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Plant Disease Detection using Image Processing Techniques

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ABSTRACT

The Indian economy is highly dependent on Agriculture productivity. Having diseases in plants are natural, so disease detection in plant plays an important role in agriculture field. If proper care is not taken, then it causes very serious effects on plants, so that respective product quality and product quantity is affected. Plant disease detection using automatic technique is very useful because it reduces a large work of monitoring in big farms. At very early stage itself it detects the symptoms of diseases when they appear on plant leaves. This project focuses on an approach based on image processing techniques to detect the disease of plants.

Keywords : Image Processing, Feature Extraction. Convolutional Neural Network, Disease.

I. INTRODUCTION

Agriculture is a backbone of Indian economic system. In our country, nearly 70% of Economy depends on cultivation. Plant diseases cause reduction in agricultural product quality and quantity. So to detect the disease related to leaves is the main aim of our project. The main purpose of this project is to detect the leaf disease by using image processing techniques. The traditional approach for detection and recognition of the diseases relies on eye observation that is extraordinarily slow technique conjointly as offers less accuracy. In some countries, taking advice from experts to find out plant leaf disease is expensive and time consuming. Automatic recognition of plant leaf diseases are required to detect the features of disease in early stages when they appear on the growing leaf. In image processing, it starts with capturing images of healthy and unhealthy leaves. Images of leaves are captured and stored in database for experiment. After that, the images are applied for pre-processing. Feature Extraction is done after image pre-processing. Then the output of feature extraction is given to the Convolutional Neural Network for classification.

II. RELATED WORK

[1] This paper discussed the methodology to create an approach for disease detection using deep neural network. In this approach they have combined IOT and image processing techniques such as pre-processing and feature extraction techniques for different features such as color, texture, size and performs classification using deep learning model that for identification of plant leaf disease.

[2] This paper discussed the image processing techniques for detection of plant diseases. In this paper, they have proposed an Android application that helps farmers to identify plant disease by uploading the leaf image to the system. The system has set of algorithms. The algorithms can identify the type of diseases. By using database it sends the result back to the user. [3]This paper discussed algorithm for image segmentation technique is used for automatic

detection and classification of plant leaf diseases and survey on different diseases classification that can be used for plant leaf disease detection. Image segmentation, which is an important aspect for disease detection, is done by using genetic algorithm.

[4] This paper discussed main objective is detection of diseases at the early stage by focusing on image processing techniques. It includes the number of capturing the image of leaves to identifying the disease. Camera and the display device interfaced with the Raspberry PI along which the data is stored in the cloud. Here the main feature is that the crops in the field are continuously monitored and the data is streamed lively. The captured images are analysed by various steps like pre-processing, segmentation, feature extraction.

[5] This paper discussed the main aim is to develop an effective method to diagnose a disease and symptoms. A multi-layer convolutional neural network is used for classification of mango leaves. This paper is validated on real time data set. This method is automatic, computationally efficient and cost effective.

III. METHODOLOGY

To detect the diseases of leaves is the main aim of the project. For addressing this problem we are developing an automated system to identify the leaf diseases. The main objective is to detect the leaf disease by using image processing techniques. In proposed system leaf disease detection is done by using image processing technique like Image Acquisition , Pre- processing, feature extraction & convolutional Neural Network algorithm so as to improve the accuracy of detecting the leaf disease detection in a better way.

A. Image Acquisition

Image Acquisition is the first step in digital image processing that retrieves the image from camera, so that it can be act as input to the process.

B. Image Pre-Processing

The main aim of image pre-processing is associate improvement of image information that removes unwanted distortions or enhances some image options necessary for any process, to get rid of noise within the image, different pre-processing techniques like histogram equalization & image resize are used.

C. Histogram Equalization

Histogram equalization is a process in image processing which adjust the contrast of image using the image's histogram. This process increases the global contrast of image. By this process the intensities of the image can be better distributed on the histogram. Histogram equalization achieves this by effectively spreading out intensity values persistently.

D. CLAHE

CLAHE is a method to improve the clarity of local image features by increasing the image contrast of local regions. AHE over amplify the contrast in near-constant regions of the image, since the histogram in such regions is highly concentrated. Because of this, AHE may cause noise amplification in near-constant regions. Contrast Limited AHE (CLAHE) is a form of adaptive histogram equalization. It limits the contrast amplification, so that it can reduce noise amplification problem.

E. Image Resize

The resolution of document images is typically higher than 2000 x 2000, which is too large to be fed to a CNN with the current availability of computing resources. Large input dimension costs more computation resources and also leads to a greater chance of over fitting. After Converting RGB image into CLAHE (Contrast Limited Adaptive Histogram Equalization) it resizes into a 70* 70 for better resolution.

F. Feature Extraction

Feature extraction plays an important role for identification of an object. In many application of image processing feature extraction is used. color, texture, morphology, edges etc. are the features which can be used in plant disease detection . It can be used for the detection of infected plant areas. It can also reduce the amount of redundant data for a given analysis.

