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# Leaf Disease Detection of Cotton Plant Using Image Processing Techniques

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***Abstract:*** *Identification of the symptoms of plant diseases by means of image processing techniques is of prime concern in the area of research. There is a need for a plant disease diagnosis system that may support farmers during their daily struggle. The proposed work is a development of an efficient diagnosis system that focuses on plant disease identification by processing acquired digital images of leaves of the plant. These images are made to undergo a set of pre-processing methods for image enhancement. The enhanced image is segmented using thresholding based segmentation approaches to extract the region of interest i.e., diseased portion. Later, a satisfying set of visual texture features from the region of interest are extracted for detecting diseases accurately. Finally, treatment measures are provided to control the disease. The advisory helps farming community in effective decision making to protect their crop from diseases.*

***Keywords:*** *GLCM, Thresholding, Segmentation, Feature extraction.*

## I. Introduction

India is an agricultural country where in most of the population depends on agriculture. The early stage diagnosis of plant disease is an important task. Farmers require continuous monitoring of experts which might be prohibitively expensive and time consuming. Therefore looking for fast, less expensive and accurate method to automatically detect the diseases from the symptoms that appear on the plant leaf is of great realistic significance. This enables machine vision that is to provide image based automatic detection. The objective of this project is to detect plant leaf disease detection.

