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Analyzing and Detecting Plant Pathology through Image Thresholding, Canny Edge Detection, and Morphological Operations

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ABSTRACT

In general determination of plant pathology is meticulous challenging task in agriculture field. A plant turn-into unhealthy when it is unceasingly disordered by few factors that results in an irregular biological science procedure that interrupt the plant's natural structure, growing function, or other activities. Intercessions with many of the plants are vital part in physiological or biochemical systems evoke the specific unhealthy situations or symptoms. Plant disorders can be mostly categorized according to the nature of their essential causal agent, either contagious or noncontagious. In nature, plants may be affected by moreover disease-causing agent at a time. Knowing about the diseases, its characteristics, how to resolve is required and hence it is called as plant pathology. Plant pathology is the scientific learning of disorders and caused by pathogens environmental conditions. To mitigate this issue, This work presented a method to identify the plant pathology based on the image. This exploration designates effective; First phase concerns with training of healthy sample and diseased sample. Second phase concerns with the training of test sample and generates result based on the edge detection, Morphological Image Processing and at the end histogram analysis is based on the intensity levels of the colour.

Keywords : Plant Pathology, Image Thresholding, Canny edge detection, Morphological Image Processing, Histogram analysis.

I. INTRODUCTION

India is an [1] agricultural country; wherein about 70% of the population depends on agriculture. Farmers have wide range of diversity to select suitable Fruit and Vegetable crops. However, the cultivation of these crops for optimum yield and quality produce is highly technical. It can be improved by the aid of technological support. The management of perennial fruit crops requires close monitoring especially for the management of diseases that can affect production significantly and subsequently the post-harvest life. Our research focuses on the detection of plants diseases based on edge detection and color matching histogram technique. We need two very significance characteristic that is mainly concern with the accuracy of detection and speed to recognize the image diseases. Based on the color space, histogram, and edge detection techniques, we can able to find the disease of plant. In this system, there are Main two phase. First phase includes all the healthy and disease leaves are given as input to system. In the training process, the RGB color components are separated into three layers Red, Green and Blue i.e. gray scale image and then apply the CANNY's edge detecting technique. After the edge detection

technique histogram is plot for each component of healthy and disease leaf image and stored in the systems. Second phase is mainly concern the test the testing samples that are given as input. In the training process of testing leaf, the RGB color components of testing leaf image is separated into red, green and blue components and apply CANNY's edge detection technique on each component. To find the histogram plot for each components and compare all the stored results and identify disease infected or not in the plants leaf & show disease name.

Image processing taking hold an efficient set of implementation for the analysis of imagery used in precise agriculture. From the farmers' visual perception, automating analysis of production restricting factors and building rational management plans saves both time and money. Automating this analysis is particularly advantageous for those farmers to which proficient knowledge and advice is not readily available or affordable. Technological progression in the development of precision agriculture machinery and software will then prove to be inexpensive and quicker than on-ground human involvement and data collection.

