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SMART CROP AND FERTILIZER RECOMMANDATION SYSTEM

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Abstract: India's economy, which is mostly dependent on agricultural products and yield growth, is an agricultural nation. An increasing area of study in crop production analysis is data mining. The ability to anticipate yield is a critical issue in agriculture. Any farmer is curious to know how much of a crop he can anticipate. Analyze the different factors that are associated, such as the location and the pH level used to calculate the soil's alkalinity. Location is used in conjunction with the use of third-party applications like APIs for weather and temperature, type of soil, nutrient value of the soil in that region, amount of rainfall in that region, and soil composition. Percentages of nutrients like Nitrogen (N), Phosphorous (P), and Potassium (K) are also used. All of these data variables will be analysed, and the data will be trained using different machine learning methods that are appropriate for building models. The system includes a model to be exact and accurate in predicting crop production and to provide the end user with appropriate recommendations regarding required fertiliser ratios based on atmospheric and soil factors of the land that enhance to boost crop yield and increase farmer income.

Keywords: Decision Trees, Bagging, Random forest algorithm, Boosting, Gradient Boosting, XGBoost.

Introduction:

India is a country with a large population and unpredictable climatic changes that must protect the world's food resources. When there is a drought, framers have significant issues. The kind of soil has a are high yield and low yield. The obtained result for the crop yield prediction using SMO classifier gives less significant impact on crop productivity. Advising farmers to use fertilisers could assist them in making the optimal choice for their farming scenario [1]. There are numerous studies that demonstrate how Information and Communication Technology (ICT) can be used to forecast crop yield [2]. Data mining allows us to forecast agricultural yields as well. We can advise the farmer to plant a better crop for a higher yield by thoroughly analysing the prior data. The difficulty lies in creating the most effective model to forecast the crop's production, therefore experiment with many algorithms, compare them all, and decide which one has the least error and loss before choosing that model to forecast the crop's yield. This research compares the performance of the two algorithms and forecasts the results of the top model.

Related Work:

Niketa et al 2016 [1] have indicated that the yield of the crop depends on the seasonal climate. In India, climate conditions vary unconditionally. In the time of drought, farmers face serious problems. So this taken into consideration they used some machine learning algorithms to help the farmers to suggest the crop for the better yield. They take various data from the previous years to estimate future data. They used SMO classifiers in WEKA to classify the results. The main factors that take into consideration are minimum temperature, maximum temperature, average temperature, and previous year's crop information and yield information. Using SMO tool they classified the previous data into two classes that

accuracy when compared to naïve Bayes, multilayer perceptron and Bayesian network. Eswari et al 2018 [2] have indicated that yield of the crop depends on the perception, average, minimum and maximum temperature. Apart, from that, they have taken one more attribute named crop evapotranspiration. The crop evapotranspiration is a function of both the weather and growth stage of the plant. This attribute is taken into consideration to get a good decision on the yield of the groups. They all collected the dataset with these attributes and send as input to the Bayesian network and classify into the two classes named true and false classes and compared with the observed classifications in the model with a confusion matrix and bring the accuracy. Finally, they concluded that crop yield prediction with Naïve Bayes and Bayesian network give high accuracy when compared to SMO classifier and forecasting the crop yield prediction in different climate and cropping scenarios will be beneficial. Shruti Mishra et al 2018 [3] have indicated that applying the data mining techniques on historical climate and crop production data several predictions are made which increase the crop productivity. The decision support system has to be implemented for the farmers to take proper decisions about soil and crop to be cultivated. They have collected the dataset with attributes of the crop season, Area and production in hectares and analyzed with various algorithms in WEKA. They analyzed data with four methods and found their accuracy and compared with each other. The four methods used are J48, IBK, LAD tree, LWL in WEKA. They concluded that the IBK had got more accuracy when compared to all other and that depends upon the nature type and the nature of the dataset. Chlingaryana et al 2017 [4] indicated the major factor in the crop yield prediction is the nitrogen level in the soil. Nowadays remote sensing systems are mostly used in decision making. These remote sensing data is used to help the farmers to improve the crop yield. Huge remote sensing data is used to make a decision. Nitrogen is used to improve the crop yield and make the soil fertile. Machine Learning algorithms are used to make the decision. major factors we are going to take it into consideration is nitrogen, type of soil and yield analysis of previous data of these factors are helpful to make the accurate decision and predict the yield and helps the farmer.

Proposed System Methodology:

Prediction of the crop yield using the efficient algorithm and suggest how much quantity of fertilizer should be used to get the proper yield for the crop.

Now a day's precision agriculture is used to improve the yield and giving suggestion to farmers. It uses information technology to ensure the crop and soil.it says how they need to optimize the production and health of the soil. The obtained results are back-propagation neural network is used to get different vegetarian incidents. The conventional neural network of long term memory to predict feature data. Dakshayini Patil at all 2017 [5] indicated that rice crop plays a major role in the economy. They used various data mining techniques to predict the yield of the rice crop. Rice crop is the sustainable security of India. In general, it contributes 40% to the general yield. High yield of the crop is based on the appropriate climatic conditions. Learning a better strategy to grow the crop according to the climatic conditions can improve the crop yield. The reports utilize various mining techniques based on the previous data of the crop yield and different climatic regions. In this, the authors used data of 27 regions of Maharashtra to predict the yield of the crop. Weighted contribution to its yield enactment. One sort of system sees the hubs as “artificial neurons”. These are called neural systems. The back engendering calculation (Rumelhart and McClelland, 1986) is utilized in layered feed-forward ANNs. This implies the counterfeit neurons are sorted out in layers and send their signs "forward", and after that, the blunders are spread in reverse [7]. The system gets contributions by neurons in the info layer, and the yield of the arrange is given by the neurons on a yield layer. There might be at least one middle of theroad concealed layers. This neural arrange engineering is extremely mainstream, since it very well may be connected to a wide range of undertakings. The principal term, "feed forward" depicts how this neural arrange procedures and reviews designs. In a feed-forward neural system, neurons are just associated with forward. Each layer of the neural system contains associations with the following layer (for instance, from the contribution to the covered up layer), yet there are no associations back. The expression back spreadportrays how this kind of neural system is prepared[8]. A back spread is a type of managed preparing. When utilizing a managed preparing strategy, the system must be given both example inputs and foreseen yields. The foreseen yields are looked at against the real yields for given information. Utilizing the foreseen yields, the back proliferation preparing calculation at that point takes a

