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Crop Yield Prediction Data Analytics In Drone Agriculture Using Machine Learning

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Abstract: ***The core objective of crop yield estimation is to achieve higher agricultural crop production and many established models are exploited to increase the yield of crop production. Nowadays, ML is being used worldwide due to its efficiency in various sectors such as forecasting, fault detection, pattern recognition, etc. The ML algorithms also help to improve the crop yield production rate when there is a loss in unfavorable conditions. The ML algorithms are applied for the crop selection method to reduce the losses crop yield production irrespective of distracting environment. In India, we all know that Agriculture is the backbone of the country. This paper predicts the yield of almost all kinds of crops that are planted in India. Random Forest Regression is a supervised learning algorithm that uses ensemble learning method for regression. A Random Forest operates by constructing several decision trees during training time and outputting the mean of the classes as the prediction of all the trees. Visual Remote Sensing System such as human visual system. The Sensors are now used by farmers and agronomists to help them improve their operations. As a same time Odor Detection Using an E-Nose With a Reduced Sensor.***

I. INTRODUCTION

Machine Learning (ML) is a subset of artificial intelligence (AI) that focuses on the development of algorithms and statistical models that enable computers to perform tasks without explicit programming. The primary goal of machine learning is to enable machines to learn from data and improve their performance over time.

Machine Learning is the study of computer algorithms that can improve automatically through experience and by the use of data. It is seen as a part of Artificial Intelligence. Machine learning algorithms build a model based on sample data, known as training data, in order to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks. In India, there are more than a hundred crops planted around the whole country.

The practice of precision agriculture has been enabled by the advent of GPS and GNSS. The farmer's and/or researcher's ability to locate their precise position in a field allows for the creation of maps of the spatial variability of as many variables as can be measured (e.g. crop yield, terrain features/topography, organic matter content, moisture levels, nitrogen levels, pH, EC, Mg, K, and others). Similar data is collected by sensor arrays mounted on GPS-equipped combine harvesters. These arrays consist of real-time sensors that measure everything from chlorophyll levels to plant water status, along with multispectral imagery. This data is used in conjunction with satellite imagery by variable rate technology (VRT) including seeders, sprayers, etc. to optimally distribute resources. However, recent technological advances have enabled the use of real-time sensors directly in soil, which can wirelessly transmit data without the need of human presence. The work will help farmers to increase the yield of their crops. Storage of big data in clusters by using K-means clustering algorithm, reduce it to appropriate/valid content using the algorithm.

II. PROPOSED SYSTEM

This paper is to present a novel Multi sensor Machine-Learning Approach (MMLA) for classifying multi sensor data. The fusion strategy supports high-quality data analysis in agricultural contexts for cultivation recommendations. Visual

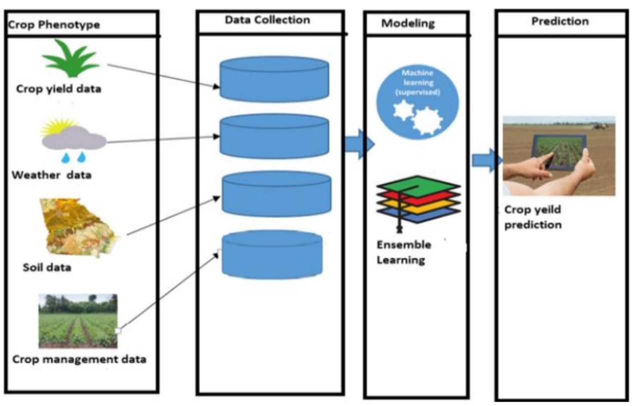
Remote Sensing System such as human visual system. The Sensors are now used by farmers and agronomists to help them improve their operations. As a same time Odor Detection Using an E-Nose With a Reduced Sensor. ML is being used worldwide due to its efficiency in various sectors such as forecasting, fault detection, pattern recognition, etc. The ML algorithms also help to improve the crop yield production rate when there is a loss in unfavorable conditions. The ML algorithms are applied for the crop selection method to reduce the losses crop yield production irrespective of distracting environment. Machine learning (ML) plays a support tool for Crop Yield Prediction (CYP) including supporting decisions on what crops to grow and what to do during the growing season of the crops. The present research deals with systematic reviews that extracts and synthesize the features used for CYP and furthermore, there are a variety of methods that were developed to analyze crop yield prediction using artificial intelligence techniques.

