ISSN No:-2456-2165

Soil Classification and Crop Prediction Using Machine

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Abstract:- Soil classification is a major problem and a heated topic in many countries. The world's population is drastically increasing at an alarming rate which in turn makes the demand for food crops. Farmers are forced to block soil cultivation since their conventional methods are insufficient to fulfil escalating needs. To optimize agricultural output, farmers must understand the best soil type for a certain crop, which has an impact on growing food demand. There are several methods for categorizing soil in a scientific way, but each has its own set of disadvantages, such as time and effort. Computer-based soil classification approaches are essential since they will aid farmers in the field and will be quick. Advanced Machine Learning technique-based soil classification methodologies can be used to classify soil and extract various features from it.

Keywords:- *Soil Classification, Crop Prediction, Machine Learning, Convolutional Neural Network.*

I. INTRODUCTION

The agriculture sector is the backbone of the economy in emerging nations such as India. Farmers require a new method to selecting crops that are lucrative for them and provide a high yield. We all know how important soil is in agriculture. Soil comes in a variety of forms. Different crops flourish in different soil types, and each soil type has its own set of traits. To determine which crops, grow best in which soil types, we must first understand the attributes and characteristics of each soil type. In this case,machine learning approaches might be useful. It has made great development in recent years. In agricultural data processing, machine learning is still a young and hard study topic.

Soil classification is the classification of soils that have comparable qualities into parts. Soils are a considerably more complicated to study than other natural resourcethan air and water.

The soil classification system is critical in establishing the amount of construction and landscaping restrictions that apply to a specific piece of land. Soil classification is simply the practise of classifying soil into classes or groups with comparable properties.

We will construct an application in this project that employs many machine learning algorithms, such as Convolutional Neural Networks, to categorize soil based on an image provided by the user. The Android Application also advises users on other crops that may be produced in that particular soil based on various criteria such as weather and humidity, so that farmers can make informed decisions about what crops to plant in their fields to maximize profitability.

With the increased use of smartphones in recent years, it is now quite possible for anybody with a smartphone to use our program to simply identify soil and anticipate the crops that may be produced in the soil.

II. LITERATURE SURVEY

- S k Al Zaminur Rahman et.al proposed a technique in this work that can forecast soil series based on land type and then recommend appropriate crops based on the prediction.
- B. Bhattacharya et.al proposed “Machine learning in soil classification” in which he says that Measured signals are segmented using a segmentation method in this article. Second, the notable properties of these segments are extracted using the boundary energy technique.
- Pramudyana Agus Harlianto et.al proposed “Comparison of machine learning algorithms for soil type classification” in which the research compares and contrasts several machine learning techniques for categorising soil types. Support vector machine (SVM), neural network, decision tree, and nave bayesian techniques are described and assessed for this categorization. Real-world data is used to create the soil dataset.
- Amélie Beucher et.al proposed “Artificial neural networks and decision tree classification for predicting soil drainage classes” in which They state Soil drainage affects plant development as well as a number of biophysical processes such as nutrient cycling and greenhouse gas fluxes. As a result, soil drainage maps are useful tools in agriculture, forestry, and environmentalmanagement.
- Saeed Khaki et.al proposed a “Crop Yield Prediction Using Deep Neural Networks” in which the Accurate yield prediction requires a fundamental understanding of the functional relationship between yield and these interaction components, which requires big datasets and advanced algorithms to find.
- M K Dharani et.al proposed a “Review on Crop Prediction Using Deep Learning” in which Deep learning and its hybrid techniques, such as artificial neural networks, deep neural networks, and recurrent neural networks, were investigated in this research. It helpeddetermine how artificial intelligence technology may help increase agricultural output.

