracy-94.73 percent.
Moiz et al.,(2022)/[29]	ML-based wheat production predic- tion system.	SMOreg, MLP, Gaussian method.	Better RMSE-0.5552 and PAD - 0.0093 for SMO-reg.
Dela Cruz et al.,(2017)/[30]	Smart Farm Auto- mated IrrigationSystem (SFAIS)	ANN Feed For- ward, Backpropa-gation.	The 81st round has the highest accura- cy efficiency, with an MSE of0.0027394.
Murugan et al.,(2017)/[31]	Creation of an adap- tive system for accu- rate agriculture sur- veillance using drone & satellite measurements, with implications for precision agriculturemonitoring out-comes.	Adaptive approach	A method for sepa- rating sparse & dense zones within a sugarcane area is described. It utiliz- es satellite meas- urements. For test- ing, reliability was87 percent.
Ngo et al.,(2019)/[32]	Weeds Identificationin Agricultural Field	CNN for weed identification; data augmentation for Image prepro-cessing.	Accuracy-70.5%
Anand et al.,(2015)/[33]	Progress in creating a system that uses fuzzy techniques and mobile computing to combat ex-cessive water use.	Fuzzy Logic Con-troller	Over than half of the water is saved using a fuzzy approach and a mobile service technology.

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