ADVANTAGES

Farmers can use an accurate crop production prediction model to assist them determine what to grow and when to grow it Crop yield forecasting is a difficult task for decision-makers at all levels, including at the national and regional (e.g., EU) levels.

Farmers may use a crop production prediction model to help them decide what to plant and when to plant it.

SYSTEM ARCHITECTURE



System Architecture

Machine learning is an important decision support tool for crop yield prediction, including supporting decisions on what crops to grow and what to do during the growing season of the crops. According to our analysis, the most used features are temperature, rainfall, and soil type, and the most applied algorithm is Machine learning in these models.

The Weather module inputs daily weather data and also can generate long term (e.g., 30-year) series of daily weather data that reproduce the statistical properties of a shorter series of weather years. The minimum daily weather data required are solar radiation, minimum and maximum air temperatures, and precipitation.

III. IMPLEMENTATION

Thus, to cover a larger area, more devices would be required thus increasing the total cost of implementation. The speed of data transfer in Z-Wave is less (around 100kbps) which restricts it to low data transfer activities such as monitoring and control. All data transmitted over LoRa is encrypted twice, once by the nodes and once by the LoRaWAN protocol. LoRa is also an open technology with an open and transparent standard. LoRa is backed by tech giants like CISCO and IBM, who are members of the LoRa alliance.

The LoRa technology is elementary in nature due to its simplistic implementation and fast deployment. we can move towards the implementation of the kNN algorithm. First, data is loaded into the model. kNN being a supervised learning method requires data to be loaded in labeled form. Next, K is declared according to the desired number of neighbours.

Then, for every element in the dataset, the ``distance" or ``relation" with the query input is calculated by the machine learning algorithm. The distance between the element and the query input is then added to an ordered collection and is subsequently sorted in increasing order of the distances. Random Forest cannot be used in case of extrapolation of data as it could produce inaccurate results. Although Random Forest can be used for both regression and classi_cation, it is better

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suited for classi_cation tasks. Also, it does not produce proper results when dealing with sparse data. Random Forest also needs more time for implementation and requires larger data and greater resources.

In the presence of correlated predictors, Random Forest is known to produce inexact results. Random Forest can be used to predict pest attacks in cotton plants. Various factors were very considered and the Correlation _lter selection method was used to select the most important features. Random Forest was then used to determine the number of trees to get a low error rate and important parameters were sighted out and used for clustering to determine the outcome.

When implementing a suitable solution to support data analysis tasks in agricultural contexts, data fusion tasks have been immersed in a variety of applications and approached from various points of view. Moreover, the multisensor data fusion strategy responds appropriately to agricultural-related queries.

DATA ANALYSIS AND USING DRONE

Crop yield prediction in drone agriculture using machine learning involves a systematic data analysis approach that integrates drone-collected data and advanced analytics to optimize agricultural practices. Drones equipped with cutting-edge sensors, including multispectral and environmental sensors, are deployed over fields to gather a wealth of information. This data undergoes thorough preprocessing, where cleaning and normalization ensure its quality and consistency. Feature engineering, including the extraction of valuable vegetation indices, enhances the dataset's informativeness. it also include software input only.

Exploratory Data Analysis

Exploratory Data Analysis (EDA) delves into the dataset's characteristics, uncovering patterns and correlations. Feature selection focuses on key variables that significantly impact crop yield. Machine learning models, such as regression and ensemble methods, are chosen based on the dataset's nuances. Training these models on historical data allows them to capture intricate relationships, and evaluation metrics, like Mean Absolute Error (MAE), gauge their accuracy and generalizability.

Drone Systems

Integration with drone systems enables real-time data processing during flights, providing farmers with immediate insights. Continuous monitoring mechanisms ensure the model adapts to evolving environmental conditions, while periodic updates with new data refine its predictive capabilities. The system extends beyond prediction, generating alerts and recommendations for farmers to make timely, informed decisions.

A user-friendly interface facilitates the visualization of predictions and recommendations, empowering farmers with actionable insights. Security measures safeguard sensitive agricultural data, adhering to privacy regulations and ethical data usage. In summary, the synergy of drone technology and machine learning in crop yield prediction offers a holistic solution to modern agriculture, enhancing productivity and sustainability.

