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Plant Disease Prediction System using Image Processing

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ABSTRACT

Agriculture productivity is the major issue which affects the Indian economy. Crop cultivation plays an essential role in the agricultural field. Presently, the loss of food is mainly due to infected crops, which reflexively reduces the production rate. The major cause for decrease in the quality and amount of agricultural productivity is due to the diseases in plants. The occurrence of diseases in plants may result in significant loss in both quality and quantity of agricultural productivity. This can produce the negative impact on the countries whose economies are primarily dependent on the agriculture. Farmers encounter great difficulties in detecting and controlling plant diseases. Hence the detection of plant diseases in the earlier stages is very important to avoid the loss in terms of quality, quantity and finance. This paper mainly focuses on the approach based on image processing techniques that help farmers for detecting the diseases of plants by uploading leaf image to the system.
Keywords: Image Processing, CNN, Plant Disease Identification.

I. INTRODUCTION

Extensive research has been conducted to explore various methods for automated identification of plant diseases. The disease can manifest in various parts of the plant such as roots, stem, fruit or leaves. As stated before, this work concentrates particularly on leaves.

Plant disease identification by visual way is more laborious task and at the same time less accurate and can be done only in limited areas. In plants, some general diseases are brown and yellow spots, or early and late scorch, and other are fungal, viral and bacterial diseases.

Image processing is used for measuring affected area of disease and to determine the difference in the color of the affected area. Image segmentation is the process of separating or grouping an image into different parts. There are many ways of performing image segmentation, ranging from the simple threshold method to advanced color image segmentation methods. The segmentation process is based on various features found in the image. This might be color information, boundaries or segment of an image.
There are various steps that are being performed in order to achieve the desired result. This approach consists of four main steps: image acquisition, image segmentation, feature extraction and disease classification.

The main objective of designing and building this system is to reduce the difficulties facing by the farmers. Continuous monitoring is a time-consuming process and quite expensive in case of large farms. Using this system, it takes less time to detect whether the plant is healthy or not and provide instant results.

II. PROPOSED SYSTEM AND METHODOLOGY

The proposed system uses image-processing and it is composed of four main phases:

- In the first phase we create a color transformation structure for the RGB leaf image, and then image preprocessing is done.
- Next, in the second phase, the images are segmented using the K-Means clustering technique.
- In the third phase, we calculate the texture features for the segmented infected objects.
- CNN Classification is applied to predict whether the plant is healthy or not.

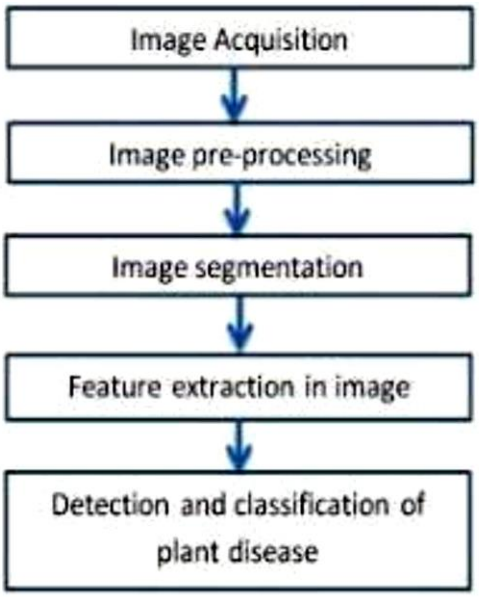

Figure 1: Block Diagram

Image Processing

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. It involves four techniques i.e. image acquisition, image segmentation, feature extraction to get processed image and classification using classifier.

Techniques of image processing:

A. Image Acquisition

The images of the plant leaf are captured. This image is in RGB (Red, Green and Blue) for color transformation structure for the RGB leaf image is created, and then, a device-independent color space transformation for the color transformation structure is applied.

B. Image Pre-processing

Image pre-processing is an improvement of an image data that suppresses unwanted distortions or enhances some image features important for further processing. Some common image pre-processing operations include standardizing the size of an image, removing noise, converting to another color space etc.

C. Image Smoothing

Smoothing is often used to reduce noise within an image or to produce a less pixilated image. Most smoothing methods are based on low pass filters. Smoothing is also usually based on a single value representing the image, such as the average value of the image or the middle (median) value. For this purpose, Filter 2D method is used. As for one-dimensional signals, images also can be filtered with

various low-pass filters (LPF), high-pass filters (HPF), etc. A LPF helps in removing noise, or blurring the image. A HPF filters helps in finding edges in an image. Gaussian filter is an example for filters which is used to reduce noise in an image.

Gaussian blur (also known as Gaussian smoothing) is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, typically to reduce image noise. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen, distinctly different from the bokeh effect produced by an out-of-focus lens or the shadow of an object under usual illumination. Gaussian smoothing is also used as a pre-processing stage in computer vision algorithms in order to enhance image structures at different scales.

D. Image Segmentation

Image segmentation is the process used to simplify the representation of an image into something that is more meaningful and easier to analyze. It means partitioning of image into various parts of same features or having some similarity. Image segmentation can be done by using K-means clustering.

