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A Classical Machine-Learning Algorithm for Crop and Fertiliser Advisors

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ABSTRACT: Agriculture is a significant source of income in India. When crop production is affected by seasonal, economic, and biological patterns, farmers can find themselves in a difficult situation. When soil type, temperature, air pressure, humidity, and crop type are all considered, these dangers can be minimized. Machine learning is a relatively new research area in crop recommendation systems. In the past, farmers' previous experience with a particular field and crop was considered when making crop predictions. Crop forecasting is a difficult problem that cannot be solved with the data currently available. In this case, techniques based on machine learning are the way to go. Many machine learning approaches are being used and tested in the agricultural industry for the upcoming year's crop production forecasts. Crop productivity can be estimated using historical data in this work. To do this, machine learning techniques like the Random Forest are used to analyze agricultural data and identify the best fertiliser for each crop. When it comes to growing an interesting crop, the fertilizer expert offers advice on how to boost the soil's nitrogen, phosphorus, and potassium levels. It explains how to make it better. Input from the user is required on a website built with Flask that includes options for crop advisor and fertiliser advisor. The model predicts the outcome and shows it to the user based on the inputs.

KEYWORDS: Machine Learning, Random Forest, Nitrogen, Phosphorus, Potassium.

I. INTRODUCTION

Since ancient times, agriculture has been revered as the foundation of Indian society and the most significant aspect of Indian culture. Ancient people were able to adapt to their needs because they grew their own food. Agricultural technology and practices are deteriorating because of a lack of innovation. Due to the abundance of inventions that lead to unhealthy living, people have been concentrating on the production of artificial items that are hybrid products. When it comes to cultivating crops, many people are unaware of their significance. These farming methods are also altering seasonal climate conditions, putting at risk important assets like land, water, and air, and resulting in food insecurities as a result. Machine learning uses supervised, unsupervised, and reinforcement learning methods to develop its algorithms. Each method has advantages and disadvantages. Using a data set that includes both inputs and outputs, the algorithm builds a mathematical model that it can use to predict future outcomes. No desired output labels are included in a dataset used by the program to create a mathematical model. Soil nitrogen (N) affects leaf development, while phosphorus (P) influences root development, flower and fruit development, and all other aspects of plant growth. Potassium (K) in the soil has a direct effect on the plant's overall performance. It's easier to choose soil with appropriate NPK values if you're familiar with its composition.

To date, many farmers have relied on their previous farming experience and seasonal planning when deciding what crops to plant. However, as we all know, the weather can change at any time, and soil fertilisers are an important part of ensuring healthy crop growth. Some farmers have no idea how to improve the soil's fertility for their crops. Our project uses nitrogen, phosphorous, and potassium as fertilisers so that the machine learning algorithms can tell us which crops should be grown in each field based on various crop input values, such as pH level, rainfall, state, and city, and estimate which crop is best suited to the field. If we provide the values for nitrogen, potassium, and phosphorus for the crop we want to yield, it will suggest ways to raise the soil's NPK levels to increase yield. For all of this, a flask is used, which

is mostly used to create a webpage in which the user specifications can be input, and the output results can be obtained by simply clicking on the submit button on the webpage.

II. RELATED WORK

“Improving Crop Productivity Through A Crop Recommendation System Using Ensembling Technique” by Nidhi H Kulkarni, G N Srinivasan, B M Sagar, N K Cauvery. The algorithm used is Random Forest, Naive Bayes, and Linear SVM. The advantages are: The average classification accuracy obtained by combining the independent base learners is 99.91%. The disadvantage is Soil Datasets w.r.t four crops Rice, Cotton Sugarcane, wheat. “Crop Recommendation System using Machine Learning” by Dhruvi Gosai, Chintal Raval, Rikin Nayak, Hardik Jayswal, Axat Patel. The algorithm used are Decision Tree, Naive Bayes, Support Vector Machine, Logistic Regression, Random Forest, XGBoost, and CNN. The advantages are The Analysis has been performed on these six types of machine learning algorithms and out of these six algorithms XGBoost achieved the best accuracy result. The disadvantage is Manual Humidity and Temperatures values. “Crop Yield Prediction Using Machine Learning Algorithms” by Aruvansh Nigam, Saksham Garg, Archit Agrawal, Parul Agrawal. The algorithm used are Random Forest, Artificial Neuron Network, KNN, XGBoost, and Stochastic Gradient Descent. The advantages are farmers in choosing the right crop to grow in the next season and bridge the gap between Technology and agricultural sector. The disadvantage is Less Accuracy. “Soil Fertilizer Recommendation System using Fuzzy Logic” by Jenskierlin I. Haban, John Carlo V. Puno, Argel A. Bandala. The algorithm used is Fuzzy Logic. The advantages are the results show that the fuzzy logic system is successfully developed and simulated to give appropriate fertilizer recommendations. The disadvantage is Only Four Kinds of fertilizers.

