PLANT DISEASE DETECTION AND SUPPLEMENT RECOMMENDATION USING CNN

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Abstract: In India agriculture plays a crucial role in countries economy, here the problem is rapid growth of diseases in plants. Early diagnosis of crop diseases is essential for global well-being and health. The traditional method of diagnosis is for a pathologist to visit the site and visually analyze each plant. However, in-person testing for some plant diseases is limited due to low accuracy and limited staff availability. Solving these problems requires the development of computational approaches to identify and classify various plant diseases. Presence of low-intensity information in image background and foreground, extreme color similarity between normal and infected plant regions, sample disturbances, and changes in plant leaf position, chrominance, structure and size provides accurate identification and classification of plants. Illness is difficult. With the help of CNN, we created a reliable plant disease classification system. In this study, we proposed a CNN-based deep learning technique for identifying various plant leaf diseases and providing disease-specific nutrients. Our goal is to identify and classify plant diseases before providing treatment. The record in question is from his Kaggle, a well-known public source. The dataset contains his 70,295 botanical photographs of the following fruits and vegetables like Apples, blueberries, cherries, corn, grapes, oranges, peaches, pepper bells, potatoes, raspberries, soybeans, strawberries, and tomatoes. The proposed method is capable of handling complex scenarios from a plant perspective, successfully detecting various disease forms and prescribing specific supplements against diseases.

Key Words: Kaggle , CNN, Plant Disease, Pathologist, Image background & Foreground.

I. INTRODUCTION

Agriculture employs over 70% of India's population. Plant disease detection is very important to prevent yield loss. Manually monitoring plant diseases is very difficult. It requires considerable effort, plant disease expertise, and a long time. As a result, machine learning-based image processing and algorithms can be used to detect crop diseases. In this project, we described a method for detecting plant diseases from leaf images. Image processing is a subset of signal processing that extracts image attributes or useful information. Machine learning is a subset of artificial intelligence that functions autonomously or directs how to perform certain tasks. A fundamental goal of machine learning is to understand training data and combine that training data into predictions that are useful to humans. With a large amount of training data, it helps us make rational decisions and predict good performance. Leaf color, degree of leaf damage, leaf area, and structural criteria are used for classification. In this study, we analyzed a number of image metrics or traits to identify leaf diseases in different plants to achieve the highest accuracy. Previously, detection of plant diseases was done by visual inspection of leaves or by specific chemical procedures by specialists, requiring large teams of specialists and regular monitoring of plants. This is expensive on large farms. A variety of current technologies have arisen to reduce postharvest processing, strengthen the sustainability of agriculture, and increase production. For illness detection, based in laboratories techniques such as polymerase chain response, chromatography of gases, mass spectroscopy, thermography, and hyper spectral methods have been used. However, these techniques are inefficient and lengthy. In recent years, server-based and mobile-based approaches to illness identification have been used. Many aspects of these technologies, such as high resolution cameras, powerful processing, and deep built-in accessories, contribute to automatic disease recognition. To improve the identification rate and accuracy of the results, modern technologies such as machine learning

and deep learning algorithms have been used. Several studies have been conducted in the application of artificial intelligence for identifying plant illnesses and diagnosis. Rural farmers sometimes have difficulty distinguishing between diseases that may be present in their crops. It is not reasonable for them to go to the farm office to find out what the infection is. The goal is to distinguish between plant-introduced diseases by observing plant shape using image processing and machine learning. Pests and diseases destroy crops and plant parts, leading to reduced food production and food poverty. In addition, many developing countries lack an understanding of pest and disease control. Virulent infectious diseases, poor disease control, and dramatic changes in the environment are some of the major causes of declining food production.

In such cases, recommendation systems are useful when monitoring large fields. The ability to automatically detect disease simply by observing signs on plant leaves makes it easy and cheap. Because it employs statistical machine learning and image processing algorithms, the suggested approach for identifying plant diseases is less computationally expensive and takes less time to predict than other deep learning-based approaches.

II. LITERATURESURVEY

[1] P.R. Rothe and RV Kshirsagar published "Identification of cotton leaf diseases using pattern recognition techniques" using snake segmentation and Hu moments as features. Active contour models are used to limit survival within infected regions, and BPNN classifiers address different classes of problems. The average classification rate is 85.52%.

[2] "Detection and Classification of Leaf Diseases Using Computer Vision Techniques and Fuzzy Logic," AakankshaRastogi, Ritika Arora, and Shanu Sharma. Segment the defect regions using K-means clustering. GLCM is used to extract texture information. Fuzzy logic is used to rank diseases. They used an artificial neural network (ANN) as a classifier. This primarily helps determine the extent of leaf disease.

