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Crop yield prediction and alternate crop prediction using ML

Disha Chiplonker
dishachiplonker.17cs@saividya.ac.in
Sai Vidya Institute of Technology, Rajanukunte, Karnataka

Arjun A.
arjuna.17cs@saividya.ac.in
Sai Vidya Institute of Technology, Rajanukunte, Karnataka

Pruthvi M.
pruthvim.17cs@saividya.ac.in
Sai Vidya Institute of Technology, Rajanukunte, Karnataka

Rakshith V. R.
rakshithvr.17cs@saividya.ac.in
Sai Vidya Institute of Technology, Rajanukunte, Karnataka

Sunil G. L.
sunil.gl@saividya.ac.in
Sai Vidya Institute of Technology, Rajanukunte, Karnataka

ABSTRACT

Agriculture is one of the most important occupation practiced in India. It is the broadest economic sector and plays an important role in overall development of the country. About 60% of the land in India is used for agriculture in order to suffice the needs of 1.2 billion people. Thus, modernization of agriculture is very important and thus will lead the farmers our culture towards profit. The proposed method aims to provide an efficient and accurate solution for prediction of yield rate of crop and also providing alternate crop based on given condition. So, using machine learning algorithms and techniques such as Linear Regression, Random Forest Regressor to identify the pattern among data and process it as per the input condition, the method predicts yield rate of crop and alternate crop. The proposed method takes into consideration factors like location and weather conditions to process the data.

Keywords: *Crop, Crop Prediction, Yield Prediction, Alternate Crop Prediction, Machine Learning, Random Forest Regression, Linear Regression*

1. INTRODUCTION

India has perpetually been an agricultural country. Its economy depends on the agriculture yield growth and agroindustry merchandise. In India, agriculture is basically affected by rain that may be an extremely unpredictable issue. Agriculture growth conjointly depends on various soil parameters, particularly element like Phosphorus, Potassium, crop rotation, soil, and surface temperature and also on weather aspects like temperature, rainfall, etc. India is gradually progressing towards technical development. Thus, technology can persuade to be useful to agriculture which is able to successively increase crop productivity leading to higher yields for the farmer. The planned project provides an answer for sensible agriculture by watching the agricultural field which may assist the farmers in increasing their productivity to an excellent extent. Agriculture is one amongst the foremost vital occupation practiced within the country. It's the broadest economic sector and plays a crucial role within the overall development of the country. About three fourth of the land in our country is employed for agriculture so as to do the requirement of over a billion individuals. Thus, modernization of agriculture is extremely important and can lead the farmers of our country towards profit.

Predicting the crop yield earlier of its harvest would facilitate the policy manufacturers and farmers to take applicable measures for promoting and storage. Earlier yield prediction was performed by considering the farmer's expertise on a selected field and crop. However, because the conditions day by day terribly worsen, farmers are forced to cultivate a lot of crops. Being this the present state of affairs, several of them do not have enough information concerning the new crops and don't seem to be responsive to the advantages they get while farming them. This project can facilitate the farmers to understand the yield of their crop before cultivating it onto the agricultural field and so facilitate them to form the suitable choices. It makes an attempt to resolve the problem by building a very low paradigm of an interactive prediction system. Implementation of such a system with an easy-to-use interface primarily based on web graphic and also machine learning rule is administered. This work presents a system, within the style of a web-based application, which may use knowledge analytics techniques so as to predict the foremost profitable crop within the current weather and soil conditions.

2. LITERATURE SURVEY

[1] Crop Yield Prediction Using Deep Reinforcement Learning Model for Sustainable Agrarian Applications – D Elavarasan & P M D Vincent. The work constructs a Deep Recurrent Q-Network model which may be a Recurrent Neural

Network deep learning algorithm over the Q-Learning reinforcement learning algorithm to predict the crop yield. This proposed model predicts the crop yield outperforming different existing models by preserving by an accuracy of 93.7%.