III. METHODOLOGY

The system basically uses a Jupyter notebook which imports the os and sets the path to read the dataset. In every dataset, we have both input and output attributes. To get a good prediction for some models we should consider a large dataset. We needed dataset of crop dataset with the related feature. Various attributes included in the dataset are nitrogen, phosphorus, potassium, humidity, PH value, rainfall, and crop. It is divided into training and testing data. Of the dataset used, 80% are used to prepare a training dataset and 20% of data are used to prepare a testing dataset. The class labels are apple, banana, black gram, chickpea, coconut, coffee, cotton, grapes, jute, kidney beans, lentil, maize, mango, moth beans, mung beans, muskmelon, orange, pigeon peas, pomegranate, rice, and watermelon.

Random Forest Algorithm

The algorithm works in 2 phases. Figure 1., showed the first phase, Using the dataset and given number of trees to build before taking the average result it draws decision trees in the second phase, it predicts the result by taking most of the output from the trees built.

```
from sklearn.ensemble import RandomForestClassifier

RF = RandomForestClassifier(n_estimators=3, random_state=0)
RF.fit(Xtrain, Ytrain)

predicted_values = RF.predict(Xtest)
acc.append(x)
model.append('RF')

x = metrics.accuracy_score(Ytest, predicted_values)
print("RF's Accuracy is: ", x)
```

Figure. 1 Random Forest Code

Downloading the model for further usage i.e., for building a website using flask.

Creating a website using Flask

Firstly, we need to import the flask library which is an inbuilt library of python which helps us to create an interactive website. We need to use the downloaded model i.e. random forest model so that we can use that model for further

usages like predicting the output of a crop using the inputs given by the user. We create the main page which contains crop and fertilizersub-pages.To get the result of crop prediction we need to give serval inputs like Nitrogen, Potassium, Phosphorus, pH level, Rainfall, State, and City. Based on the values given by the user that inputs are given to the model in the backend,and it predicts the output and displays it to the user. Whereas, for fertilizer, we need a predefined file that contains information about how to improve the NPK values based on the crop NPK values.Users will give their soil NPK value and the crop they want to grow then our model will take those values and check the required NPK values of that crop and verify the user NPK values based on that it gives information on how to improve it if any NPK value is low or high.

IV. EXPERIMENTAL RESULTS



Figure. 2 Main Page

Figure 2 gives us an idea about the main page and when you click on crop on the left corner it takes us to the next page i.e., Figure 3.

