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# Analysis of Fungus in Plant Using Image Processing Techniques

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***Abstract:*** **The present work proposes a methodology for analysis of fungus in plant, using image processing techniques. The fungus kills the young seedling; it spread by air and can also infect plant. Therefore it is very important to monitor the leaf at regular intervals so as to keep track on quality of growth of plant. For analysis of fungus is focused on technique using MATLAB 7.0. The image are captured by digital camera mobile and processed using image growing, then the part of the leaf spot has been used for the classification purpose of the trait and test. The acquired image are in jpeg format and are converted to gray scale image. The gray scale images are enhanced and make noise free. The Ostu algorithm is applied to get threshold image. The pixel neighborhood is applied to enhance the pixel of leaf to show clearly the fungus area. Clustering is applied to get infected part of the leaf. RGB image is then segmented for analysis of fungus in plant. Comparative analyses of Image Edge Detection techniques are presented. It has been observed that the Canny Edge Detection algorithm is computationally more expensive compared to Sobel Edge Detection technique. The fungus infected area is 24.5951%.**

***Keywords:*** **Edge Detection, K-Means Clustering, Otsu Thrsholding, Pixel Neighbourhood.**

## I. INTRODUCTION

Farmers face significant losses in agriculture in India due to the lack of appropriate technology. Vegetable quality is frequently referred to size, shape, mass, firmness, color and bruises from which it can be classified and sorted. However, technological implementation in that sector turns unfeasible by software, equipment as well as operational costs.

In evolution the sustainable agriculture system, the emerging technologies have made important contribution. It is found that fungus cause heavy crop losses amounting to several billion dollars annually. With these techniques it is now possible to reduce errors, costs to achieve ecological and economically sustainable agriculture. Using MATLAB software as a tool in image processing, we can analyse fungus using various algorithm.

There are various techniques includes

1. **Image Segmentation.**
2. **Edge Detection**
3. **K-means Clustering.**

**1.** Image segmentation has become a very important task in today's scenario. It is a fundamental process in many image, video and computer vision application.

**2**. Edge detection refers to the process of identifying and locating sharp continuities is an image. Edge detection is used to obtain information from the frames as a precursor step to feature extraction and object segmentation.

**3**. Clustering is a data mining technique of grouping sample so that the samples are similar within each group, the groups are called cluster. K-means clustering techniques classifies the pixel with same characteristics into one cluster the forming different clusters according to coherence between pixels in a cluster. The program supports all image manipulations as reading and writing of image files, operation on individual pixels, image regions, whole images and volumes. Volumes

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ordered as a sequence of images can be operated upon as a whole. It also can perform basic operations as convolution, edge detection, Fourier transform, histogram, editing and color manipulation, dilatation as well as mathematical operation on sets of images such as multiplication and/or division.

## II. RELATED WORK

Image processing has been proved to be effective tool for analysis in various fields and applications. Agriculture sector where the parameters like canopy, were the important measures from the farmer's point of view. The analysis of the parameters has proved to be accurate and less time consuming as compared to traditional methods.[1]

One of the most important techniques is Edge Detection Techniques for natural image segmentation. It separates an image into its component regions or objects. Image segmentation needs to segment the object from the background to read the image properly & identify the content of the image carefully. Edge characterizes boundries and is therefore a problem of fundamental importance in image processing. Image Edge Detection significantly reduces the amount of data & filters out unless information. Since Edge Detection is in the forefront of image processing for object detection, it is crucial to have a good understanding of Edge Detection Algorithm.[2][3][4]

The crop of Tomato is very often infected by a disease that leaves spot of brown, gray or off-white colors on the plants leafs in winter. Scientifically, this disease is known as cerospora leaf spot or cercospora cruciferarum. It is kind of fungus that often kills young seedlings. A novel machine has been proposed that it determines the nature of fungus & its depth into the tomato steam. The image of the crop leaves are taken by a good quality color camera. The ability to identify the tomatoes based on quality in the food industry which is the most important technology in the realization of automatic tomato sorting machine in order to reduce the work of human & also time consuming. Image Histogram processing and analysis will be used to get the exact color ranges of tomato.[5][6]

