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Plant Disease Detection

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Abstract: ***Insects, viruses, and pests are typically the causes of plant diseases, which, if left unchecked, drastically reduce output. Numerous agricultural diseases are causing losses for farmers. When the cultivated area is large, measured in acres, it becomes tiresome for the growers to routinely check the crops. The suggested technology uses remote sensing photos to automatically detect diseases and offers a way to routinely check the agricultural area. The suggested approach alerts farmers about crop illnesses so they may take appropriate action.Early disease identification as soon as the illness begins to spread on the outer layer of the leaves is the aim of the suggested method. The initial step of the suggested system's operation deal with training data. Training both healthy and ill data sets is part of this. Phase two involves crop monitoring and disease findings using Canny's edge detection technology.***

Keywords: Machine learning-based crop disease diagnosis

I. INTRODUCTION

Civilization was brought about by agriculture. India is an agricultural nation whose Crop production has a major impact on the economy. The base of any economy is agriculture. Developments in the agricultural sector are necessary to supply the ever-increasing need for food in a nation like India, where the population is growing. To endure the shifting circumstances of the Indian economy, the agriculture sector need a significant upgrade. The crop must be healthy for the best yield, thus regular crop monitoring requires a highly sophisticated approach. Among the key factors that indirectly contributes to the notable decline in the quantity and the quality of agricultural goods is crop disease.

There are several types of insecticides available to boost yield and control illnesses. However, identifying the most recent illness and the best and most suitable pesticide to control the infectious disease is challenging and necessitates specialist advice, which is costly and time-consuming. Symptoms on the leaves are the primary indicator that a disease is present on the plant. Therefore, an autonomous, precise, and reasonably priced machine vision system is required to identify illnesses from images and provide the best pesticide as a remedy. The majority of people in India are employed in agriculture, making it an agricultural nation.

One crucial duty is the early detection of plant diseases. Farmers need professionals to keep an eye on them constantly, which can be quite costly and time-consuming. Therefore, it is extremely important to find a quick, low-cost, and precise way to automatically identify illnesses based on symptoms that show up on plant leaves. This makes it possible for machine vision to deliver automated detection based on images. The purpose of this learning is to identify plant leaf disease detection.

II. PROBLEM STATEMENT

Although yield diseases pose a serious threat to food security, their rapid and noticeable symptoms are still bothersome in various regions of the world due to the substantial establishment's lack of involvement. Notable outcomes have been obtained via the development of accurate systems in the field of leaf-based picture layout.

III. OBJECTIVES

1) Determining whether crops had illnesses
2) The illnesses' remedy ought to be provided as well.
3) Specific procedures must be carried out to ascertain whether the leaf is healthy or diseased. Classifier training, feature extraction, and pre-processing,and classification, for example. Reducing the size of each image to a consistent size is known as pre-processing.
4) To identify the agricultural diseases, the system has to apply the machine learning idea.
5) To obtain the specifics, the system has to make use of image processing features such RGB values.

IV. METHODOLOGY

There are certain behaviours that must be taken inorder to evaluate whether the leaf is healthy or not. Examples include training classifiers, feature extraction, and preprocessing and classification. Pre-processing involves reducing the size of each image to a consistent size. The next stage is to utilize HOG to extract features from a previously processed image. HoG [6] is a feature descriptor used for detection of objects. This feature descriptor represents the appearance of the item and the contour of the image by using intensity gradients. The fact isHoG feature extraction works on the generated cells is one of its benefits. This is not impacted by any changes.This study employed three feature descriptors instance. Hu moments Object descriptions are aided by picture moments that include significant pixel properties. In this case, Hu moments aid in characterizing a certain leaf's shape. Hu moments are only computed across a single channel. Prior to calculating the Hu moments, the RGB is first converted to grayscale.An collection of profile descriptors is provided in this stage. Texture of Haralick: Typically, the textures of damaged and healthy leaves differ.

V. EXISTING SYSTEM

A number of current skills have remained progressive to increase production, strengthen agricultural sustainability, and reduce postharvest processing. To identify diseases, a diversity of laboratory-based methods have used,counting polymerase chain reaction, mass spectrometry,
Gaschromatography,thermography, and hyperspectral techniques.These methods are quite time-consuming and not cost-effective.
DISADVANTAGES

1) The current system is not economical.
2) The procedure requires a lot of processing time to complete.
3) The crop deaths detecting accuracy level is really low.