A. Data Set Description:
This is the sample data set used in this project. The data in Table I is data used to predict crop yield based on 7 factors. These 7 factors are state, district, crop, area, season, production by this data we can create a machine learning model and train the model and we can predict the production and from Table II we can predict the amount of fertilizer should be used to get the proper yield the input parameters are the quantity of nitrogen, phosphorus, and the output is the amount of the respective fertilizer should be used. Hear in the input parameters 1, 2, 3, 4, 5, 6 represents the very high, high, above average, below average, low and very low quantity present in the soil respectively.

B. Necessary Packages:

- Numpy
- Pandas
- Matplotlib.pyplot
- Scikit-learn
- Tensorflow
- Jupyter

Store the data related to the yield and fertilizer in the csv which consists of the state_name, district_name, crop_year, season, crop, area, production, and another data set consists of level of the phosphorous, level of potassium, level of nitrogen in the soil, how much amount of phosphorous, potassium, nitrogen should be used to increase soil fertility.

C. Architecture:

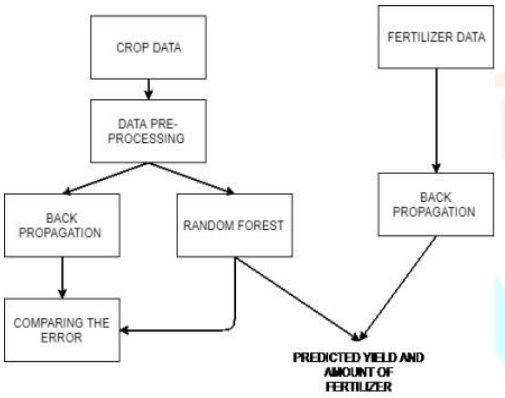

Fig. 1. Architecture diagram

is the Backpropagation algorithm. The backpropagation algorithm is the concept from the multiple layer perceptron in the artificial neural network. The backpropagation algorithm is used for large datasets which have no proper relationships between the attributes of the dataset to form a network model by training the dataset and predict the determined mistake and changes loads of the different layers in reverse from the yielding layer to the info layer [9].

D. Metadata:
All the main data used in the data set are initialized with the number to use in the algorithm it is like initializing all the details. In this metadata, we are going to initialize all the crop names with the numbers. This data makes us use the data easily in the algorithm. Hear the metadata of all the crops is given with a particular number. This number is not duplicated that is one number is given to one crop, the same number is not given to the other crop. This metadata consists of more than a hundred crops that grown all over India.

E. Data Pre-processing:

Hear the raw data in the crop data is cleaned and the metadata is appending to it by removing the things which are converted to the integer. So, the data is easy to train. Hear all the data. In this pre-processing, we first load the metadata into this and then this metadata will be attached to the data and replace the converted data with metadata. Then this data will be moved further and remove the unwanted data in the list and it will divide the data into the train and the test data For this splitting of the data into train and test we need to import train_test_split which in the scikit-learn this will help the pre-processed data to split the data into train and test according to the given weight given in the code. The division of the test and train is done in 0.2 and 0.8 that is 20 and 80 percent respectively.

F. **Random Forest Algorithm**:

[13] This algorithm suits for both huge and small data to give an efficient prediction. Based on the given data to the algorithm it forms various decision trees and checks for how many trees give the same prediction. It is based on the votes it will count and which trees give the same output after that the output given by the maximum trees it will show as output as explained in Fig. 2. The given data in the project go to the random forest algorithm and hear it will build ten trees and pass data to it. Every tree is classified based on the various conditions and it will train the model according to it and will count the number of trees will give the same output and which has more count it will be decided as the output.

G. Fertilizer utilization using Back-propagation:

output. This algorithm mainly consists of the three layers in the network model, They are the input layer, hidden layer, and output layer. Input layer in the model is mainly responsible for giving the inputs to the model, then the hidden layer which is in between the input layer and output layer and this mainly responsible to get the output from the input layer as input and calculate according to the weights present on the input to hidden layer and gives the desired output result and the last layer is output layer which gives the output predicted from the network model. Backpropagation algorithm is a supervised learning algorithm. To train a dataset in a back propagation algorithm it should have the desired output attribute in the dataset. Backpropagation algorithm is trained in a way we fix the output value or attribute to the dataset that is to be trained, At first iteration is output is calculated and observes the difference between the expected output and the obtained the output based on that observation it backpropagates the error and update the weights between the nodes in the layers and bias. The network is thus trained with many iterations until it gets the desired output. After training the network model then it's validated and generalized by the test dataset whether the prediction is accurate or not.

After validation of the network model, we can predict by giving the unknown data and predict the output to the unknown data given to the model.

CONCLUSION AND FUTURE WORK:

Crop yield prediction and efficient use of the fertilizer is successfully predicted and also found the efficient algorithm from both the algorithm and obtained the most efficient output of the yield. In future developing the web application based on this ideology and make the user use this easily and help the user to understand the yield of the crop, he is going to crop in that season.

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