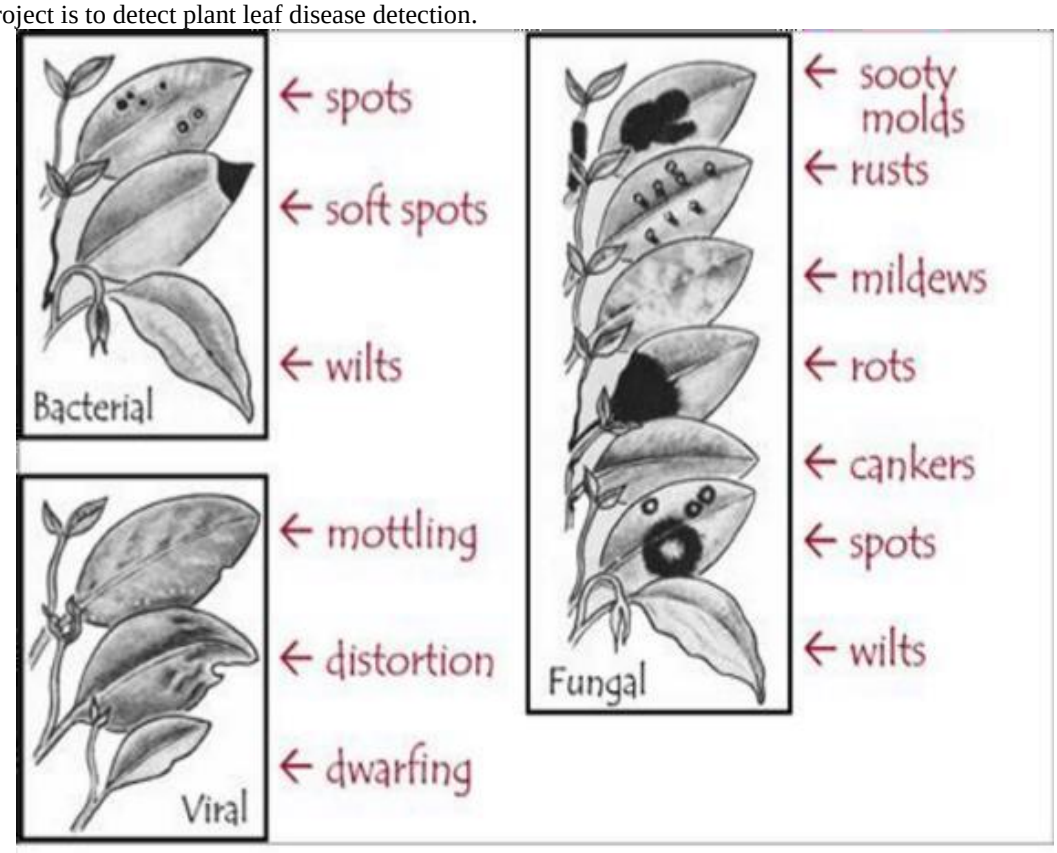


**Figure 1** Types of Diseases

There are two main characteristics of plant disease detection machine-learning methods that must be achieved, they are: speed and accuracy. There is need for developing technique such as automatic plant disease detection and classification using leaf image processing techniques. This will prove useful technique for farmers and will alert them at the right time before spreading of the disease over large area. Solution is composed of four main phases; in the first phase we create a color transformation structure for the RGB leaf image and then, we apply color space transformation for the color transformation structure. Then image is segmented. In the second phase, unnecessary part (green area) within leaf area is removed. In third phase we calculate the texture features for the segmented infected object. Finally, in the fourth phase the extracted features are passed through a pre-trained neural network.

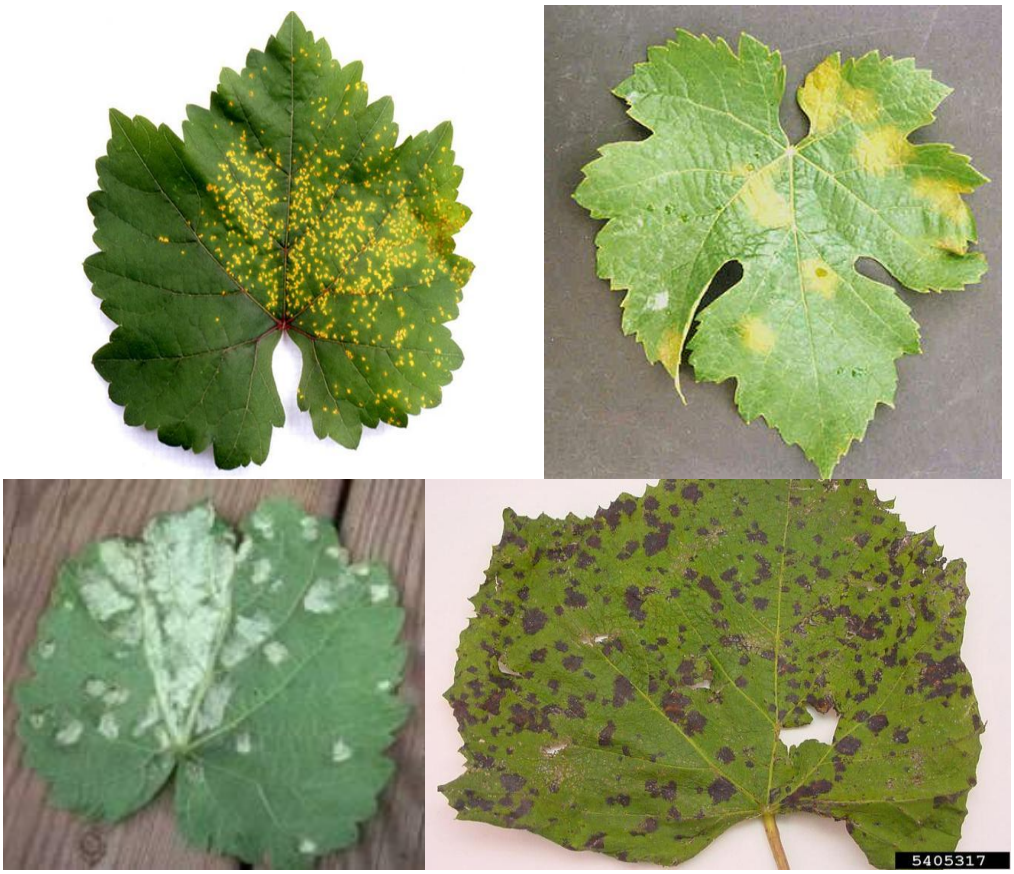


**Figure 2.** Sample images from our dataset.

## II. Proposed Approach

There are 5 main steps used for the detection of leaf diseases. This scheme is consists of:
1) Image Acquisition
2) Image Pre-processing
3) Segmentation
4) Feature Extraction
5) Classification

