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Soil Classification And Crop Prediction Using Convolutional Neural Network

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Abstract: India is a country where agriculture and agriculture related industries are the major source of living for the people. Agriculture is a major source of the economy of the country. The farmers and government agencies can make the necessary preparations, such as storing the crop, selling it, setting a minimum support price, importing, and exporting, etc., by accurately forecasting the crop output before it is harvested. Prediction of crops deals with a large set of databases. The major goal of the proposed effort is to develop an appropriate model for categorising different types of soil series data along with suggestions for appropriate crops.

I. INTRODUCTION

Farmers do not choose the right crop based on the market scenario. Difficulty to understand climate conditions due to strong climate changes. Farmers unable to understand which crop to select by which the production will improve. Prediction of crop yield in advance can help the farmers. Instead of worrying about crop prediction with the current method, farmers immediately go for yield prediction. Crop production forecasting is difficult since it depends on so many variables. Even though numerous models have so far been developed, the performance of current models. The main purpose of the proposed work is to create a suitable model for classifying various kinds of soil series data along with suitable crops suggestion. Machine learning techniques are used to predict agricultural productivity. This aids farmers in selecting the most suitable crop. Machine learning techniques help in getting maximum yield of crops. Agriculture employs a variety of machine learning techniques to boost agricultural yield rates. These methods can aid in resolving agricultural issues.

II. RELATED WORK

Namgiri Suresh *et. al.*, 2021[1] has proposed a paper Crop Yield Prediction Using Random Forest Algorithm in which they presented the study that showed the practical use of data mining techniques in predicting crop yield based on climate input parameters. D.Jayanarayana Reddy *et. al.*,2021[2] has proposed a paper Crop Yield Prediction using Machine Learning Algorithm in which they have investigated multiple ML methods applied to crop yield estimation. Fariha Shahrin *et. al.*2020[3] has proposed a paper Agricultural Analysis and Crop Yield Prediction of Habiganj using Multispectral Bands of Satellite Imagery with Machine Learning in which they talked about crop growth and yield prediction with agricultural mapping and monitoring using K-means and Mask R-CNN algorithms in Python and Matlab.

Fatin Farhan Haque *et. al.*, 2020[4] has proposed a paper Crop Yield Analysis Using Machine Learning Algorithms in which they have discussed two machine learning algorithms to predict crop yield, Support Vector Regression (SVR) and Linear Regression (LR). Prof. A. V. Deorankar *et. al.*,2020[5] has proposed a paper An Analytical Approach for Soil and Land Classification System using Image Processing which proposed an analytical study of various advanced and efficient classification mechanisms and techniques and stated the proper utilisation of the number of features of remotely sensed data and selecting the best suitable classifier for improving the accuracy of the classification. Also discussed demerits and merits of existing methods. Ramesh Medar *et. al.*, 2019[6] has proposed a paper Crop Yield Prediction using Machine Learning Techniques in which to predict the crop yield rate a java application is created using two ML algorithms, first is Naive Bayes method and second is K-Nearest neighbour method. Yogesh Gandge *et. al.*, 2017[7] has proposed a paper 'A Study on Various Data Mining Techniques for Crop Yield Prediction' covers research on several data mining strategies for forecasting crop yield and suggests that accuracy can be improved by implementing a large dataset.

Aditya Dhanraj Ramekar *et al.*, 2022[8] has proposed a paper 'Crop Prediction Using CNN Algorithm' in which the research work helps utilising machine learning, one of the most cutting-edge technologies in crop prediction, work assists the beginning farmer in assisting them in guiding them for sowing the acceptable crops. Giorgio Morales *et al.*, 2022[9] has proposed a paper "Improved Yield Prediction of Winter Wheat Using a Novel Two-Dimensional Deep Regression Neural Network Trained via Remote Sensing" evaluate the performance of proposed Hyper3DNetReg network in comparison to other machine learning-based crop yield prediction techniques. Saeed Khaki *et al.*, 2020[10], "A CNN-RNN Framework for Crop Yield Prediction" proposed a CNN-RNN model along with other well-liked techniques like random forest (RF), deep fully connected neural networks

(DFNN), and LASSO to forecast corn and soybean yield across the entire Corn Belt in the United States for the years 2016, 2017, and 2018 using historical data. The new model produced average yields with root-mean-square errors (RMSE) of 9% and 8%, respectively.