II. PROPOSED METHODOLOGY

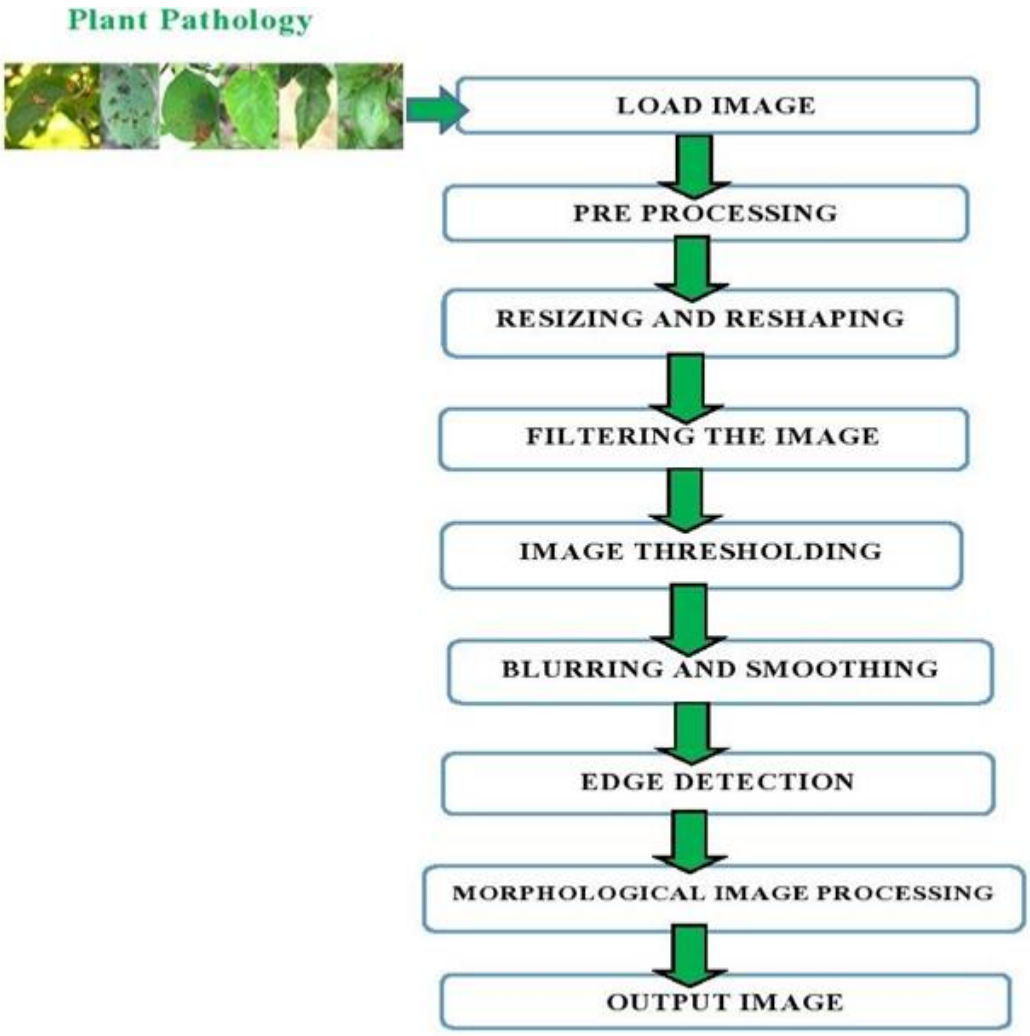


Figure.1. Process flow for Plant Pathology

Our paper implemented an analysis and detection of plant pathology and provides the result to find the leaf disorders. In our proposed system we are providing a solution to recover from the leaf diseases and also show that disordered portion of the leaf by using image processing proficiency. The process flow for plant pathology by

2.1 Image Acquisition:

In this paper, we are used kaggle data-sets which are freely availablee and then loading the image. Given a photo of an apple leaf, can you accurately assess its health? This competition will challenge you to distinguish between leaves which are normal and abnormal condition of disordered with apple rust, apple scab. In figure shows that reading the plant image from opencv library and displayed in the shape (400, 1900, 3).

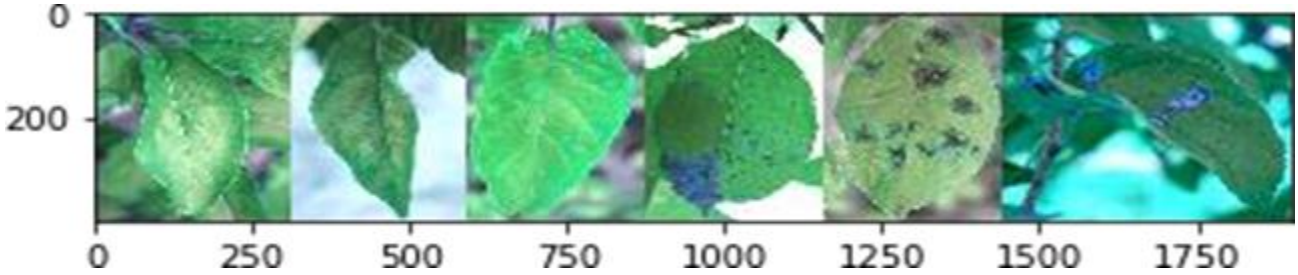


Figure.2. Reading the image

2.2 Pre Processing

Pre-processing is the operation of images at the lowest level of abstraction and to remove the noise from the signal.

