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Precision Agriculture for Indian Context using Learning Techniques

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ABSTRACT

The agricultural industry is very important in the economic growth process. A Proper soil test will guarantee that enough fertilizer is applied to meet the crop's needs while also taking use of the nutrients already available in the soil, Soil analysis is a collection of chemical processes that identify not only the amount of available plant nutrients in the soil, but also the chemical, physical, and biological aspects of the soil that are vital for plant nutrition, or "soil health" Taking soil samples, Laboratory analysis of samples and the interpretation of the results by the issuance of fertilizer recommendation is very lengthy process for farmers. So we've created a soil analysis system Using technology in agriculture results in higher yields and better final product quality. This machine learning algorithm provides a best crop and its required fertilizers as a solution, allowing farmers to make more money by producing the system's recommended crop.

Keywords- CNN (Convolutional neural network), Machine Learning, Prediction

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I. INTRODUCTION

Agriculture is the primary source of income in India. India is additionally called as agricultural country. In India 50% man force is involved in agriculture activities. The soil is the most important and basic thing in agriculture. However, due to the usual procedure, farmers are increasingly employing it as well. farmers didn't get satisfactory results means the amount of crops isn't increasing to extend the amount of crops need good quality of soil. So soil testing is completed. Soil testing is very important instead of the most task of farming the assembly and quality of crops totally rely on the soil. Soil testing is crucial because it gives information on all nutrients which present within the soil like Ca (Calcium), K (Potassium), and N (Nitrogen). Farmers in India, especially many regions in Maharashtra state faces drought thanks to which their crop and yielding are becoming degraded. In unsuccessful for his or her repayment of the loan amount they try and suicide. It's the most reason for increasing suicide cases. To assist the farmers to choose the crop to be plow for his or her benefits we motivated to make this method. We design the system with the help of cutting-edge technologies. We use machine learning to form the system. There are different soil kinds and every kind has different features for various crops Different strategies and models are now being used in this industry to improve the number of crops. As a result, the major goal of this technique is to create a model that will assist farmers in determining which crop will best absorb a certain type of soil. We are utilizing machine learning approaches in this system to help advise crops based on soil categorization or soil series. The model merely proposes soil type, and based on that, it can suggest appropriate crops Different classifiers are utilized in this, and the crop is suggested by the model.

II. PROBLEM STATEMENT

One of the most challenging tasks for humans is determining the sort of crop that is suitable for the soil. Design and Implement Desktop Based Model for Suggestion of crop and Fertilizers using Python.

III. LITERATURE SURVEY

Agriculture Soil Analysis for Suitable Crop Prediction (Institute of Electrical and Electronics Engineers IEEE May

2021) Vishal Kumar [1] et.al. The model offers soil types and crops to plant based on those soil types. The final application is a web browser in which we load an image of soil, after which the application forecasts soil type and, based on soil type, crop suitable for that soil. The CNN (Convolutional neural network) algorithm is used to train the model and determine the final result.

Jagdeep Yadav [2] et.al Soil analysis and crop fertility prediction using machine learning (International Research Journal of Engineering and Technology IRJET March 2021. A model for predicting soil fertility and agricultural output with crop kinds that can thrive in fertile soil is proposed. The study focused on soil and agricultural records from the Indian subcontinent. For soil classification and agricultural yield, machine learning methods such as Support Vector Machine (SVM), Random Forest, Naive Bayes, Linear Regression, Multilayer Perceptron (MLP), and ANN are utilized.

C.P.Wickramasinghe [3] et al Smart Crop and Fertilizer Prediction System (Institute of Electrical and Electronics Engineers IEEE Dec 2019) This research mainly focuses on suggesting the best crop according to soil fertility of land and also it recommends a fertilizer plan to optimize the amount of fertilizers applied for suggested crops. Multi Class SVM algorithm is used to optimize the quantity Nitrogen, Phosphorus, Potassium application to various crops by analyzing the several kinds of " 'RD's SCSCOE, Department of Computer Engineering 2021-22" - 4 - common fertilizers used in dry & wet zones, nutrient availability in soil and the nutrient requirement of crops.

Komal Abhang [4] et.al Soil Analysis and Crop Fertility Prediction (International Research Journal of Engineering and Technology (IRJET MAR 2018 This project used a handheld device to develop an automated soil testing method to determine the pH of the soil. Then, based on the pH, we'll calculate the amount of NPK in the soil. We're utilizing a classification system to predict suitable crops based on the data from our device, as well as give the necessary fertilizers.

Sk Al Zaminur [5] et.al Soil Classification Using Machine Learning Methods and Crop Suggestion Based on Soil Series (Institute of Electrical and Electronics Engineers IEEE Dec 2018). We have presented a solution in this work. Model that can estimate soil series based on land type and suggest appropriate crops based on the prediction.

IV. PROJECT SCOPE

During the growing phase, farmers can test the soil many times and take the required precautions. Obtain a good yield Farmers will be able to maintain track of their fertility with the reports issued at the conclusion. Crop prediction is easy to detect using machine learning techniques.

V. EXISTING SYSTEM

Soil analysis is a valuable tool for your farm since it determines the inputs that are required for optimal and cost-effective output. A thorough soil examination is recommended. Ensure that enough fertilizer is provided to meet the needs while also taking advantage of the nutrients already present in the soil. The term "analysis" refers to a collection of chemical operations. Calculate the amount of plant nutrients present. Chemical, physical, and biological variables are all present in soil. Soil health refers to important biological soil properties for plant nourishment. soil sample collection As a result of fertilizer delivery, samples are analyzed and interpreted in the laboratory. Obtaining a recommendation is a time-consuming process for farmers. As a result, we developed a soil analysis system. Two datasets are used. There are various soil kinds, including 1.Peat soil 2.Sandy soil 3.Laterite Soil 4. yellow soil and Various crops and It can make recommendations based on the type of soil. Agriculture is covered by CNN. An algorithm is used to train the model and find the resultant. A web browser is the final Programmed.