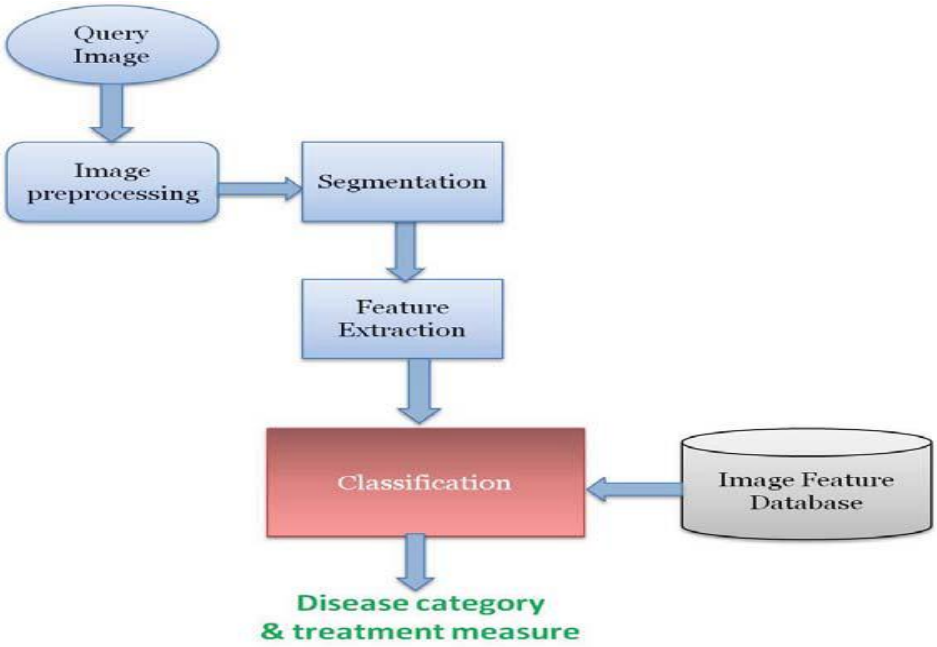


**Figure 3** Block Diagram

2.1) Image Acquisition

The images of various leaves acquired using a digital camera with required resolution for better quality. The construction of an image database is clearly dependent on the application. All the images are stored in JPEG format for keeping uniformity.

2.2) Image Pre-processing

This module includes two preprocessing phases: image resize and image filtering respectively. All the acquired images are resized to a standard resolution. Resized images are filtered to remove any noise content present in the image. Here, a rotationally symmetric Gaussian Low Pass filter is applied and a positive standard deviation sigma

2.3) Segmentation

Segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics. It involves partitioning an image into groups of pixels which are homogeneous with respect to the pixel labeling criterion. Segmentationapproachemployed in the present work namely thresholding based masking.

Thresholding Method:

This approach reads in the RGB input image resulted from k-means clustering approach i.e., the image with region of interest containing diseased leaf spots. The procedure begins with reading the pixel values of red, green and blue bands separately. Programmatically observation showed that diseased portions of the image are visually clear in green band and contain pixel values less than that of non-diseased portions. Hence, this value is chosen as threshold to attenuate the pixel with higher range in the image in green band. On this basis, a mask is created containing R, G, and B values of pixels representing diseased portion as 1 (one) and rest being 0 (zero). This mask is applied on the input ROI image to extract only the region of interest.

2.4) Feature Extraction

In statistical texture analysis, texture features are computed from the statistical distribution of observed combinations of intensities at specified positions relative to each other in the image.

GLCM methodology

Gray level Co-occurrence matrix (GLCM) is generated for each pixel map for H & S images of infected cluster.

1. The graycomatrix function creates a gray level co-occurrence matrix by calculating how frequently a pixel with the particular intensity value i occurs in a specified spatial relationship to a pixel with the value j.
2. By default this spatial relationship is the pixel of interest and its immediate right pixel.
3. However we can specify some other spatial relationship between twos. To create multiple GLCMs, specify an array of offsets to the graycomatrix function. These offsets define pixel relationships of varying direction and distance. Directions can be horizontal, vertical, along two diagonals.
4. Calculating statistics from GLCM matrix also known as SGDM.

2.5) Classification
Feature vector of input images is compared with the database.
The class with which minimum distance is obtained is identified class.
The classifier used in this is Euclidian distance classifier.