2.2.1 Resizing and Reshaping

Image resizing refers to the scaling of images. Scaling comes handy in many image processing. It helps in reducing the number of pixels from an image and that has several advantages. Resizing and reshaping an image into specific width and height. Convert BGR to RGB with OpenCV function cvtColor. The gray level or gray value indicates the brightness of a pixel value between 0 and 255.

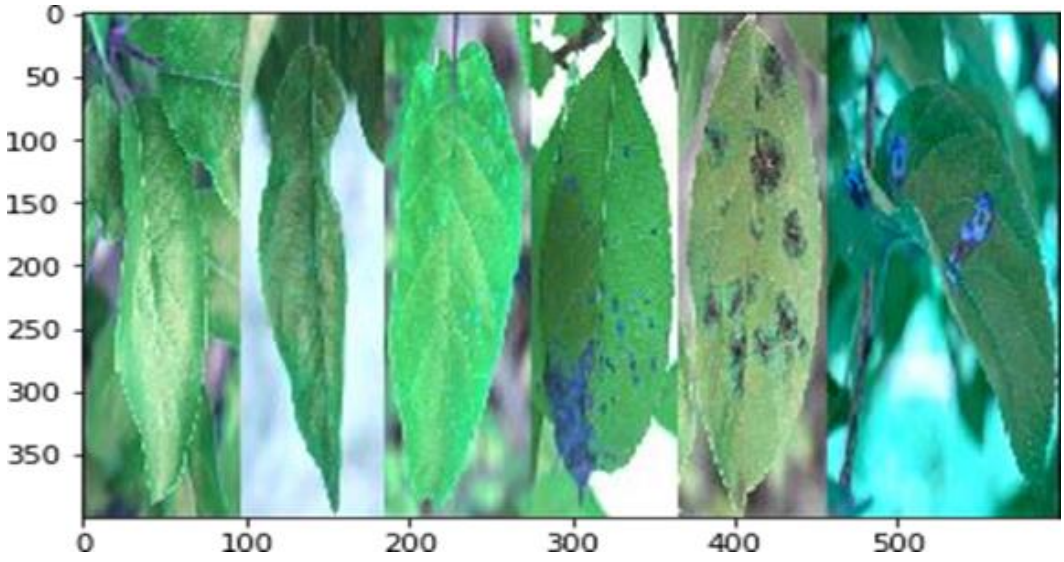


Figure.3. Resizing the image

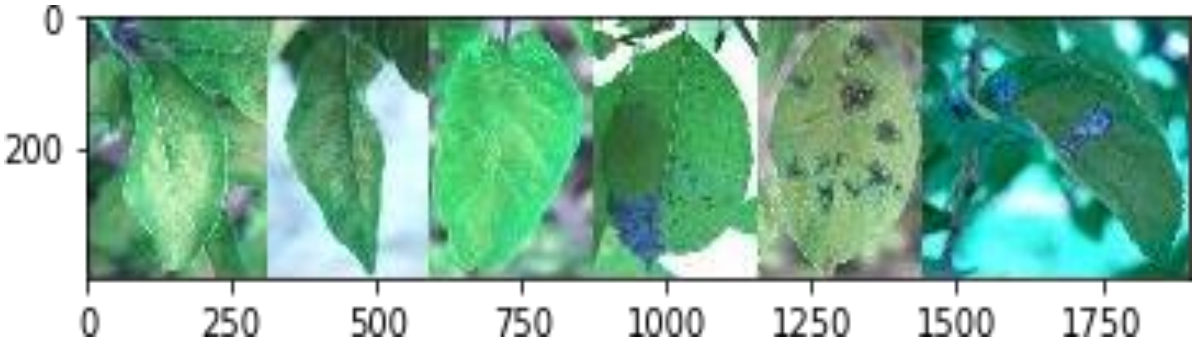


Figure.4. Reshaping the image

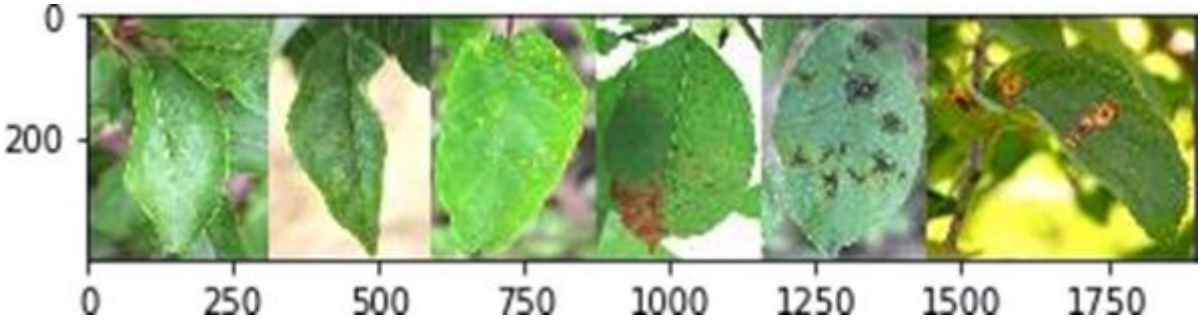