The studies of plant trait/diseases refer to the studies of visually observable patterns of a particular plant. Nowadays crop face many disease/traits. Damage of the insect is one of the major trait/diseases. Insecticides are not always proved efficient because insecticides may be toxic to some kind of birds. The identification of mostly green colored pixels. The pixels are masked based on thresholding values that are computed using otsu's method. The additional step is that pixels with zeros red,green,blue values & the pixels on the boundries of the infected cluster. The advances in various methods used to study plant diseases/trait using image processing.[7][8][9]

The K-means clustering algorithm is one of the most widely used algorithm. The color based segmentation method that used k-means clustering techniques. The k-means algorithm is an iterative technique used to partition an image into k cluster. The standard k-means algorithm produces accurate segmentation results only when applied to images defined by homogeneous region.[10]

## III. DATA FLOW DIAGRAM FOR EXISTING SYSTEM

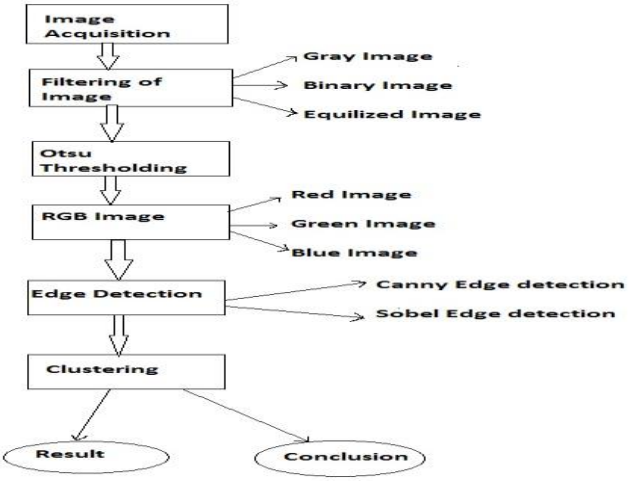


**Fig. 1 Data flow diagram**

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## IV. METHODOLOGY

### a) Image Acquisition:

The input image is aquired by using digital camera focused on leaves to get the good quality of images.

**Fig. 2 Input Image.**

Usually images obtained during image aquisition are not suitable for the identification and classification purpose, they need to be filter becuse of some factors such as noise, unwanted background, climatic condition and poor resolution of images.

### b) Filtering image:

To remove these unwanted factors the input image is converted into Gray Scale Image, Equilized Image and Binary Image. The images are enhanced using histogram euilization technique as shown in below.