[3] "Visual-based automated diagnosis of banana bacterium and black sigatoka" was proposed by GodliverOwomugisha, John A. Quinn, Ernest Mwebaze, and James Lwasa. A color histogram is taken and converted from RGB to HSV and then to L*a*b. A max tree is constructed using peak components, 5 shape attributes are used for classification, and area under curve evaluation is used. They used nearest neighbors, decision trees, random forests, hyperrandom trees, naive Bayes, and SV classifiers. A highly random tree produces very high scores across seven classifiers, providing real-time information and adding versatility to the application.

[4] uan Tian, Chunjiang Zhao, Shenglian Lu and XinyuGuo, "SVM-based Multiple Classifier System for Recognition of Wheat Leaf Diseases", Color features are encoded in HIS in RGB, and seven invariant moments are used as shape parameters Used by GLCM. They used his SVM classifier with MCS for offline disease detection in wheat plants.

III.EXISTING SYSTEM

This version relies on an existing method developed with the assistance of deep mastering algorithms. This method makes use of histogram of oriented gradients, a switch learning method, although it does not provide precision and supplement recommendation to the diseased plant.

Disadvantages:

    a.   Less precision.

    b.   Less comfort characteristics.

    c.   We can't recommend a supplement.

IV. PROPOSEDMETHOD

To overcome the problems of an existing system, the proposed method has evolved. The proposed system is developed to identifyplant disease and recommend particular supplementto the disease along with accuracy by using conventional neural network. Here we will load a plant leaf image then preprocessing is applied then for image segmentation and feature extraction rotation, scaling, gamma correction, PCA color augmentationis applied to the uploaded image, and then CNN classification technique is applied to find plant disease supplement recommend.

Advantages:

    a.   High precision.

    b.   Less complexity.

   c.   Supplement Recommendation.

V. METHODOLOGY

Tools Used:

The whole system is implemented using python programming language in COLAB.

Workflow:

I completed this entire project using Python and COLAB. The necessary libraries are imported, the data is analyzed after import, the data is summarized, all zero values are removed, and finally the data is converted to the format required by the CNN algorithms used. The following diagram shows how the analysis is done.
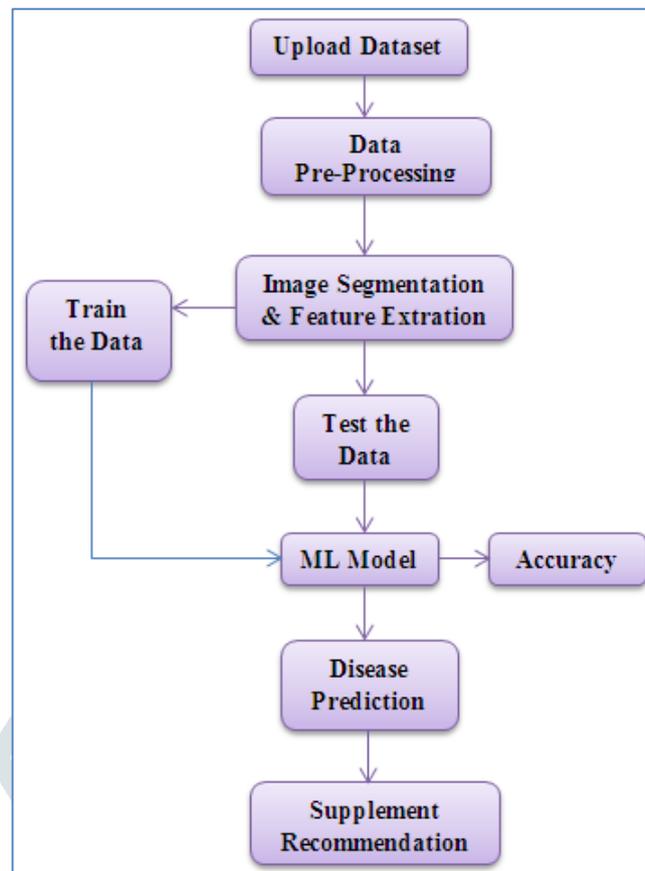
Modules:

1. Upload Dataset
2. Data pre-processing
3. Image Segmentation
4. Feature Extraction
5. Training
6. Prediction
7. Result Analysis

1. Upload Dataset

Here we use the pre prepared dataset which contains around 70,295 botanical leaf photographs of the following fruits and vegetables like Apples, blueberries, cherries, corn, grapes, oranges, peaches, pepper bells, potatoes, raspberries, soybeans, strawberries, and tomatoes.In the total dataset 70% is used for training and 30% is used for testing.