Figure.5. BGR TO RGB Conversion

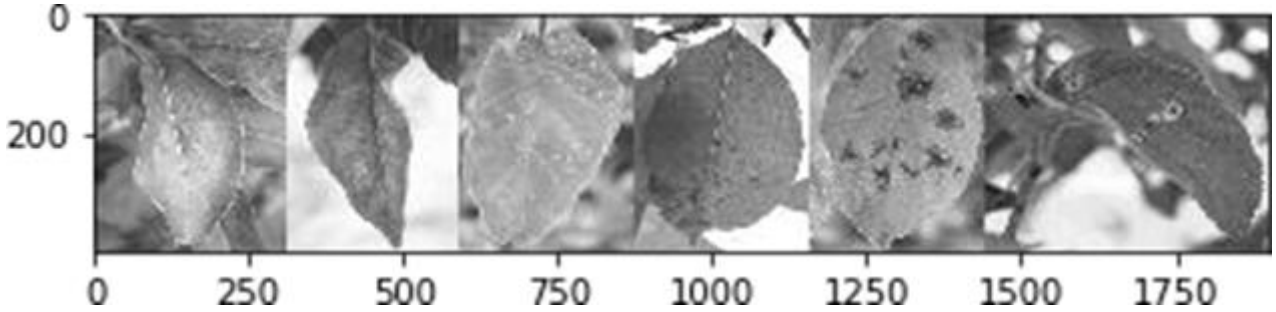


Figure.6. Grayscale image

2.3 Filtering the Image

Filtering method used for modifying or enhancing an image and filter an image to emphasize certain features or remove other features.

2.3.1 Mean Filter

It is used to blur an image in order to remove noise. To determine the mean of the pixel values within an n x n kernel and pixel intensity of the center element is then replaced by the mean. Eliminates the noise in the image and smooth's the edges of the both colour and gray scale image..