## III. Experimental Results And Observations

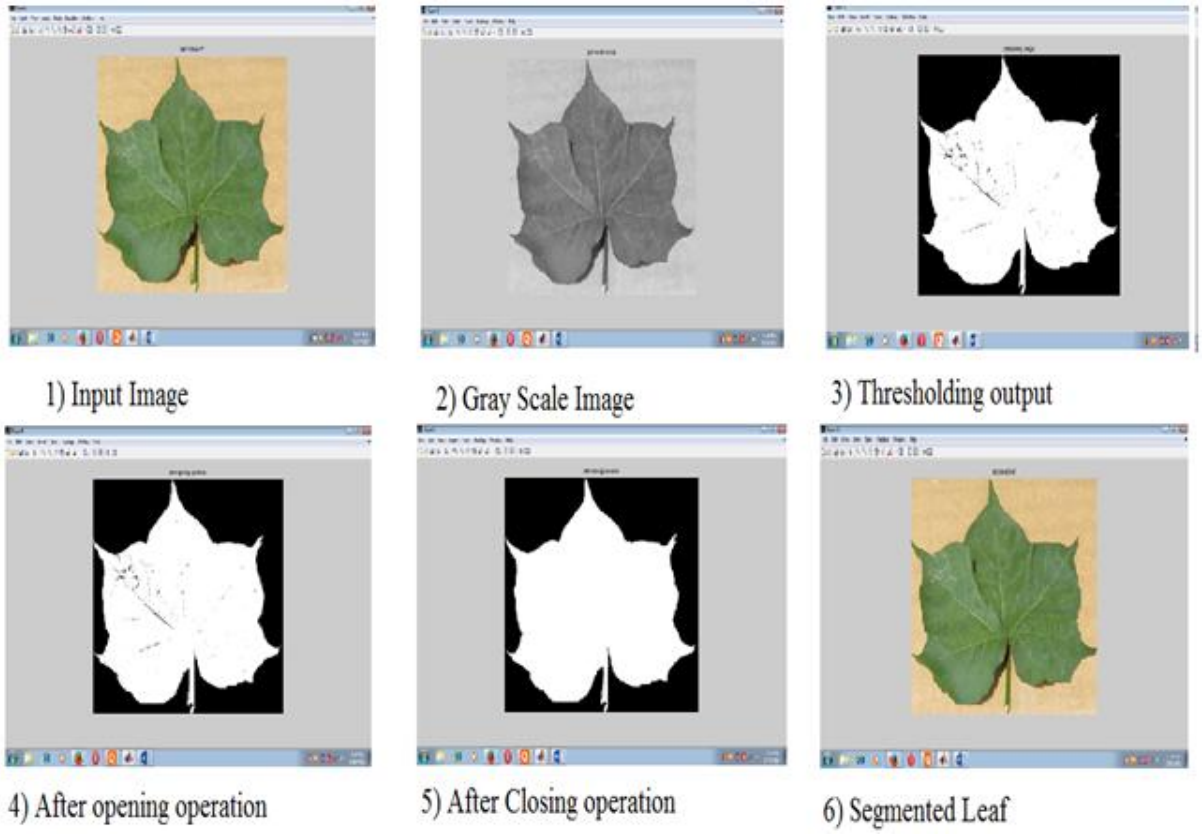


**Figure 4.** Leaf images after performing operation

As discussed in the introduction, solution is composed of four phases.In this, input image is selected from dataset folder as shown in Figure 2. Color transformation structure is created. Then color based segmentation is applied to get the infected region of interest. The choice of selection of number of clusters is user dependent. This is the region of interest for further processing. Infected cluster is selected. Green pixels are masked based on threshold value set. Also Pixels on the boundaries are also removed as they both do not contribute to disease identification process.

## IV. Conclusion

The proposed plant disease diagnosis system serves the farming community to improve their crop productivity by correctly classifying the disease type being occurred.The system is developed to detect cotton plant disease spots. The system effectively segments the diseased portion of the image of leaf sample using thresholding based region extraction (diseased spots).

The system accurately detects diseased spots present, if any and classifies type of disease being affected using Euclidian classifier based on the features extracted from the diseased portion using GLCM matrix. The result obtained helps farmers/agronomists in making effective decisions and efficiently to protect their crops from heavy loss due to a vast spreading of diseases.

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