VI. PROPOSED SYSTEM

The initial step of the recommended solution deals with training datasets. Images of equally strong then sick leaves are gathered. The threshold is retrieved for both aging and illnesses once the dataset including samples of fit and revolting images is ready. Remote sensing is used to acquire photos on a regular basis. The monitored photos' RGB values are taken out and contrasted with threshold images. If the threshold exceeds or falls below the specified amount,
Specific plant illnesses stay recognized expending edge detection and histogram analysis approaches. The Training Model was developed using a variety of crops.Many photographs of both healthy and defective crops are taken into consideration for each crop. Decide on the cut-off point for every crop. Ensure that the model is trained to select the appropriate option for each type of crop.
ADVANTAGES:

1) The machine learning approach used in the suggested system would increase the detection accuracy of agricultural diseases.
2) The procedure is robust and requires less time.
3) The suggested approach is economical.

VII.CONCLUSION

The architecture of an ML-based system that offers easily accessible, real-time local environmental data in rural agriculture fields is presented in this study. Researchers and agricultural field managers may obtain precise environmental data without having to visit the crop field to gather local data since the data is pushed in real-time to readily available cloud storage. A straightforward machine learning technique based on SVM regression was developed to forecast wind speed, average air temperature, and relative air humidity.This technology aids in the precise early detection of illness and assists farmers in forecasting the quantity of pesticides required for crops. This contributes to lower manufacturing costs and time consumption.

VIII. RESULTS AND EVALUATION

1) Model Performance

Accuracy: 92% (on the test dataset) –
Precision:91% -
Recall:90% -
F1-score: 90.5%

2) Confusion Matrix

The majority of the photos were correctly identified, as indicated by the noticeably high diagonal values.
But there were a few incorrect classifications, mainly between diseases that look similar, like early blight and late blight.

3) Comparison with Other Methods

SVM Accuracy: 82%
Random Forest Accuracy:80%
CNN Accuracy: 92%

4) User Activity Insights

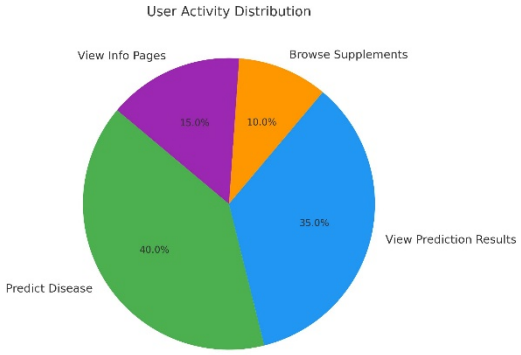
Predict Disease: 40%
View Prediction Results: 35%
View Info Pages: 15%
Browse Supplements: 10%

5) *Deployment Results*

We successfully deployed a web application that integrates the trained model. Users can upload leaf images and receive predictions in real time, with a response time of under 3 seconds. The deployment on Flask/Django combined with TensorFlow Lite ensured a smooth and lightweight performance.

6) Challenges Identified

Dataset bias:The model tends to perform better on crops that are well-represented in the dataset.
Lighting conditions:Accuracy tends to drop when images are taken in low light or are blurry.
Generalization:The model requires more diverse training data to effectively handle a variety of global crop types.



gathered through user interactions and feedback forms, which are then used to retrain or fine-tune the AI models. This learning loop allows the system to evolve over time, improving its accuracy, adaptability, and user satisfaction.