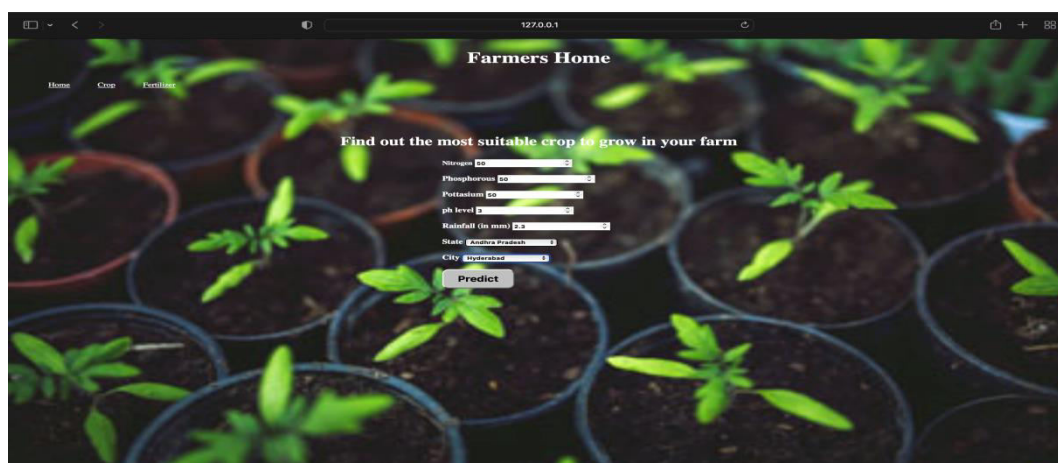


Figure 3. Crop Page

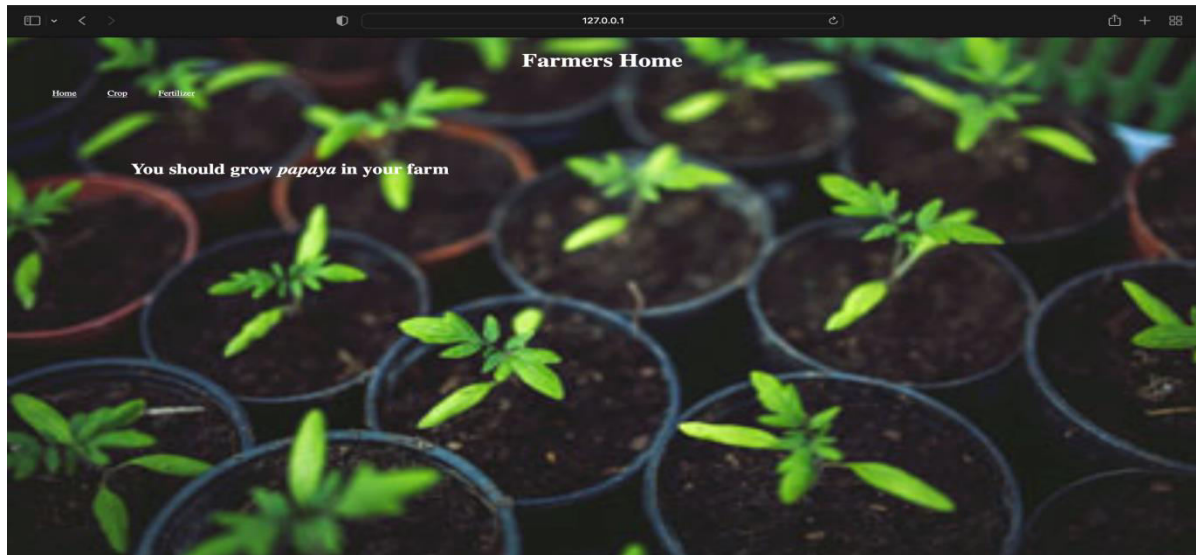


Figure 4. Crop Output Page

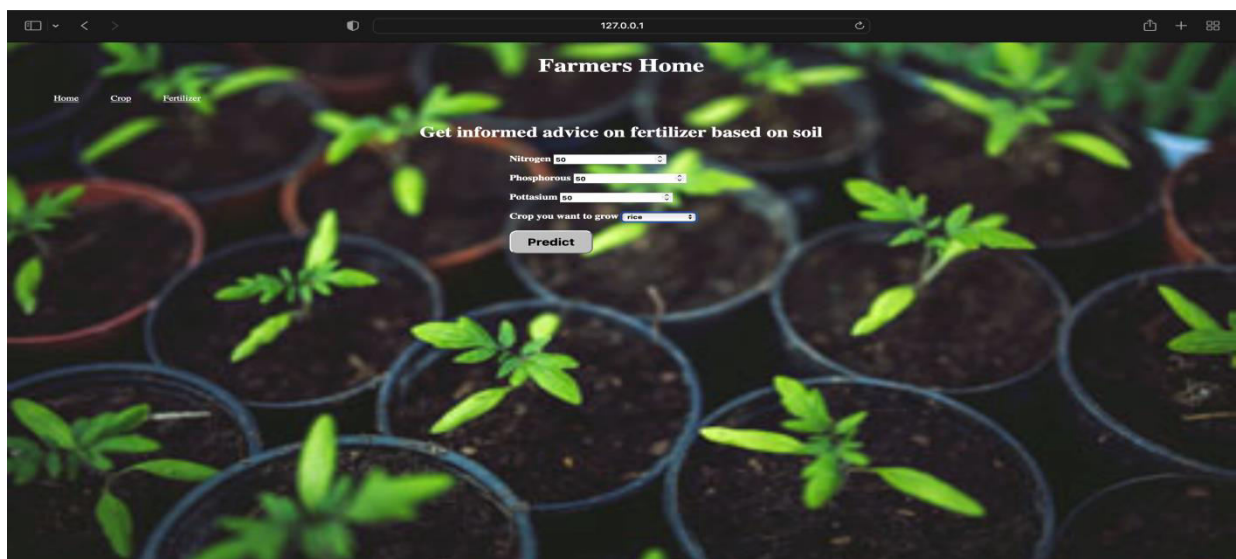


Figure 5. Fertilizer Page

This is what the crop page looks like, and we need to give the inputs when you click on predict it gives us the output as shown in Figure 4. When you click on fertilizer it takes us to the fertilizer page as shown in Figure 5. When we give the required inputs in the pages and click on predict it gives us information about how to improve it.

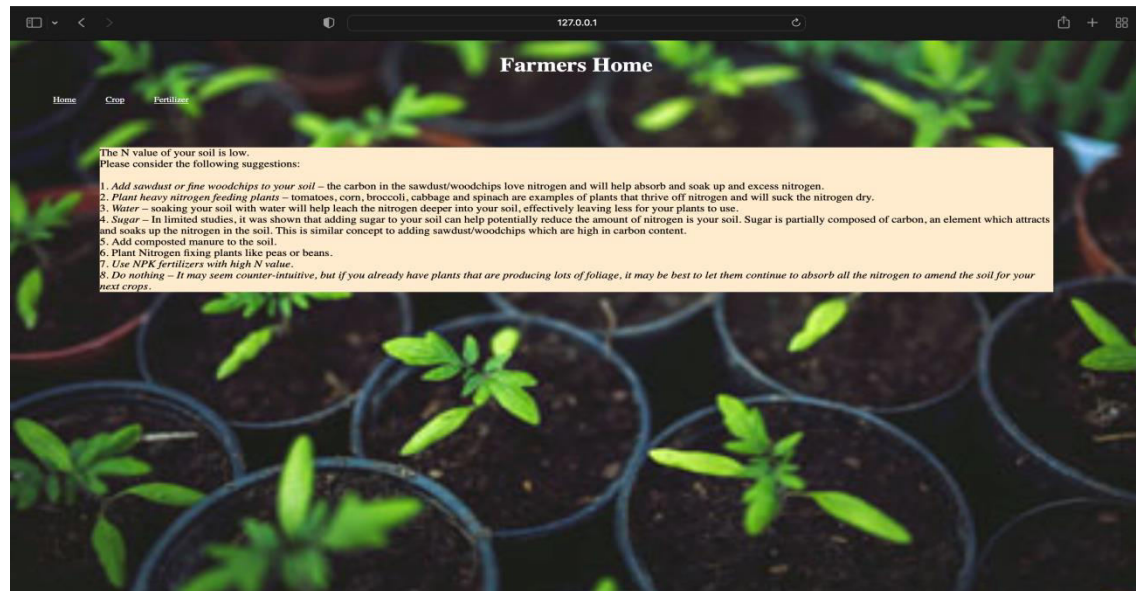


Figure 6. Fertilizer Output Page

V. CONCLUSION

In this paper, using a simple technique to utilize machine learning techniques to provide crop prediction. Machine learning techniques can provide intelligent models that are simpler than traditional physical models. with the help of a flask to create a webpage that takes input from farmers and predicts the output. The fertiliser advisor will instruct the farmers to improve the NPK content in the soil based on the crop of their interest. The evaluation results show that these machine learning models can predict the crop to be grown accurately enough to compete with traditional models.

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