VI. PROPOSED SYSTEM

This system's primary goal is to give crop forecast using machine learning methods. Increase India's agriculture-based economy.

6.1 System Architecture

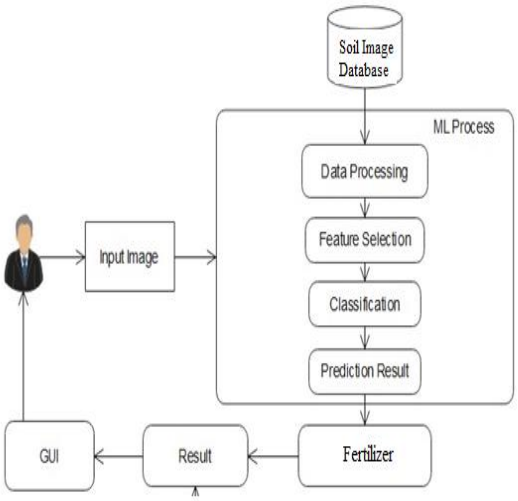

Fig. 1 System Architecture

1. Soil Type-: We worked on the following soil types dataset, which are Peat Soil, Yellow Soil, cinder Soil, Laterite Soil. In this model, we should collect image dataset for each soil type. With the assistance of soil type. It is simple to predict crop based on soil type using an image dataset.
2. Soil Analysis With the assistance of soil dataset and nutrients dataset, analysis of crop prediction should be done.
3. Nutrients-: We are going to collect the dataset regarding nutrients present in the each soil type. The nutrients dataset contains values of Nitrogen, phosphorous, and potassium present in the soil.
4. Crop Prediction : As a result of soil type module, soil analysis module, and nutrients module prediction of crop should be done. For the prediction process CNN algorithm is used.

5. Fertilizer Suggestion : As a result of soil type, nutrients present in soil, and crop prediction fertilizers should be suggested.

VII.ALGORITHM

A Convolutional Neural Network is a powerful image processing, artificial intelligence (AI) that use deep learning to perform both generative and descriptive tasks. Because of its great accuracy, CNNs are utilized for picture categorization and recognition.

Step 1: Convolution Operation

The three components of the convolution operation are as follows:

- Input image
- Feature detector
- Feature map

Step 1: ReLU Layer
This is because images are non-linear by definition. You'll see a lot of non-linear components in any image if you look closely (e.g. the transition between pixels, the borders, the colors, etc.). The rectifier further breaks up the linearity to compensate for any linearity imposed on an image during the processing. Procedure of convolution.
Step 2: Pooling
Max pooling is concerned with teaching your convolutional neural network that, despite these disparities, all of the images are same. The network must first acquire a property known as "spatial variance" to accomplish this. This characteristic helps the network to detect the item in the image regardless of image textures, distances from where it was shot, angles, or anything else.
Step 3: Flattening
This is a fast explanation of the flattening process and how data travels from pooled to flattened layers while working with Convolutional Neural Networks.
Step 4: Pooling
You'll have a long vector of input data after the flattening stage, which you'll pass through the artificial neural network to be further processed, which is known as pooling.
Pooling types include mean, maximum, and sum.
Step 5: Full Connection
Everything we learned in the previous sections will be combined in this section. You'll gain a better understanding of how Convolutional Neural Networks work and how the "neurons" that are eventually produced learn to classify images by learning this.
Step 6: Summary
Finally, it will wrap up the training and provide a quick recap of the concepts covered.
Step 7: SoftMax & Cross-Entropy
CNN model optimization functions. To determine final precision and losses.

CNN In Our Project:
a. Sort the data into folders with labels, such as soil images.
b. Read dataset
c. Read features of all images and label (here, dataset folder name) it
d. Save it in model file
e. Get input image
f. Read features of input image
g. Compare features of stored features
h. Display the label as a prediction of features that are nearly identical.

7.1 Mathematical Model:

Let S stand for the Closed System, which is defined as
S = {Ip, Op, A, Ss, Su, Fi}

Where Ip stands for "Input Set",
Op = Output Set,
Su = Success Condition,
Fi = Failure Condition
Ss = Set of user states,
A = Set of actions. Set of input= Ip = {username, password, input image, nutrients}
Set of actions= A = {F1,F2,F3,F4,F5,F6} Where,

F1 = user authentication;
F2 = soil type image input
F3 = The object in this image was detected by the system.
F4 = Execute the Image Processing and Machine Learning operation.
F5= Detecting multiple sources
F6= This result is displayed and saved in the database.
Set of user's states= Ss = {registration state, login state, selection soil type image, classified image, logout}

Set of output=Op= {Show results}

Su=Success state= {Registration Success, Login Success, Algorithm applied successfully}

Fi=Failure State= {Registration failed, Login failed, CNN falilure}
Exceptions List= NullPointerException during registration, RecordNotFound (InvalidPassword) during login, and NullValuesException during showing

VIII. CONCLUSION

In our system, we proposed that farmers recognize and detect soil type detection in their daily lives. Our proposed system employs image processing to detect soil type and crop prediction based on soil types and nutrients present in a specific soil. For our system, we are using CNN techniques and methods. Sort the results by soil type and notify the farmer as soon as possible.

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