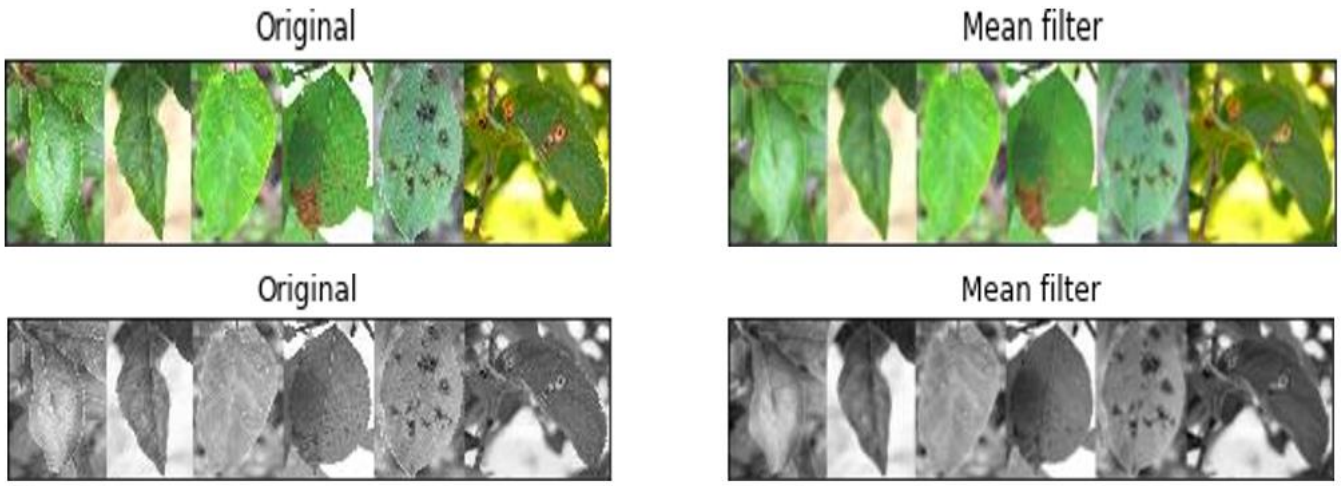


Figure.7. Apply Mean filtering for the colour and Grayscale images

2.3.2 Gaussian Filter

The Gaussian Filter is used to compute the intensity of the gradients. To remove the detail and noise in particular image. Then, prospective edges are thinned to 1-pixel curves by removing non-maximum pixels of the gradient magnitude. Gaussion distribution by

$G(x) = 1/2 \sqrt{2} \pi \sigma e^{-x^2/2\sigma^2}$ (1)

Where σ is the standard deviation of the distribution of the pixel values. G(x) is the gaussion function.

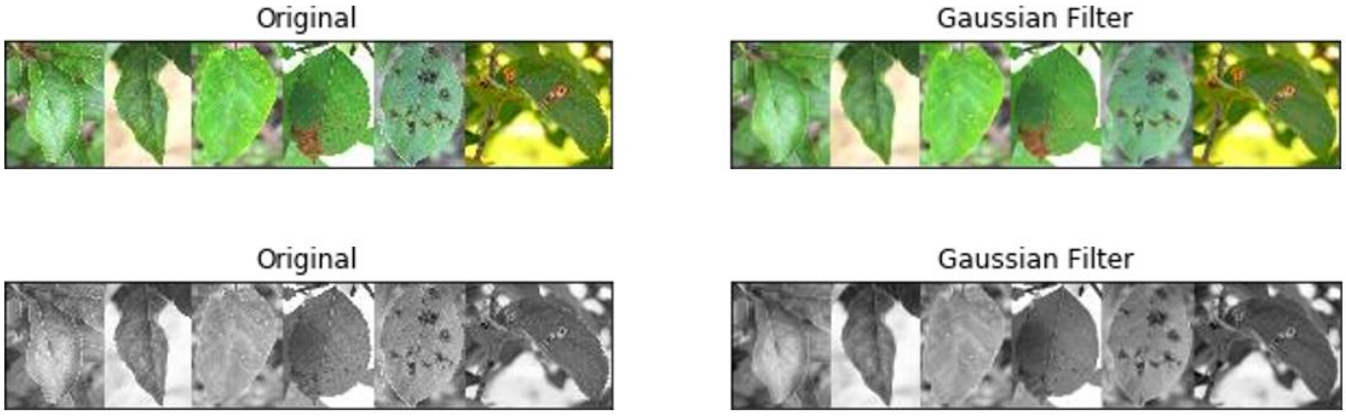


Figure. 8. Apply the Gaussian filtering for the colour and Grayscale images

2.4 Image Thresholding

Thresholding is a form of image segmentation. To create a binary image from a gray scale or full-color image. In order to separate "object" or foreground pixels from background pixels to aid in image processing. Here applied with Global Thresholding, Global Adaptive Mean and Adaptive Gaussion Thresholding method.