ISSN No:-2456-2165

III. MODULES IDENTIFIED

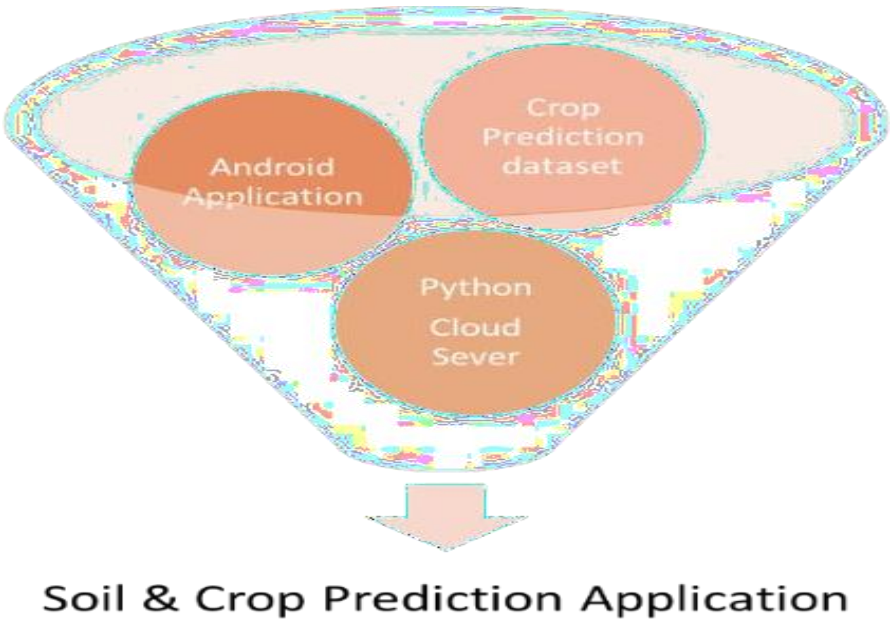

Fig. 1: Modules identified

This project has been divided into three modules:

- Android Application
- Crop Prediction Dataset
- Python Cloud Server

➢ *Android Application*

The android application uses flutter for the frontend development and is used to communicate with the python server.

➢ *Crop Prediction Dataset*

The Dataset is used to train the Machine learning model.

➢ *Python Cloud Server*

Python flask framework is used to run the server side application and provide API's.

IV. METHODOLOGY

In country like India where most of the farmers are uneducated there is a requirement to make them understand complex topics of agriculture in a simpler manner. The soil prediction application helps them to understand better about the soil in which they are farming which will lead to better yields.

There are many types of soil that are subjected to varying environmental stresses. Soil is categorised primarily by its texture, proportions, and various organic and mineral components. The primary goalof this research is to anticipate the kind of soil and select appropriate crops. In this project, we want to make accurate predictions of soil type based on photographs provided by the user via the Android application, as well as to recommend crops that may be cultivated in that setting.

Support Vector Machine (SVM) is a Supervised machine Learning approach used for classification. It is commonly used in Machine Learning for Classification tasks. The goal of the SVM method is to determine the optimal line. SVM chooses the end most points to create the final output.

V. RESULTS

The proposed application in the paper uses SVM Algorithm to predict the type of the soil and gives us the preferred crop to be grown in the soil as shown in fig 4. The accuracy of the model is 82.35 percent and is shown in fig 1. The model can be trained with more datasets to improve the accuracy. The android application build can be used as an interface between the user and the backend shown in fig 4 and fig 3 respectively.

ISSN No:-2456-2165

```
#result=svm_model_linear.predict([[md1,predict[1],predict[2]
#print(feature[result[0]])

D:\anaconda\lib\site-packages\numpy\_distributor_init.py:30:
D:\anaconda\lib\site-packages\numpy\.libs\libopenblas.EL2C6P
D:\anaconda\lib\site-packages\numpy\.libs\libopenblas.QVLO2T
  warnings.warn("loaded more than 1 DLL from .libs:"

82.35294117647058
[[27  0  0  1  0  0  0  0  0  0  0]
 [ 0 36  0  0  0  0  0  0  0  0  0]
 [ 2  0  8  6  0  0  0  0  0  0  0]
 [ 1  0  2  7  0  0  0  0  0  0  0]
 [ 0  0  0  0 25  0  0  0  0  0  0]
 [ 0  0  0  0  0 11  5  0  0  0  0]
 [ 0  0  0  0  0  1 17  0  0  0  0]
 [ 0 18  0  0  0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0 10  0  0]
 [ 0  0  0  0  0  0  0  0  0 12  0]
 [ 0  0  0  0  0  0  0  0  0  0 15]]

In [ ]:
```