III. PROPOSED WORK

- Data collection

This is the process of gathering, measuring, and evaluating data from diverse sources in order to arrive at conclusions is known as data collection. Data can be gathered from a variety of sources, including social media tracking, online surveys, customer feedback, and more. This dataset consists of 5 categories of soils with 80-20% split into training and test dataset. Each training class consist more than 1000 images and test class has approximately 500 image each.

- Pre-processing step

This process involves transforming unprocessed data into the form that can be used and interpreted for additional analysis. Dataset may contain unorganised and inconsistent data, it may contain manual entry inaccuracies, missing values, inconsistent schema, etc. which is to be handled using pre-processing by converting it into usable format.

- Feature extraction

In this process new features are created using existing ones to reduce the number of features and old features are discarded. Several image pre-processing techniques, such as binarization, thresholding, scaling, normalising, etc., are applied to the sampled image before getting features. Following that, techniques for feature extraction are used to obtain features that will be helpful in the classification and recognition of images.

- CNN Algorithm

Then CNN Algorithm is applied for classification of images. For deep learning algorithms, a CNN is a specific kind of network design that is used for tasks like image recognition and pixel data processing. Even though deep learning uses a variety of neural network types, CNNs are the preferred network design for identifying and classifying objects.

- Crop Prediction

Using this model, the best crops for the region and their production can be selected, increasing the worth and profit of farming as well. Crop genetic progress has boosted the efficiency of farm resource use, lowering environmental pressures. Crop production predictions under different climatic circumstances can assist farmers and other stakeholders in making fundamental decisions about agronomy and product choices. The productivity and profitability of a farm rise with larger yields and more intense use of the farmland; this improves the well-being of farming families.

IV. PROPOSED METHOD

- Working

Through crop prediction systems better planning and decisions can be chalked out for enhancing the yield. A dataset of soil images is supplied to the CNN network model during model training. Dataset may contain some incomplete, redundant, inconsistent data. Therefore, in this step such redundant data should be filtered. Data should be normalised. The simplest way to create features from an image is to use these raw pixel values as separate features. For a grayscale image, Background Threshold is set to (0,0,0) by default, corresponding to the black colour, and for a colour edge a pixel is viewed as a pixel that is part of an object if any of the RGB values are greater than the corresponding value in the Background Threshold. Features are then retrieved from the photos, and feature selection is done. This step aims at identifying and using most relevant attribute from the dataset. Next, an 80%-20% split of the processed dataset is made into train and test datasets. That is 80% of the dataset goes into the training set and 20% of the dataset goes into the testing set. In order to anticipate the most suited crop, the CNN model is then trained to classify the soil type.