Clustering is the task of dividing the data points into a number of groups, such that data points in the same groups are more similar to other data points in that same group than those in other groups. These groups are known as clusters. One of the most commonly used clustering algorithms is k-means. Here, the k represents the number of clusters (not to be confused with k-nearest neighbor). Let's understand how k-means works:

1. First, randomly select k initial clusters
2. Randomly assign each data point to any one of the k clusters.
3. Calculate the centers of these clusters.
4. Calculate the distance of all the points from the center of each cluster
5. Depending on this distance, the points are reassigned to the nearest cluster.
6. Calculate the center of the newly formed clusters.
7. Finally, repeat steps (4), (5) and (6) until either the center of the clusters does not change, or we reach the set number of iterations.

E. Feature Extraction

Feature extraction plays an important role for identification of an object. Feature extraction is the process by which certain features of interest within an image are detected and represented for further processing. In many applications of image processing feature extraction is used.

Color, texture, morphology, edges etc. are the features which can be used in plant disease detection. The features normally used for analysis are contrast, energy, correlation, homogeneity.

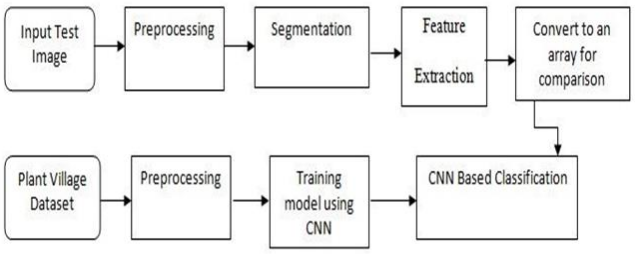

Figure 2: Flowchart

III. METHODOLOGY

Pre-processing and Training the model (CNN):

The dataset PlantVillage is obtained from Kaggle and pre-processed such as Image reshaping, resizing and conversion to an array form. Similar processing is also done on the test image. The dataset consists of about 20197 leaves of different plant species, out of which any image can be used as a test image for the software.

Then we train the model using CNN so that it can identify the test image and the disease it has. CNN has different layers that are Dense, Dropout, Activation, Flatten, Convolution2D, MaxPooling2D. After the model is trained successfully, the system can identify the disease if the plant species is contained in the dataset. After successful training and pre-processing, comparison of the test image and trained model takes place to predict the disease.

IV. RESULTS AND DISCUSSION

The webpage is developed using flask. Flask is a web framework which provides tools, libraries, and technologies.

The user loads the leaf image and clicks on upload image button.

The system will send the response to the user. It loads the image of the plant leaves and the input image undergoes several processing steps like image pre-processing and removes the noise in the image. Image segmentation is performed to partition the image into various parts of same features or having some similarity.

The next step is extracting unique features from the leaf, so the features are extracted and edges are detected by using canny edge detection and finally by using the CNN classifier it identifies the disease and displays it on screen when the user clicks the predict button.

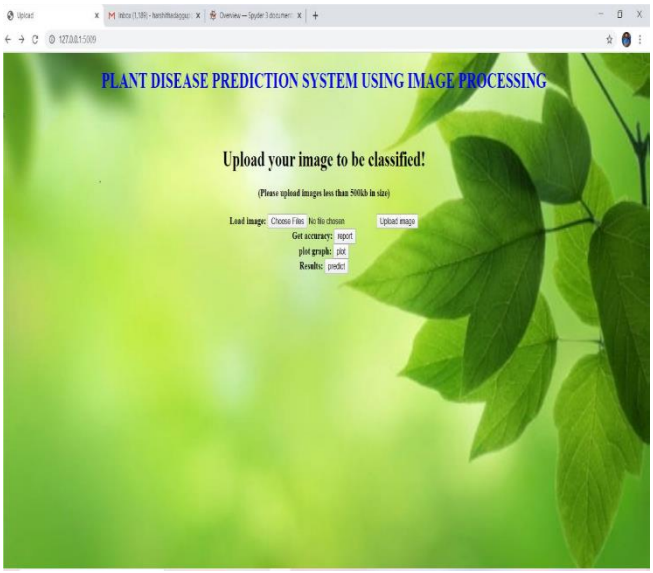

Figure 3: Front End Interface

Figure 4: Image is loaded

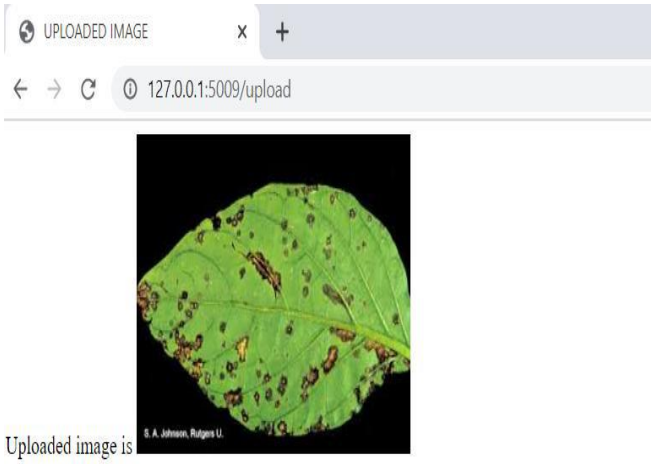

Figure 5: Uploaded Image

Figure 6: Result

V. CONCLUSION

Plant health monitoring and disease detection of plants is very crucial for sustainable agriculture. In this paper the application of image processing techniques to detect plant disease is discussed. The main objective of designing and building this system is to automate the existing manual system and to provide easier and convenient ways for the farmers to predict whether the plant is healthy or not. The developed system helps farmers to identify the plant disease at initial stage itself, with very less computational efforts the optimum results are obtained, and it will improve the cultivation with healthy plants.

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