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Revolutionizing of Crop Management Using a Smart Approach with AI Technology

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ABSTRACT

India is home to more people per capita than any other country and the vast majority of its workers are involved in farming. Farmers use fertilizer carelessly, not understanding the exact quantity or composition of the deficit, and they keep growing repeatedly planting the same crops in the absence of different varieties. Soil acidification and topsoil
damage aren't the only consequences; this also affects crop yields directly. As a result, we improved the system for farmers by using machine learning techniques. The ideal crop for a certain parcel of land may be determined by our algorithm using content and weather data.

Keywords; Machine learning, data mining, agriculture, agricultural yield, supervised algorithms.

1. INTRODUCTION

Among India's many vital economic areas, agriculture stands out. It is essential to the nation's development as a whole since it forms the foundation of the economy. The country farms almost 60% of its land area in order to feed its 1.3 billion inhabitants. That is why it is essential to employ contemporary agricultural technologies. As a result, American farmers will have a higher probability of financial success [1]. Farmers relied on their familiarity with the region's past to make forecasts about crops and output. They will pick the most widely grown crop in the area or on their own land without considering the soil's nutritional levels (potassium, phosphorus, and nitrogen). The current state of affairs is that crop rotation is not taking place, which results in reduced fertilizer use, lower yields, soil pollution (also called soil acidity), and topsoil erosion. We made sure the farmers could relax when we developed the machine learning technology. A revolution is taking place in the farming sector because of machine learning (ML). New opportunities in the multidisciplinary

area of agritechnology for data-intensive research have arisen because to developments in machine learning (ML) such as algorithms, large datasets, and performance computers. As an example, machine learning isn't some hidden technique used in farming; it's just a collected data from a collection of well specified models using certain techniques to achieve specific goals [7]. Which crops may do well on a particular piece of land are detailed in the system's plan. because of things like soil type, temperature, humidity, and rainfall. These are sourced from V C Farm Mandya, the official government website, and the weather service. The pH, temperature, and humidity readings are supplied by the farmers or sensors that work with the system. To make predictions, machine learning algorithms go through all the data provided, look for patterns, and then rank them based on the criteria provided. The Decision Tree [6] and the Support Vector Machine (SVM) [5] are two examples of these types of algorithms. The method advises the farmer on both the crop and the quantity of fertilizer to apply. Additionally, the system should please include the amount of seed needed per acre for growth, the current market price of the crop, and an expected yield in q/acre.

2. LITERATURE SURVEY

1. Using Big Data for Smart Crop Selection Evaluation in Intelligent Agriculture (Fan-Hsun Tseng, Hsin-Hung Cho, and Hsin-Te Wu, 2015).

The demand for agricultural goods rises in tandem with the human population. However, many crops frequently experience adverse weather due to global climate change.Through the use of IoT-enabled smart agricultural equipment, this study monitors environmental variables on a farm. To investigate the factors affecting the farm's environment, the acquired data was analyzed using 3D clustering. Here are some characteristics of the proposed plan: First, the data is averaged out using moving average and variance. Then, it's analyzed using 3D clustering to find out how environmental factors and farmers' thumb rules are related. The system then shows if a crop has been correctly clustered. Lastly, it uses future environments to set a critical value in the cluster and gives input about the crop's suitability for the farm.

2. Crop Yield Analysis with the Use of Algorithms for Machine Learning by Ahmed Abdelgawad and Fatin Farhan Haque, and Venkata Prasanth.

Aside from being necessary for human survival, agriculture is also crucial to the expansion of the economy. It is difficult to predict agricultural output because of the large number of factors that affect it, including water, ultraviolet radiation, fertilizer, pesticides, and the amount of land covered. To better understand agricultural output, this research proposes two distinct machine learning (ML) methods. Two excellent methods for checking the parameters' validity of the continuous variable estimate prediction are In terms of linear regression and support vector regression, both of which need 140 data points. There is a strong correlation between the aforementioned variables and harvest success.

3. U.S. Corn Belt County-Level Yield Estimation using a Multilevel Deep Learning Network (Jie Sun, Zulong Lai, Liping Di).

Harvest management and food security depend on accurate and timely evaluation of yields from small-scale crops. Machine learning, and deep learning in particular, may integrate several datasets—including those pertaining to soil, climate, satellites, and other sources—to deliver accurate yield forecasts, as demonstrated in recent research. In order to make things more precise, we need to fix several problems. To begin, time-series data and constant data are the two main categories of remote sensing information often utilized for yield prediction. Secondly, yields are affected by both geographical and temporal aspects, yet deep learning networks receive surprisingly little focus. These networks are able to merge the two data sets.

4. A study conducted by Singh, V., Kour, H., & Singh, S., and J. Manhas was conducted to assess the efficacy of machine learning methods in predicting mustard crop yields using soil analysis data.

One important factor that impacts predictions of crop yields is the soil. Soil scientists and farmers can improve crop yields via planning ahead by measuring soil nutrients. Based on previous soil research, this study predicts mustard crop output using several machine learning methods. The The Agriculture Department at Talab Tillo, Jammu, provided the data for the experimental setup, which included soil samples from several districts in the Jammu area for the mustard crop. The data for this study was processed using five supervised the following AI methods: Artificial Neural Networks (ANNs), Multinomial Logistic Regression, Naïve Bayes, Random Forest, and K-Nearest Neighbor (KNN).

5. " Crop yield prediction using deep neural networks" by S. Khaki and L. Wang.