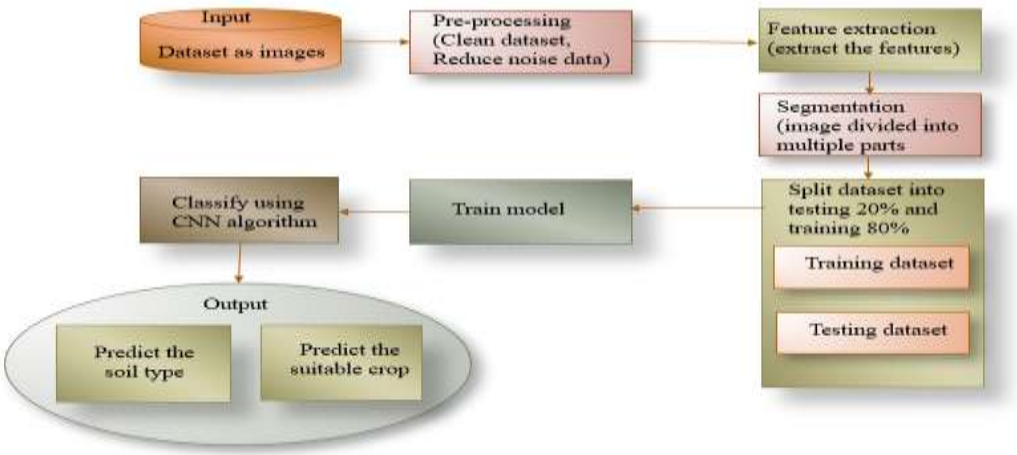

Figure 1. System Architecture

- **CNN Model**

A CNN is a particular type of network design for deep learning algorithms that is utilised for tasks like image recognition and pixel data processing. Although there are different kinds of neural networks in deep learning, CNNs are the preferred network architecture for identifying and recognising objects. The foundation of a CNN is a convolutional layer. It has several filters (or kernels), whose settings must be learned over the course of training. Typically, the filters' size is smaller than the original image. Each filter produces an activation map after it convolves with the image. By merging the outputs of neuron clusters at the preceding layer into a single neuron at the subsequent layer, the pooling layers have the effect of reducing the dimensions of the hidden layer. A fully connected layer adds a bias vector after multiplying the input by a weight matrix. One or more fully connected layers come after the convolutional (and down-sampling) layers. As the name implies, every neuron in a layer that is fully linked has connections to every neuron in the layer above it. The Dropout layer is a mask that nullifies the contribution of some neurons towards the next layer and leaves unmodified all others. The input attribute value will be passed directly to the following layer via the input layer neuron node. The output of the higher node and the input of the lower node in a multilayer neural network are functionally related. This proposed model has six convolution layers with 'Relu' activation function. One flatten layer and fully connected layer with dense layer, dropout layer and lastly dense layer with SoftMax as an activation function.

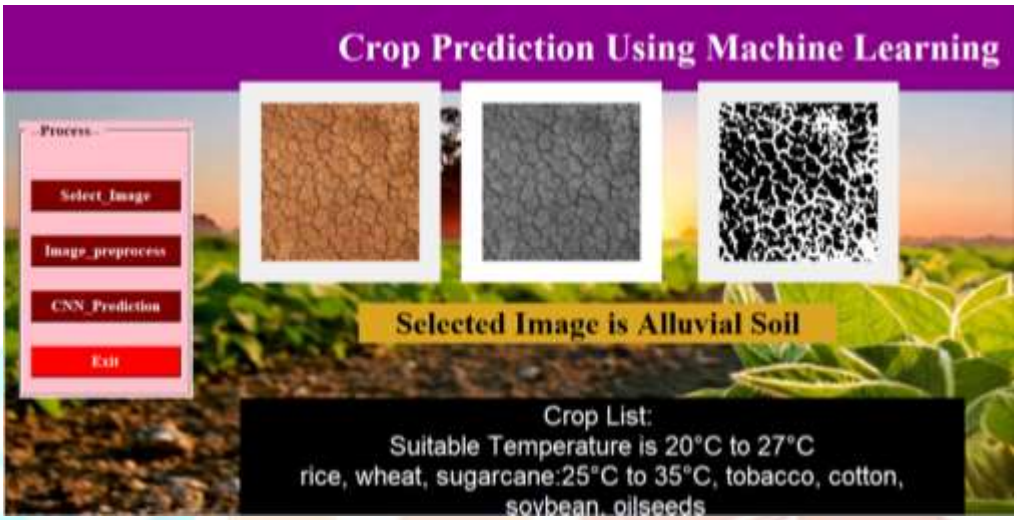

Figure 2. Output page of the model

V. RESULTS

After collecting the data, it is prepared to get implement in the Spider IDE by altering it to create a ratio of 80 % for training and 20% for testing. When the data is rationed correctly, the image of soil is fed into the program as an input as shown in fig.2, to get predicted crop output. This model had obtained an accuracy of 95% which was surely high compared to other models. Accuracy with each epoch increasing gradually is shown in below figure 3 graph.