G. Convolutional Neural Network (CNN)

In CNN, there are multiple hidden layers like Convolution layer, ReLU layer, Pooling layer, etc. that perform feature extraction from the image. Image pixels convert into array and given to the CNN. Convolution Layer is to extract features from the input image .Convolution Layer uses a matrix filter and performs convolution operation to detect patterns in the image. Image pixels convert into array and given to the CNN.

ReLU (Rectified Linear Units) layer is activation layer which performs elementwise operation, set all negative pixels to zero and introduces nonlinearity to the network. The output of this layer is rectified feature map. Pooling layer get the max element from the feature maps. Pooling layer performs down sampling operation that reduces dimensionality of feature map.

Flattening is the process of converting all the resultant 2D arrays from Pooled feature map into a single long continuous linear vector which will fed to our densely connected layer. In proposed CNN, first layer has 1000 neurons and the activation function ReLu and last layer of this neural network with 'N' neurons ((N=number of labels)one for each label) using the softmax function.

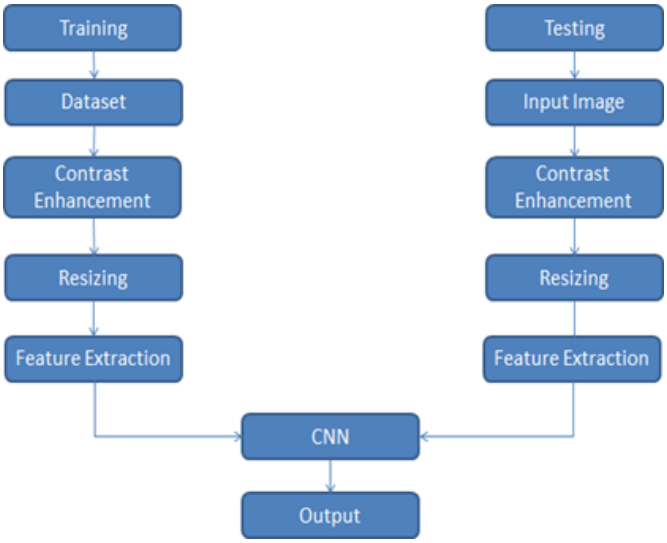

Figure 1. Dataflow diagram of the proposed system testing, by acquiring the desired tomato leaf which is diseased as shown in figure 2.

Test Image (1)

Figure 2. Original Image

To remove noise in image or other object removal, different pre-processing techniques are considered, Like histogram equalization, CLAHE to get interested image region. enhancement is carried out for increasing the contrast.

Step 1: Start.

IV. ALGORITHM

Step 2: Initially taking dataset.

Step 3: Applying histogram equalization on dataset images.

Step 4: Applying contrast limited adaptive histogram equalization (CLAHE) on dataset images.
Step 5: Applying resizing operation on dataset images.
Step 6: Taking test image.
Step 7: Applying histogram equalization on test image.
Step 8: Applying contrast limited adaptive histogram equalization (CLAHE) on test image.
Step 9: Applying resizing operation on test image. Step 10: Define CNN model.
Step 11: comparison between dataset and test image.
Step 12: display result.

V. RESULTS

Captured diseased images of tomato leaf for image processing system. Test images are the input images which is applied to detect disease on it. In Image

Figure 3. Image Enhancement(Pre-Processed Image)

The following output screen shows the resized Image where the diseased part located as shown in figure 4.

Figure 4. Resized Image

The following output screen shows name of the tomato disease, where disease can be Early Blight or Bacterial Spot as shown in figure 5.

```
31/31 [==============================] - 3
Epoch 10/10

31/31 [==============================] - 3
[[0. 0. 1.]]
Bacterial_spot

Process finished with exit code 0
```

Figure 5.Output Image Test Image (2)

Figure 6. Healthy leaf image

```
31/31 [==============================]
Epoch 10/10

31/31 [==============================]
[[1. 0. 0.]]
healthy_tomato

Process finished with exit code 0
```

Figure 7. Healthy leaf image output

Test Image (3)

Figure 8. Early blight diseased leaf image

```
31/31 [==============================]
Epoch 10/10

31/31 [==============================]
[[0. 1. 0.]]
Early_blight

Process finished with exit code 0
```

Figure 9. Early Blight diseased leaf image output

V. CONCLUSION

The main focus of this project is to identify the disease of the plant. An image processing algorithm is developed to identify the diseases. Mostly the detection and identification of the diseases are noticed when the disease advances to the severe stage which causes the loss in terms of yield, time and money. Farmers can monitor plants or crops regularly. By using this concept, the disease identification is done.This project detects the disease by using image processing techniques. The use of CNN method for classification of disease in plants we can accurately identify and classify various plant diseases using image processing techniques.

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