Fig. 2: Accuracy of the Model

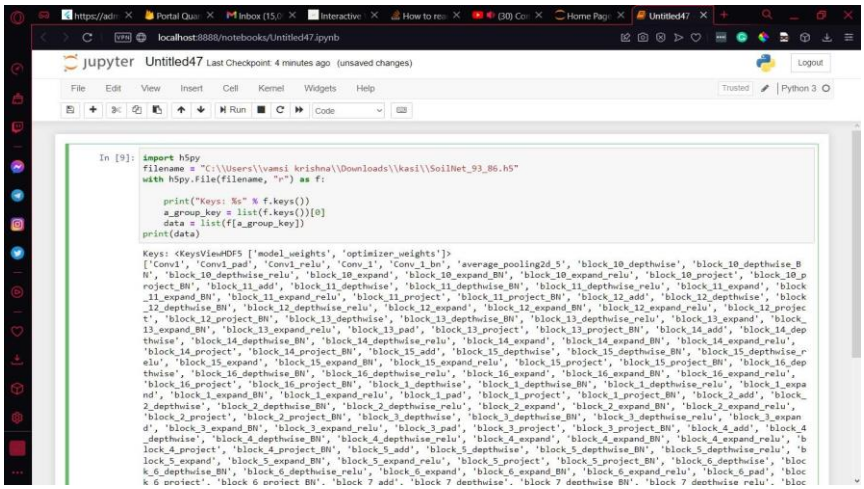

Fig. 3: Soil Prediction Machine Learning Model

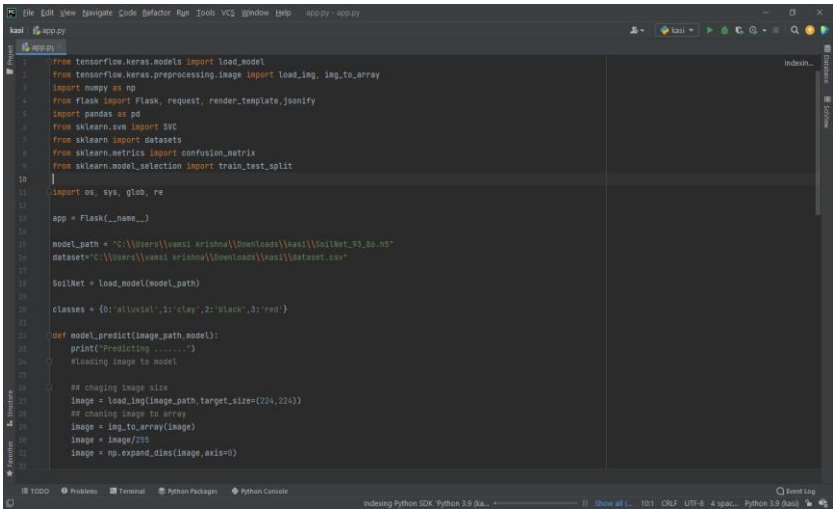

Fig. 4: Python Flask Server

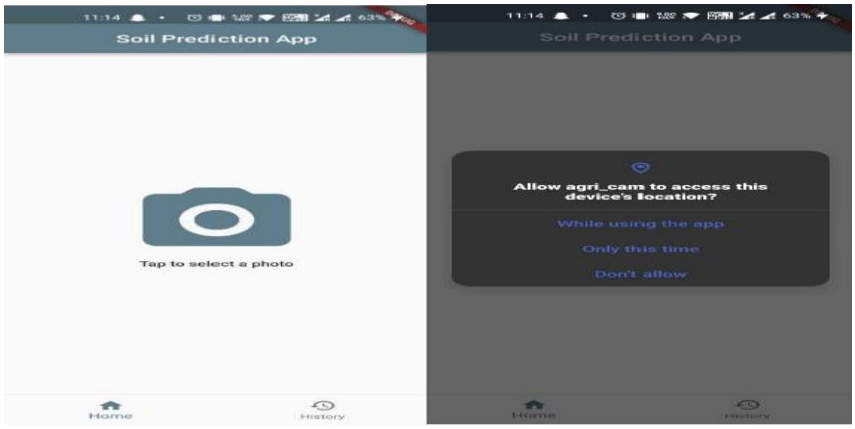

Fig. 5: Android Application User Interface

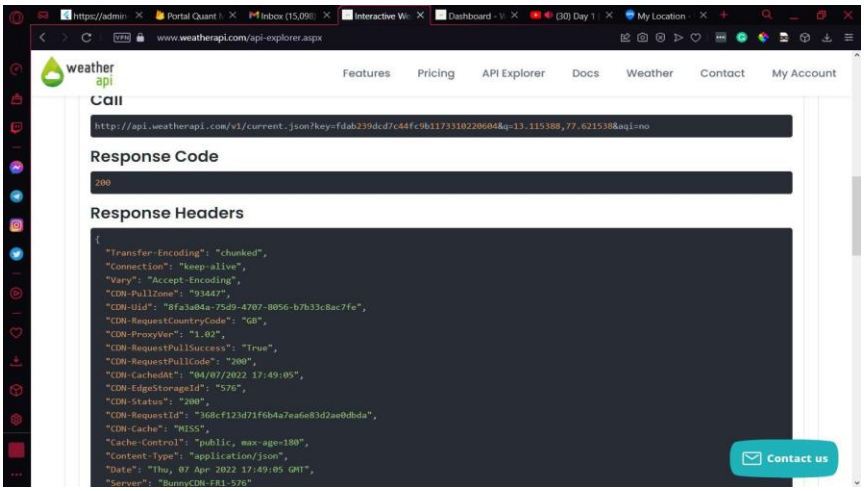

Fig. 6: Temperature and Humidity API

VI. CONCLUSION

We have created a Soil Classification model using Machine Learning which also predicts the crops which are suitable for that soil based on soil types. So, this project helps for soil Classification which is one of the most important topics, for Farmers and Agriculture Researchers.This project can be further modified in such a way that the farmers can use the application for various purposes like prediction of pests and fertilizers to be used.

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