Role of Artificial Intelligence in Agriculture Sector

A Study on The Changing Scenario of the Agrarian sector in India

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***Abstract*: Agriculture plays a major role in India's economy. A large number of the Indian households depend on agriculture as their principal means of living. Agriculture is both a major industry and foundation of the economy for the country. Factors such as climate change, population growth and food security concerns have compelled the sector into seeking more innovative approaches to protecting and improving crop yield. As a result, AI is steadily evolving as part of the industry's technological evolution. This paper focuses on the current and emerging applications of artificial intelligence in the agrarian sector**

***Index Terms*: AI, Digital farming, MAI, Drones, Precision Agriculture**

I. INTRODUCTION

AI has been found useful in almost every field of work and study. It is being employed in every field makes it the next big thing and breakthrough for a digital future. To increase the agriculture output to meet over increasing population's demand is one of the major issues being faced today. Factors like climate, soil, rain along with other factors affect the output of a crop. Farmers feel immense pressure in such situations and lack of knowledge to overcome the problems faced in farming only add further to the problem. Change in weather patterns such as increase in temperature, changes in precipitation levels, and ground water density, can affect farmers, especially those who are dependent on timely rains for their crops. AI can predict solutions for sowing, pest control and commodity pricing.This promotes increased income and provides stability for the agricultural community. Indian agriculture has been traditionally rain dependent and climate change has made farmers extremely affected by crop loss. Insights from AI through the agriculture life cycle will help to reduce uncertainty and risk in agriculture operations. AI based agriculture can potentially transform the lives of millions of farmers in India.

II. APPLICATIONS

Artificial Intelligence can be used in agriculture in variety ways. This helps in calculating correct sowing period calculation, soil monitoring for diagnosing crop diseases and controlling pest. Different applications can be summarized as follows

OPTIMAL SOWING PERIOD CALCULATION
GEOLOCATIONS FOR CROP AND SOIL MONITORING
AGRICULTURE DRONES
PRECISION AGRICULTURE
EXPERT SYSTEM FOR LEAF DISEASE DETECTION AND DIAGNOSIS
PEST AND WEED CONTOL
CHATBOTS

III. OPTIMAL SOWING PERIOD CALCULATION

To determine the correct sowing period, the Moisture Adequacy Index (MAI) can be calculated. For this historic climate data will be analyzed using AI apllications.MAI is the standardized measure used for assessing the degree of adequacy of rainfall and soil moisture to meet the potential water requirement of crops. The real-time MAI is calculated from the daily rainfall in an area and is recorded. The future MAI is calculated from weather forecasting models for the area. This data is then analyzed to build predictability, and guide farmers to pick the ideal sowing week. Moisture Adequacy Index (MAI) is the ratio of actual evapotranspiration (AET) to the potential evapotranspiration (PET). Agricultural droughts during different seasons (years) were classified into four groups based on average MAI during the season. By considering this is a factor the crop sowing period is finalized

IV. GEOLOCATION FOR CROP AND SOIL MONITORING

Deep-learning algorithms are used to process data captured by drones and software-based technology to monitor crop and soil health.

Geotagging a field enables the farmer to overlay information gathered from analysis of soils and residual nitrogen, and information on previous crops and soil resistivity. Geotagging is done in two ways:

- The field is tracked using an in-vehicle GPS receiver as the farmer drives a tractor around the field.
- The field is tracked on a base map derived from aerial or satellite imagery. The base images must have the right level of resolution and geometric quality to ensure that geolocation is sufficiently accurate

V. AGRICULTURE DRONES

Drones can provide farmers with three types of detailed views. First, seeing a crop from the air can reveal patterns that shows everything from irrigation problems to soil variation and even pest and fungal infestations that are not viewable at eye level. Second, airborne cameras can take multispectral images, capturing data from the infrared as well as the visual spectrum, which can be combined to create an outline of the crop that highlights differences between healthy and unhealthy plants. Finally, a drone can monitor a crop every week, every day, or even every hour This will create a time-series animation and it can show changes in the crop, revealing trouble spots or opportunities for better crop management.

VI. PRECISION AGRICULTURE

Precision agricultures is based on specialized equipment, software and IT services. This focusses on accessing real time data about the conditions of the crops, soil and ambient air along with other relevant information such as hyper local weather predictions, labor costs and equipment availability. Analytics uses the data to provide farmers with guidance about crop rotation, optimal planting times, harvesting times and soil management.

VII. EXPERT SYSTEM FOR LEAF DISEASE DETECTION AND DIAGNOSIS

This is done with the aid of image processing by combining an image analyzer within a diagnostic expert system model. In order to diagnose a disorder from a leaf image, four image processing phases will be applied: enhancement, segmentation, feature extraction, and classification. In order to employ this system, the system will have to train using a set of images of disorders. The system will be tested on disorders. Applying this model to any other crop disorders requires only special care to be taken in order to acquire a sufficient set of images representative of these disorders for use in the training step. Combining this model within a diagnostic expert system then will greatly reduce any error prone dialogue between the system and the user while resulting in increased accuracy in the system's diagnosis.

VIII. PEST AND WEED CONTOL

Sensors can be used to detect weeds, the type of weeds and the right herbicides to apply within the right buffer around the plant. Cameras and sensors use machine learning where the images are captured and the machines can be taught in different weeds. Then also the correct herbicides are sprayed precisely as per area. Robot is also used which reportedly leverages computer vision to monitor and precisely spray weeds on cotton plants. Precision spraying can help prevent herbicide resistance.

IX. CHATBOTS

Chatbots are traditional virtual assistants who automate interactions with end users. Artificial intelligence powered chatbots, uses machine learning techniques, understand natural language and interact with users in a personalized way. Nowadays in agriculture also this emerging technology is assisting farmers with answers to their questions, giving advice and recommendations on specific farm problems.

X. CONCLUSION

Applications of Artificial Intelligence will help to enhance digital farming. In the forthcoming years digital farming will take over conventional agricultural practices. AI works in different domains of agriculture to improve time efficiency, water management, crop monitoring, soil management, control of insecticides and pesticides etc. It also minimizes human efforts, simplifies techniques for agriculture and helps to gain through digital farming. This advanced method of agriculture will help in growing the market with single touch and minimum efforts. This area can be seen as a set of techniques and methodologies that aim to optimize the management of crops and the use of agricultural inputs, providing gain regarding financial profitability and resource sustainability. This type of AI based farming will play a vital role in the agriculture sector in India.

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