Figure.9. Apply the Thresholding Image

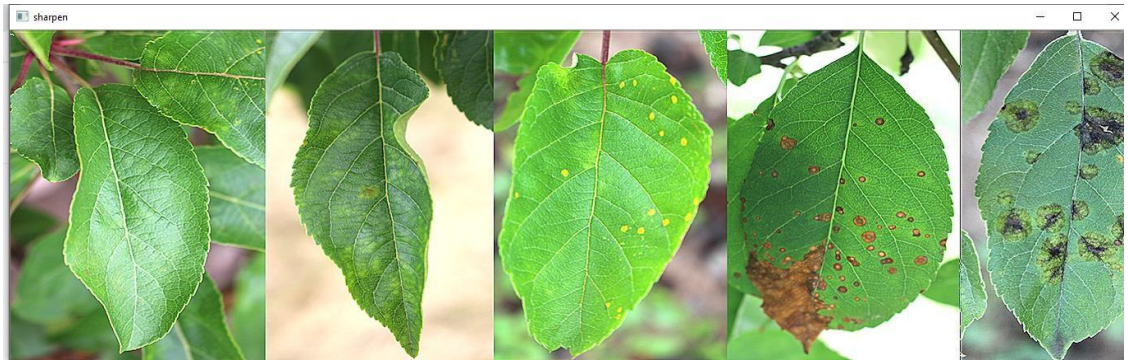
2.5 Blurring and Smoothing

Blurring is used to make an image smooth in which edges are not observed. The kernel is a special matrix, it changes the pixels using convolution to make an image blur. A low pass filter is used for blurring as it allows the low frequency to allow and stop the high frequency.

Denoising and enhancement methods are able to improve visual quality of images; Smoothing refers to in case of denoising the image when noise follows a Gaussian distribution.

Figure.10. Blurring the image

(a)



(b)

Figure.11 (a) Original image (b) Smooth and sharpening the image

2.6 Edge detection

There are many pre-defined functions to detect edges on the basis of Intensity Gradients and thresholding. The most commonly used method is Canny Edge Detection. The Canny edge detection algorithm by,

Step 1: Reduce the noise

Step 2: To finding the gradient intensity of the image

Step 3: Apply non-maximum suppression reduce the “false” responses to edge detection.

Step 4: Double thresholding operations like lower and upper boundary on the gradient values.

Step 5: Edge Tracking used by suppressing weak edges that are not connected to strong edges.

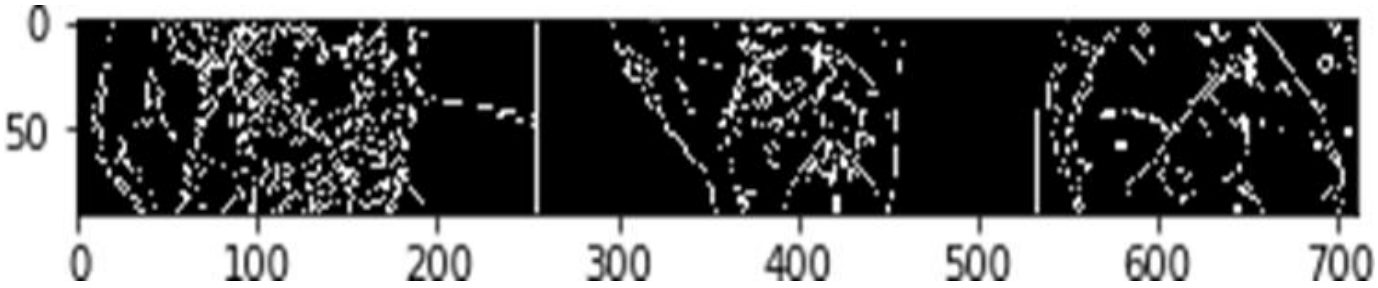


Figure.12 Apply automatic canny edge detection using the computed Median

2.7 Morphological Image Processing

It is used to process the images based on shapes and collection of non-linear operations related to the shape of the image. Usually performed by gray scale images. Here dilation is used to add pixels to the boundaries of objects in particular leaf image. Erosion removes pixels of object boundaries. Both are depends on the shape and size of the element used to process the leaf image.

