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Plant Disease Detection Using Neural Network

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***Abstract*: The first step for diagnosing a plant disease is to identify it. This is the foundation for efficient and precise plant disease prevention in a huge-wide environment. In the advancement of technology farming, plant disease identification becomes computerized, giving modern assistance, sharp approach, and preparation. This research is developing a neural network model of plant disease detection and prediction. Most of the time infection occurs in the leaf. The first step in detection is capturing the leaf image. Next these images are preprocessed through image segmentation. Then an image with RGB components is removed and it is converted to a HSV format. Finally, the image of the leaf is converted into black and white. Here White color indicates the defective part of the leaf. Neural network technique is trained to find the disease and healthy leaf. The classifier helps in the early and accurate prediction of leaf diseases.**

***Keywords*: Neural network, Leaf disease, Image extraction, Smart farming.**

1. Introduction

In this research, we proposed a new method that involves photographing a plant leaf and determining the disease, then sharing the records with the farmer. This lowers the loss while increasing production. It simplifies the task of surveying the entire area for farmers and agricultural officers. Many farmers fail to notice patterns at first look, which leads to incorrect assumptions and, in some cases, harm to the farmers.

2. Methodology

A. Dataset Description

We analyzed around 12,000 images of plant leaves, which have a spread of 5 different class labels assigned to them. Each class label is a plant-disease pair, and we try to predict the plant-disease pair given just the image of the plant leaf.

We have taken a Tomato leaves dataset from the Kaggle. The VGG16-model achieves 97.16 test accuracy in ImageNet, which is a dataset of different kinds of plant leaves such as Early blight, late blight, Healthy, Bacterial spot and Tomato Mosaic Virus, etc.

B. Image Processing Techniques

Image processing technique is carried out to enhance the feature important for further processing and analysis. In general, it involves removing sample noise, resizing images to meet requirements, filtering images for a better view of the processed image than the original image.

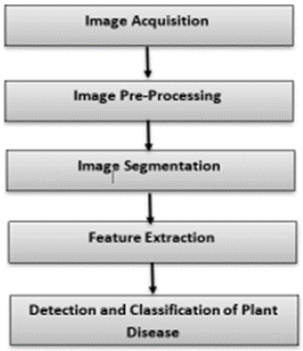

Fig. 1. Process steps

C. Image Acquisition

We gathered leaf samples of several plants from Plant Village for this study. It is an image database that is freely accessible to the public. Images of various plant leaves are found in this database. These plant leaves are divided into categories such as Healthy Leaf, Early Blight, and Late Blight, leaf affected by black rot etc.

D. Image Segmentation

The technique of image segmentation is used to divide one image into different segments/regions. The primary goal of segmentation is to transform an image's representation into something more important and easier to examine. The major purpose of image segmentation is to detect boundaries. That region shows a diseased/affected area.

E. Feature Extraction

Feature extraction is a process of extracting features or characteristics of an image that contain the most effective and important information required for determining and categorizing an image. Plant disease feature extraction has several issues when it comes to detecting the disease. In this project we have extracted color, shape of images. These features are utilized for training the models. It is useful to get accuracy.

Color feature:

RGB to HSV conversion: Colored picture can be outlined by its concentration values of the color. In a color image, the HSV model separates the magnitude component from the colored statistics. This model is perfect for experimenting with color image processing methods. The RGB color can be used to determine hue, saturation, and intensity. We can change each

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RGB point to a similar point in the HSV color model. For each image in the database, concentrated values are averaged, and these features are recovered by these steps, and the result is received concurrently.

F. Detection and Classification of Disease

The image is fed into a Neural Network for disease identification and classification after its features have been extracted. The different methods utilized in the classification problems that are done using neural networks are construction, learning, and testing. The key benefit of employing a Neural Network is that it provides reliable findings in the diagnosis of leaf disease. Training and validation of neural networks are two separate processes. The training process is used to train the neural network model, while the testing process is used to determine the neural network model's accuracy through the validation process.

The Neural Network model collects features from images directly. The received features are not trained before, instead, they are well-developed while the network is trained on a small number of image groups. The Neural Network model is made up of many layers, each of which does image processing. A technique for identifying plant diseases that aids in determining whether a plant is affected.

3. Results

Here, we are predicting the different diseases affecting to the tomato leaves using image process techniques with Neural Network. We were able to predict diseases like Early blight, late blight, Bacterial spot, Mosaic virus and Healthy leaf. We acquired 97.16% of test accuracy and 95.86% of validation accuracy.

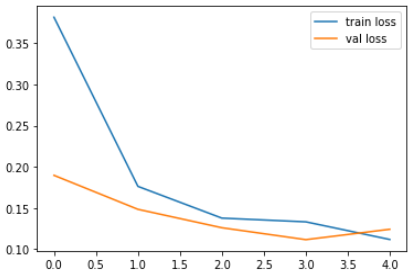

Fig. 1. Training and validation loss

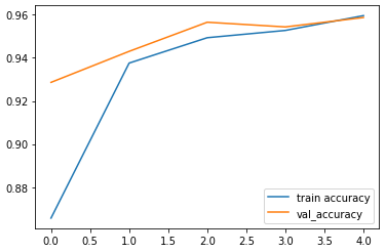

Fig. 2. Training and validation accuracy

4. Conclusion

Crop diseases cause severe damage to food security. Disease detection that is both quick and accurate is still a challenge. Recent technological advancements have the potential to reduce or eliminate this problem. Image processing and computer vision are two of these technologies. The primary diseases of plant leaves are early blight, late blight, black rot, and others. It is expected that these diseases caused most of the loss in plant production. This paper outlined a possible method for extracting low-level visual features such as color. In comparison to other classifiers, the suggested model can diagnose disease more accurately.

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