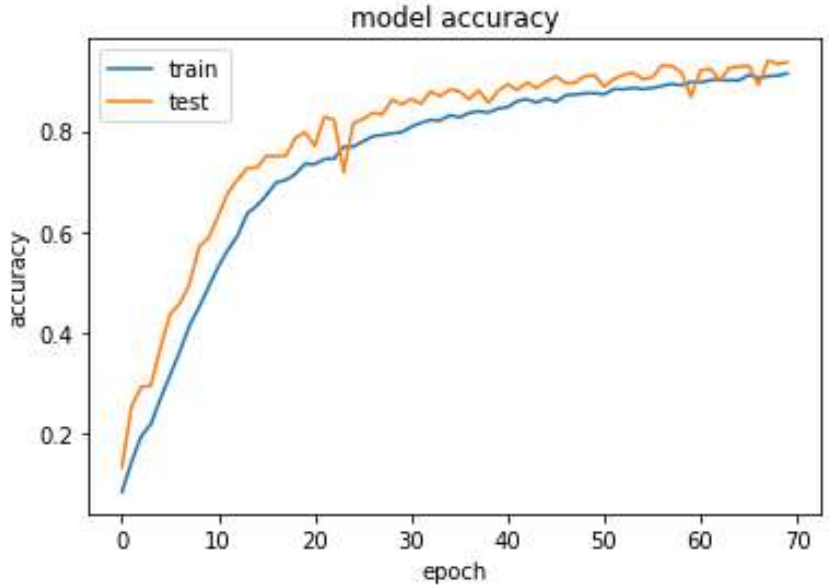

Figure 3. Accuracy graph

VI. CONCLUSION

This study provides a system for predicting crops that categorises soil types and recommends crops with the right temperature. Convolution neural networks, which provide more accuracy than any other technique, are the foundation of the proposed system. The soil image dataset has five classes, with more than 1000 photos in each training class and more than 500 images in each test class. This model's accuracy of 95% was significantly higher than that of earlier models.

VII. REFERENCES

1. Namgiri Suresh *et. al.*, 'Crop Yield Prediction Using Random Forest Algorithm' 2021 (Available at: https://ieeexplore.ieee.org/document/9441871)
2. D.Jayanarayana Reddy *et. al.,* 'Crop Yield Prediction using Machine Learning Algorithm', 2021 (Available at: https://ieeexplore.ieee.org/document/9432236)
3. Fariha Shahrin *et. al.,* 'Agricultural Analysis and Crop Yield Prediction of Habiganj using Multispectral Bands of Satellite Imagery with Machine Learning', 2020 (Available at: https://ieeexplore.ieee.org/document/9393066)
4. Fatin Farhan Haque *et. al.,* 'Crop Yield Analysis Using Machine Learning Algorithms' 2020 (Available at: https://ieeexplore.ieee.org/document/9221459)
5. Prof. A. V. Deorankar *et. al.,* 'An Analytical Approach for Soil and Land Classification System using Image Processing', 2020 (Available at: https://ieeexplore.ieee.org/document/9137952)
6. Ramesh Medar *et. al.,* 'Crop Yield Prediction using Machine Learning Techniques', 2019 (Available at: https://ieeexplore.ieee.org/document/9033611)
7. Yogesh Gandge *et. al.,* 'A Study on Various Data Mining Techniques for Crop Yield Prediction'2017(Available at: https://ieeexplore.ieee.org/abstract/document/8284541)
8. Aditya Dhanraj Ramekar *et. al.,* 'Crop Prediction Using CNN Algorithm' (Available at: www.ijraset.com/research-paper/crop-prediction-using-cnn-algorithm)
9. Giorgio Morales *et al.,* 'Improved Yield Prediction of Winter Wheat Using a Novel Two-Dimensional Deep Regression Neural Network Trained via Remote Sensing' (Available at: https://www.mdpi.com/1424-8iee220/23/1/489)
10. Saeed Khaki *et al.*, 'A CNN-RNN Framework for Crop Yield Prediction' (Available at: https://www.frontiersin.org/articles/10.3389/fpls.2019.01750/full)