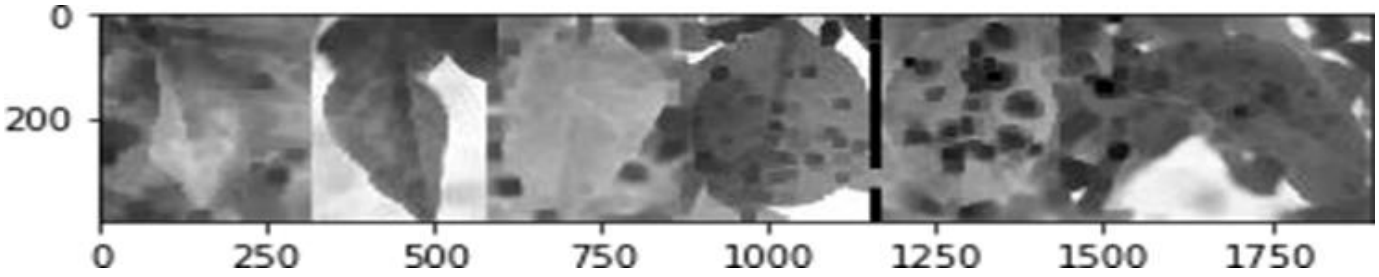


Figure.13 Apply erosion method

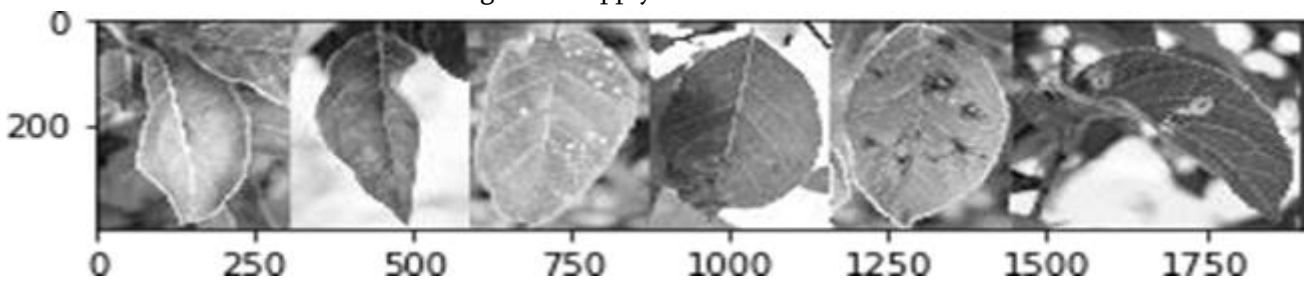


Figure.14 Apply dilation method

2.8 Histogram Analysis

The histogram of an image refers to a histogram of the pixel intensity values in a leaf image at each different intensity value found in that image. In figure2 shows that x label in intensity level and y label in intensity frequency.