Future Of IOT Technologies

In the future, the integration of IoT technologies will play a pivotal role in advancing the capabilities of drone-based agriculture and machine learning for crop yield prediction. By deploying a network of IoT sensors across fields, farmers can gather real-time, granular data on crucial environmental variables such as soil conditions, humidity, and temperature. These IoT sensors will complement the data collected by drones, providing a comprehensive understanding of the agricultural landscape.

The seamless connectivity established through IoT protocols will enable constant communication between sensors, drones, and a central processing unit. This connectivity facilitates not only the transmission of real-time data but also the implementation of responsive actions through automated systems. With the incorporation of edge computing at the drone level, data processing and analysis can occur locally, minimizing latency and optimizing bandwidth usage.

The real-time monitoring capabilities afforded by IoT will enhance the accuracy of predictive models. Machine learning algorithms, trained on historical crop yield data and now enriched with dynamic IoT inputs, can deliver more precise and adaptive predictions. Automation, guided by these predictions and real-time sensor data, will empower farmers to make timely and informed decisions regarding irrigation, fertilization, and other agricultural practices.

Moreover, the integration of IoT will contribute to sustainability efforts by optimizing energy consumption. Automated processes, such as irrigation and climate control, can be fine-tuned based on real-time data, ensuring resources are used efficiently. The implementation of actuators and controllers, enabled by IoT, allows for the seamless execution of these optimized practices.

Farmers will have the ability to remotely monitor and control their agricultural operations through user-friendly interfaces, accessible via mobile applications or web platforms. This level of remote accessibility ensures that farmers can manage their fields efficiently, even when not physically present on the farm.

MODULES

- Crop dataset
- Data pre-processing
- Decision tree regression
- Evaluating the data
- Data preparation
- Prescriptive process

MODULES DESCRIPTION CROP DATASET

A database is information that is set up for easy access, management and updating. Database module contains attributes like district, land area, Soil type, Year, Season, Crop Name, Production and Rainfall. This database is used for analysis and further sent to Data Pre- processing**.**

DATA PRE-PROCESSING

In Data Pre-processing module data is cleaned and only necessary attributes are taken for Crop Yield Prediction analysis.

DECISION TREE REGRESSION

Decision tree builds regression or classification models in the form of a tree structure. It breaks down a dataset into smaller and smaller subsets while at the same time an associated decision tree is incrementally developed. The final result is a tree with decision nodes and leaf nodes

EVALUATING THE DATA

Crop Yield Prediction (CYP) mainly depends on two major feature sets. One set of data contain the land usage, land preparation, applied fertilizers, and the methods of irrigation, which depends on the farmer.

DATA PREPARATION

Fundamental prescient examination procedure in the agribusiness business. A rural practice can assist ranchers and cultivating organizations with anticipating crop yield in a specific season when to establish a yield, and when to gather for better harvest yield.

2 different dataset -for crop data and fertilizer data are used. 80% used for training and 20% dataset is used for testing the data. The district, area, season, and production factors are used to build a machine learning model which predicts yield.

PRESCRIPTIVE PROCESS

Prescriptive planting is a type of farming system that delivers data-driven planting advice that can determine variable planting rates to accommodate varying conditions across a single field, in order to maximize yield.

In addition to farmers, giant agricultural corporations like Monsanto and DuPont have a vested interest in increasing agricultural yields, and they encourage farmers to subscribe to "prescriptive planting" technology. In prescriptive planting, the farm-equipment sensors send data not just to individual farmers, but to these corporations as well. The corporations compile the data (for a fee) and send the aggregated information to the farmers and their machines, prescribing what seeds to plant, when, at what depth, and how far apart to space the rows to produce the highest yields.

IV. CONCLUSION

Agriculture is the field which helps in economic growth of our country. But this is lacking behind in using new technologies of machine learning. Hence our farmers should know all the new technologies of machine learning and other new techniques. These techniques help in getting maximum yield of crops. Many techniques of machine learning are applied on agriculture to improve yield rate of crops. These techniques also help in solving problems of agriculture. We can also get the accuracy of yield by checking for different methods. Hence we can improve the performance by checking the accuracy between different crops. Sensor technologies are implemented in many farming sectors. This paper helps in getting maximum yield rate of the crops. Also helps in selecting proper crop for their selected land and selected season. These techniques will solve the problems of farmers in agriculture field. This will help in improving the economic growth of

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