Because of agriculture, we can now ensure the existence of every species on Earth while also caring for the environment. Water, ultraviolet (UV), pesticide, fertilizer, and land cover factors are thought to have had a significant role in determining agricultural output. The best artificial neural network (ANN) method is assessed in this study, which also provides a machine learning model that uses neural networks as an example.

of India's most important economic sectors is agriculture. As the backbone of the economy, it's crucial to the growth of the nation overall. To provide food for its 1.3 billion people, the nation uses more than 60% of its land for farming. Therefore, modern farming technology must be utilized. Farmers in our nation will have a better chance of making a profit because of this [1]. Farmers relied on their familiarity with the region's past to make forecasts about crops and output.

DISADVANTAGES:

- Expensive;
- labor is required.

4. PROPOSED SYSTEM:

By considering the soil's composition and meteorological conditions, the suggested method would employ the RNN and rf algorithms to forecast which crop would be most suitable for a given plot of land.Utilizing data analysis technologies, the proposed approach ensures that the fertilizer rate change is continuously updated. Applying the crop selection method to the myriad problems that contemporary agriculture and farmers confront is the study's main objective. This is good for India's economy and agricultural output. varied terrain. As a result, the quality of the fertilizer is determined using a grading system. In addition, the rate for fertilizer of high and low quality is determined by this technique. The quality of the prediction judgments produced by an ensemble of classifiers is greater as it makes use of several classifiers. Additionally, decision-making makes use of the classifier's output in a prioritized manner. This approach is aimed at forecasting the future expenses of fertilizer. In this study, we use ensemble classifiers like rf, RNN, and hybrid classifiers. The Ranking approach is also utilized in this project.

ADVANTAGES:

What kind of crops work best on particular plots of land may be determined by our algorithm using content and weather data.

5. CNN Algorithm

Among the many several varieties of artificial neural networks, CNNs are by far the most used for image analysis.[1] Convolutional neural networks (CNNs) use mathematical technique of convolution in place of generic matrix multiplication in one or more layers.For image

processing and recognition, they are tailor-made to manage pixel data. They come in handy when you need them to.

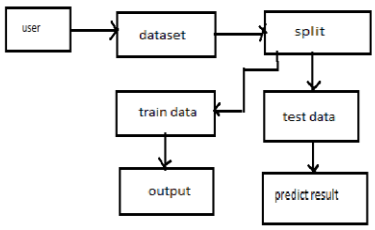
5.1 RR algorithm

In order to ensure that jobs are distributed evenly, round-robin schedulers sometimes use time-sharing. This method entails allocating a certain amount of time, or quantum[5], to each job, which is its assigned CPU time. If a work does not finish within that time, it is interrupted. When a time period is booked for that operation again, the procedure starts over. Once a process finishes or goes into a waiting state within the specified time period, the scheduler will choose the first process in the ready queue to run. A procedure that produced several very big jobs would be preferred if time-sharing was not an option or if the quanta were extremely huge in comparison to the job sizes. The scheduler makes the round-robin algorithm exit the CPU as soon as the time allotment finishes because it is a preemptive approach. In order to allocate CPU time to other processes, the round-robin scheduler will stop the job after 100 ms if task 1 takes 250 ms to finish inside a 100 ms time window. Each subsequent task will need 100 ms of CPU time, and then task 1 will receive more CPU time, and the process will continue in the same manner. This loop will keep running until the task is completed and the CPU is no longer needed.

5.2 Lstm algorithm

Artificial neural networks such as long short-term memory (LSTM) are utilized for deep learning and AI [1]. Long Short-Term Memory (LSTM) neural networks incorporate feedback connections, deviating from the standard feedforward neural networks. Visual, auditory, and kinetic data may all be processed using the RNN. That is why LSTM networks are so great for data management and making predictions. Long short-term memory (LSTM) has the potential to revolutionize a wide range of industries, including machine translation, robotic control, voice recognition, speech activity detection, speech recognition, healthcare, and many more.[12] One reason RNNs are called "LSTM" is because the majority of them possess both "long-term memory" and "short-term memory." Physiological changes in synaptic strengths are responsible for long-term memory retention; each training session causes the network's link weights and biases to go through one change. Similar to how the brain's short-term memory storage is influenced by the brain's electrical firing patterns, the activation patterns of the network fluctuate with each time-step.A "long short-term memory" capable of withstanding millions of timesteps is what the LSTM architecture is all about, as stated in [13].

6. SYSTEM ARCHITECTURE DIAGRAM



7. MODULES

- **Data Preprocessing: -**

  Following the collection of data sets from many sources. Preprocessing the dataset is necessary before training the model. Reading the collected dataset is the first step in getting ready to clean the data. The crop forecasting process will not make use of the attributes that were removed during data cleaning, which were deemed unnecessary. Datasets with missing values or unwanted characteristics should be removed in order to increase accuracy. Either these missing values should be eliminated or unwanted nan values should be used in their place.

- **Machine Learning Algorithm for Prediction: -**

  For the purpose of offering a likely result, machine learning prediction algorithms have to use highly efficient estimation based on taught information. To assess the possibility of upcoming occurrences as inferred from prior data, predictive analytics employ facts, statistical methods, and ML techniques. Not content with only understanding what has transpired, we want to offer the most accurate prediction of what is still to come. We implemented regression and classification using supervised machine learning with subcategories in our system.

- We have found that the classification method works admirably in this setup. This includes
- Making rain predictions using the SVM algorithm In order to predict future crops, scientists use the decision tree technique.

7. CONCLUSION:

Due to their increased reliance on technology and analysis, our farmers now put themselves in danger of choosing the incorrect crop to grow, which might lead to a decline in their revenue. We have created a user-friendly system for farmers that uses a graphical user interface (GUI) to figure out what crops would do best on a given plot of land, and it also gives them other useful information like how much fertilizer to use, how many seeds to use for cultivation, how much they can expect to harvest, and how much money they can make. To encourage innovation and advance the agriculture industry, this helps farmers choose the best crops to plant.

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