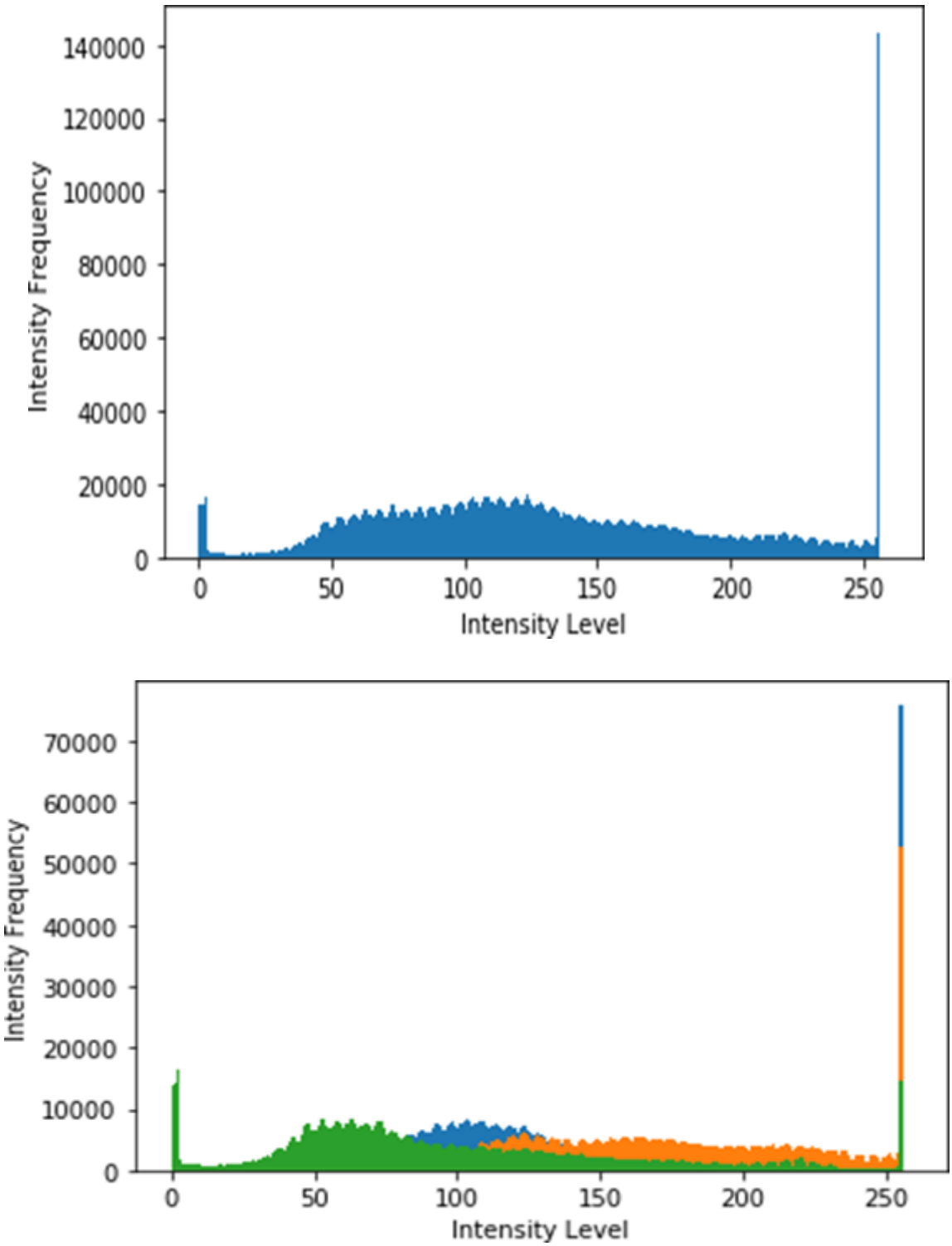


Figure.15 Histogram analysis based on the intensity level

III.CONCLUSION

In this article, the analysis and detection of leaf pathology of plant segmentation, image acquisition, pre-processing and thresholding techniques are used. Apply automatic canny edge detection using the calculated median to detect multiple edges in images. Then the morphological methods are Dilation and Erosion, the

number of pixels added and removed depends on the size and shape of the leaf. At the end the histogram analysis is based on the color intensity levels. An accurate and effective technique for automatically detecting the image of a disordered plant. Finally, analysis of the histogram shows that the intensity levels and frequencies of this color difference are accurately and effectively detected in a given image of unbalanced leaves. It is an accurate and effective technique for automatically detecting diseased plants. To extract color characteristics, they are applied to samples of healthy plant leaves and diseased plant leaves. Plant disease is detected by histogram matching. The matching of the histogram is based on the color characteristic and the technique of perceiving the edges. The training process includes the training of these samples using the technique of separating the layers that separate the red, green, and blue layers of the RGB image and using the technique of detecting the edges that detect the edges of the layer images. After creating the histogram samples and the test image, we immediately applied a histogram-based comparison technique. Comparison First with the test sample and the healthy sample if the test sample is sick, it compares the test sample with the disease sample and these steps take a few minutes to show the result of the comparison of the sick test sample or not. This is beneficial for us because we can easily understand the processing of the implementation phase.

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