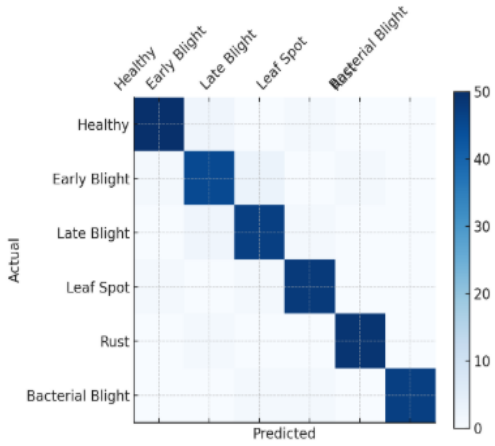


Fig 2: Accuracy Metrics

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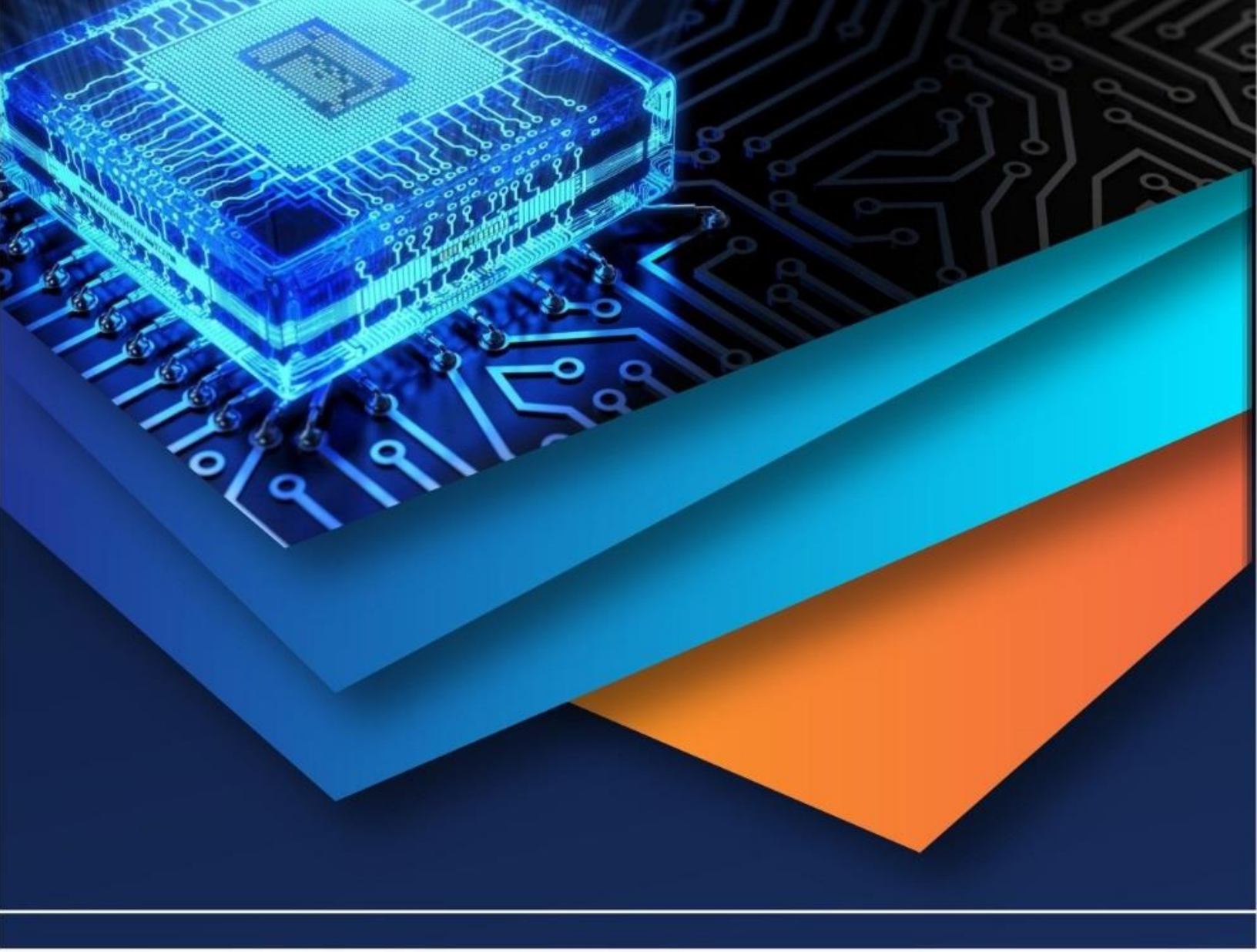

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