[2] Soil Classification using Machine Learning Methods and Crop Suggestion based on Soil Series – S A Z Rahman, K C Mitra & S M Mohidul Islam. Several machine learning algorithms like weighted k-Nearest Neighbour and Gaussian kernel- based Support Vector Machines are used for soil classification. Experimental results show that the proposed Support Vector Machine based method performs better than many other existing methods. From experimental results, we see that though K-Nearest Neighbour and Bagged tree show comparative accuracy, but Support Vector Machine shows better accuracy than other methods used here.

[3] Crop Yield Prediction Using Machine Learning Algorithms – A Nigam, S Garg, A Agarwal & P Agarwal. Many experiments were conducted on the Indian government dataset and it has been confirmed that Random Forest Regressor grants the maximum yield prediction accuracy. By combining temperature and rainfall, along with other parameters like season and area, results discloses that Random Forest is the best classifier when all parameters are considered.

[4] Crop Yield Prediction using Machine Learning Techniques – R Medar, V S Rajpurohit & S Shweta. Many techniques of machine learning are applied on agriculture to improve yield rate of crops. We can also get the accuracy of yield by checking for various methods. The paper helps in getting maximum yield rate of the crops. It also helps in selecting genuine crop for the selected particular land and for a selected season. These techniques will solve the problems of farmers in agriculture field.

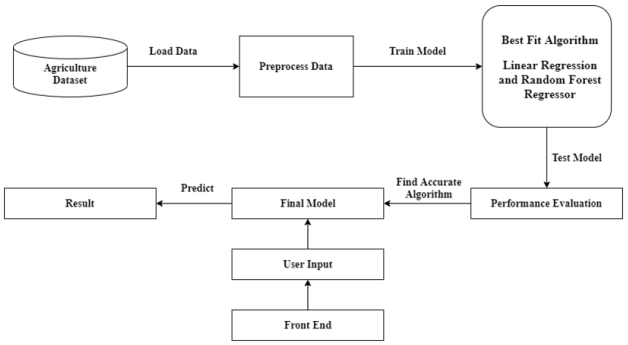
[5] Crop Prediction using Machine Learning – M Kalimuthu, P Vaishnavi & M Kishore. The proposed supervised machine learning uses naive Bayes Gaussian classifier with boosting algorithm, which is developed to predict the crop at the highest accuracy. The seed is predicted as an output for the given input parameters. It may also extend to advise the fertilizer, suitable guidelines for crop land and crops for the specified input.

[6] Prediction of Crop Cultivation – R Solanki, D Bein, J Andro-Vasko & W Bein. The paper proposes to use machine-learning algorithms to design a prediction model for crop yield prediction. On comparing the performance of varied linear and non-linear regressor models using 5-fold cross validation, it was found that using majority of the basic settings, the Random Forest Regressor executed the simplest, proceeded by Nearest-Neighbour Regression, L^2 rectilinear regression with polynomial features, and support-vector regression employing a Radial Basis Function kernel.

3. PROPOSED SYSTEM

The proposed system predicts the yield rate of the crop and also the alternate crop. The proposed system has been divided into modules for easy development. The system architecture of the proposed system is given in figure.

The agriculture dataset is loaded into the machine learning model. Data Preprocessing implies that the system will check the dataset for null values and they are removed. Since the dataset is huge, it is impossible to manually remove the null values so we implement data preprocessing. After data preprocessing, dataset is split into training and testing sets (ratio of 80:20). The dataset is now trained using the ML algorithm. This model is then used to predict the target for the newly fed data. The user can feed data using the prediction module on the web application and then the model will predict result for that data.



A. Data

The dataset taken for prediction yield rate of crop contains of seven columns. The dataset has about two lakh records of data. The attributes of the dataset are State Name, District Name, Crop Year, Season, Crop, Area and Production. Here, the attribute of production is the output which the system predicts.
The dataset taken for prediction of crop contains of five columns. The dataset has about two thousand records of data. The attributes of the dataset are temperature, humidity, pH, rainfall and crop. The attribute of crop is the predicted output.