2. Data preprocessing

    A. Null value handling
    B. Categorical handling
    C. Scaling

The specified data set for this data preparation module is missing some values, which may lead to inaccurate predictions. Remove missing values using Python. Also, to get correct results, the replicated data should be removed from the data set. Normalization is the process of scaling data to a specific range.

3. Image Segmentation:

The method of splitting an image into multiple components or parts of similar quality or features such as colour, appearance, form, and so on is known as image segmentation. Image segmentation methods include rotation, scaling, gamma correction, PCA color augmentation. These approaches can be used for both grayscale and color photographs.

4. Feature Extraction:

The process of translating the unprocessed information into a set of significant and pertinent features that can be employed in additional analysis and modelling is known as feature extraction. It entails extracting and translating the most critical and necessary details from the source data into a more manageable format.

5. Training

    A. Model training with classifier
    B. Accuracy
    C. Save model

In this module classification will done and accuracy of the model will be explained.

6. Prediction
- A. Input test data
- B. Preprocess
- C. Load model
- D. Disease Recognition
- E. supplement Recommendation

5. Result analysis
- A. View result

<div align="center">

V. MACHINE LEARNING ALGORITHMS
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Convolutional Neural Network:

Step1: convolutional operation

Convolutional operations serve as the first stepping stone for our strategy. This phase provides a brief introduction to neural network filters or feature detectors. In addition, we discuss functional maps, their parameters, detection levels, how patterns are detected, and how results are presented.
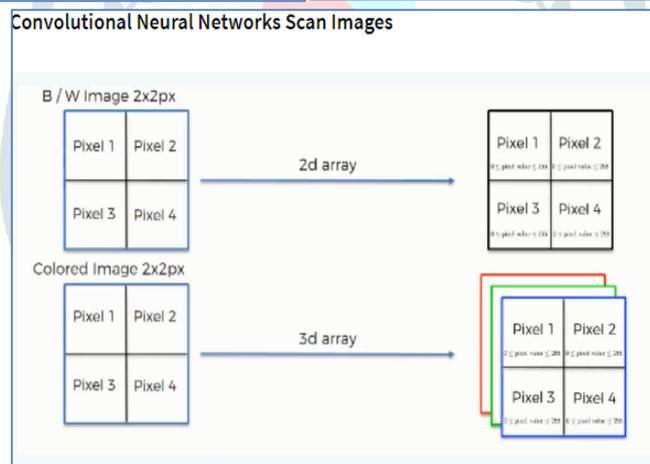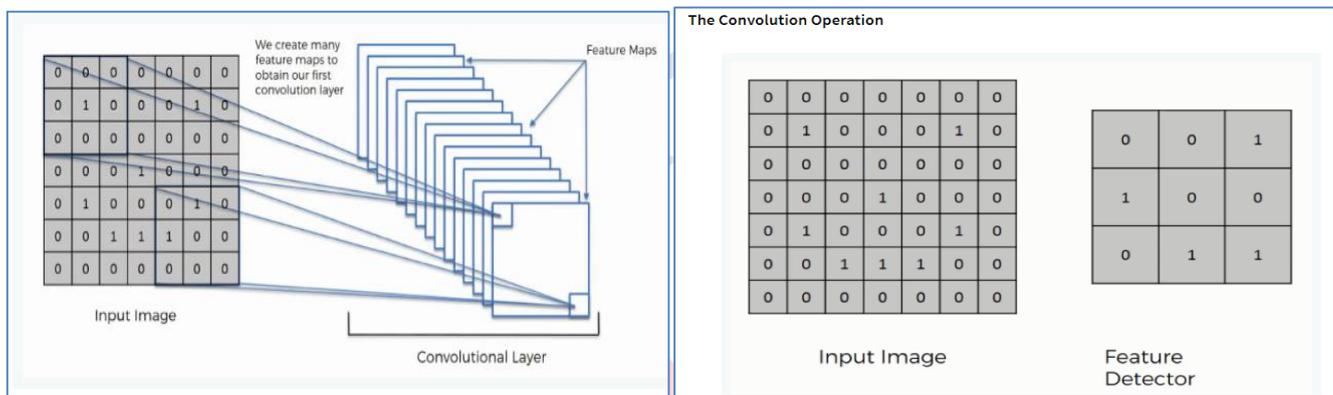
Step 2: Pooling Layer

This section describes pooling and helps you understand how pooling usually works. However, in this case, a particular type of pooling (max pooling) plays a central role. However, consider different tactics, such as medium (or full) pooling. This part ends with a presentation using visual interactive tools.