B. Backend

It consists of developing the machine learning models and saving it through the pickle library as a separate file in the same directory as the project. This machine learning model is then called as a function when the inputs from the user interface (the web page) were given by the user. It was decided to make the machine learning model and then use that model to predict the results, every time the user gives some inputs. The Machine Learning models did not always have to be made from scratch and this reduced the processing time of inputs to a large extent since. To process the inputs, Flask was used which basically passed the inputs, these inputs were then passed as arguments to the machine learning code. The machine learning code was built using the method which was found to be the most efficient.

C. User Interface

Making the user interface using the native python libraries would not have any impact on processing time and since the processing has to take place after we give inputs through the interface. Moreover, the web technologies are very popular and people tend to use websites more than the native applications. HTML and CSS were used to make four web pages, one for registration, one for login of the user, one for taking user inputs and predicting the crop yield and last one for the crop prediction. Flask was incorporated in a frontend python file which is an advantage for faster development time.

4. ALGORITHM USED

4.1 Random Forest Regression

Random. Forest is a. supervised. Learning rule used for classification. and. regression. The most versatile, simple rule to use. Random forests create decision trees on a random designated information sample, gets projection from every tree and then chooses the most effective resolution suggests of that choice. It provides a smart feature. Random Forest Regression algorithm in both the modules of predicting the yield rate of crop and predicting crop too.

Input: Agriculture Dataset – Yield Dataset/Crop Dataset
Steps:

1. Data Preprocessing: involves checking the dataset collected from Kaggle for missing values or null values. This is done using Machine Learning techniques.
2. Takes sample from agriculture dataset at random
3. For each data considered, create decision tree and acquire a result from each decision tree
4. Make a vote for each expected result.
5. Choose the prediction with the most votes as the final predicted result.

5. RESULTS

The result of implementation of the Random Forest Regression (RFR) algorithm is listed below. The algorithm is implemented for the module of predicting yield rate of a crop. It is implemented in the prediction of crop as well. Random Forest Regression was implemented as it has more pros than cons.

Table 1: Results

Module	Accuracy using RFR
Crop Yield Prediction	89%
Crop Prediction	94.63%

6. CONCLUSION

The proposed project focuses on prediction of yield of a crop and also prediction of crop based on weather conditions in a certain region. Our projects include crop yield prediction and also, crop predictions based on factors such as temperature, pH, etc. For which Random Forest Regression is the best fit algorithm. The system, takes into account all the data related to weather such as temperature, pH of soil, rainfall, etc. and also previous year's production. As the system lists out crops, crops which can be cultivated can be decided with ease. It lists out which are the best crops which can be cultivated to get the best profits in the conditions which are given. The system will help farmers in the aspect of getting an insight into the demand of the crop and the cost of the crops in the market. As it takes the data of previous year productions into consideration. This system will prove to be highly useful to be used in agricultural sector. This tool can easily be used by a user for personal use to analyze the cultivation scope in India. Also, can be used by a farmer to predict the yield rate and analyze alternative crop options. It can be used by an organization for consultancy purposes. Can be used by organizations who employ farmers and deal with agricultural operations. The proposed solution provides and simple, clear, trustworthy and comfortable way for users to access the project and work it.

7. ACKNOWLEDGEMENT

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BIOGRAPHIES

Disha Chiplonker
Student,
Sai Vidya Institute of Technology, Rajanukunte, Karnataka, India

Arjun A
Student,
Sai Vidya Institute of Technology, Rajanukunte, Karnataka, India

Pruthvi M
Student,
Sai Vidya Institute of Technology, Rajanukunte, Karnataka, India

Rakshith V. R.
Student,
Sai Vidya Institute of Technology, Rajanukunte, Karnataka, India

Sunil G. L.
Assistant Professor
Sai Vidya Institute of Technology, Rajanukunte, Karnataka, India