Step 3: Flattening

Here, we provide an overview of the flattening process and how to move from pooling to flattened layers in convolutional neural networks.

Step 4: Full Connection

This part summarizes everything that was explained in the previous section. Understanding this helps us understand how a convolutional neural network works and how the "neurons" it generates classify photos.

VI. RESULTS

Figure 1: Plant disease prediction Home Page
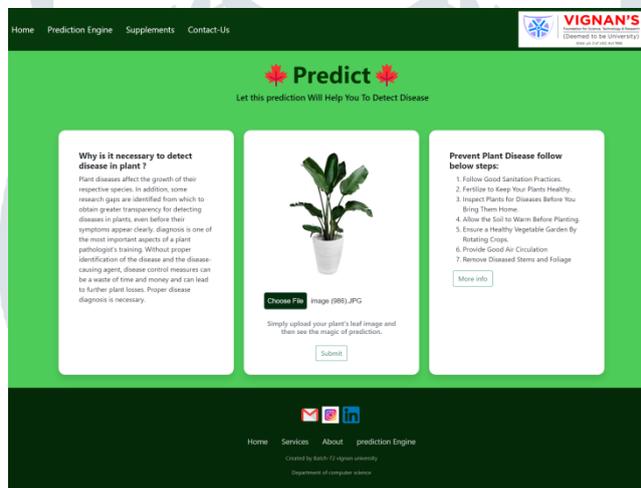
Figure 2: Prediction Engine

Figure 3: Upload Image

Figure 4: Apple plant disease & Supplement Recommendation

Figure 5: Grape plant disease & Supplement Recommendation

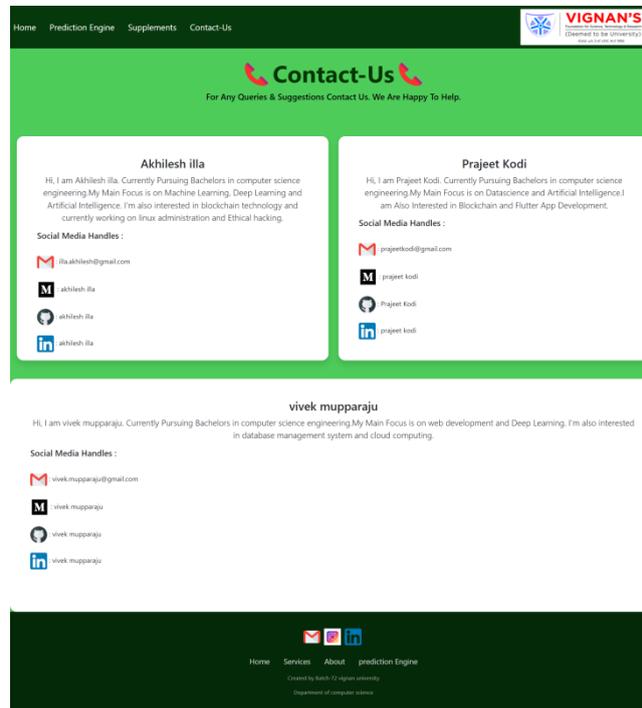**Figure 6: Potato plant disease & Supplement Recommendation**

Figure 7: Contact Us

Accuracy: This is the most commonly used performance metric for classification problems. Calculate the percentage of labels that the model predicted correctly.

$$ACCURACY = (TP + TN) / (TP + TN + FP + FN)$$

TP is the No of Samples with positive results was properly forecasted.
TN is the No of Samples withnegative results was properly forecasted.
FP is the No of Samples with positive results that were wrongly anticipated.
FN is the No of Samples with negative results that were wrongly anticipated.

Figure 8: Accuracy

Precision: It is the ratio of true positives (positive labels successfully predicted) to the sum of true positives and false positives (positive labels incorrectly predicted).

$$PRECISION = TP / (TP + FP)$$

VII. CONCLUSION

In this study, ML principles, preprocessing of data, features extraction and applying different models to the data, are described initially before they are applied to detect nutrient plant. A key step in creating a good machine learning model is the model evaluation. Building a model and getting metrics recommendations from it is essential as a result. Based on the outcomes of metric improvements, it will require time and work until we get good accuracy. Here we fully identified different types of plant diseases and nutrient deficiency in plant with 98% accuracy using CNN.The suggested method can detect nutrient deficits such as nitrogen, potassium, zinc, iron, boron, and others, as well as plant diseases such as Alternaria alternate, Anthracnose, Bacterial blight, Cercospora leaf spot, and others.

VIII.REFERENCES

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