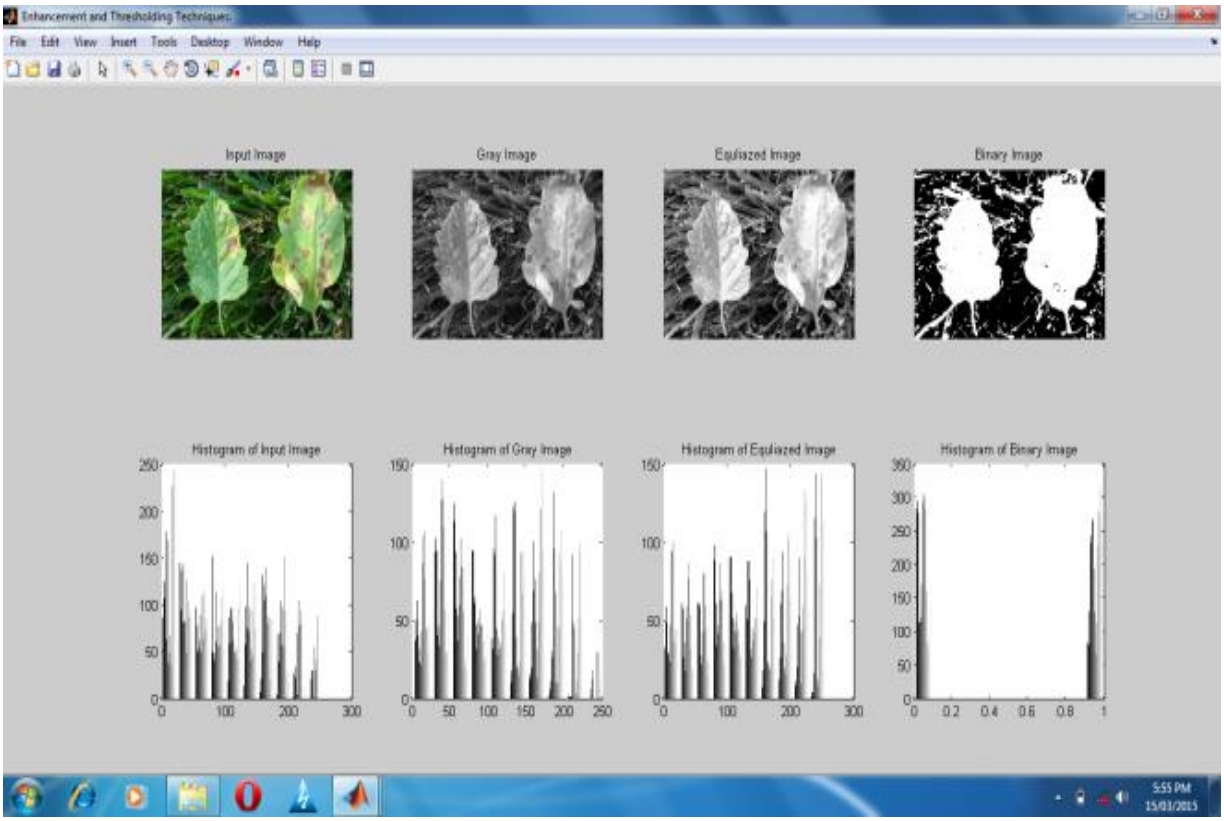


**Fig. 3 Gray, Equilized & Binary Image**

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**c) Otsu Thresholdimg:**

The thresholding is done with the help of Otsu algorithm. In this technique image is partitioned into groups on the basis of leaf area and converted into binary image with black as background and white as leaf.

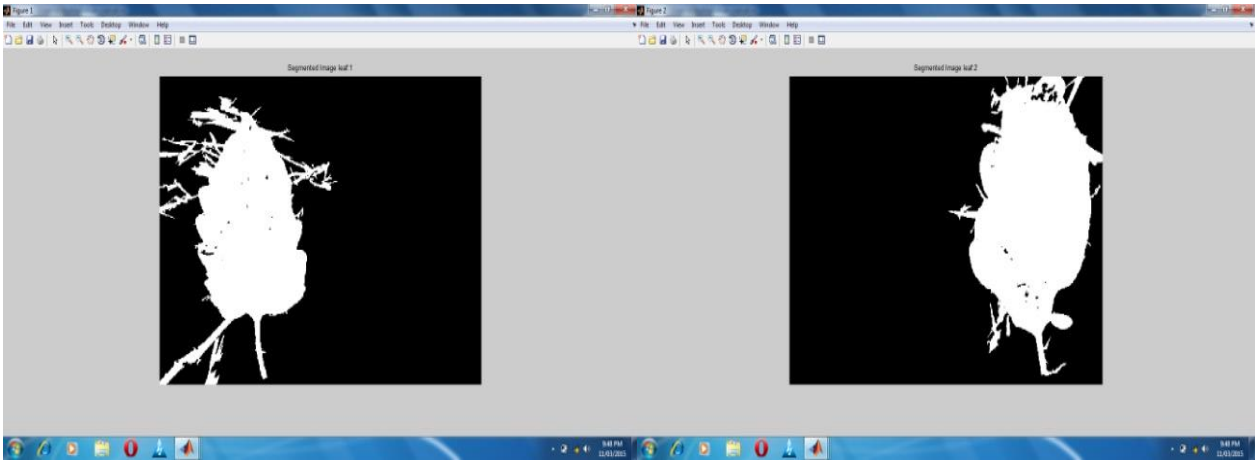

**Fig. 4 (a) Partitioned image (left leaf).** **Fig. 4 (b) Partitioned image (right leaf).**

**d) RGB image:**

The image is now converted into RGB (Red, Green and Blue) color component for fungus identification and also shows that how much of each of these colours a certain pixel should use with respective histograms.

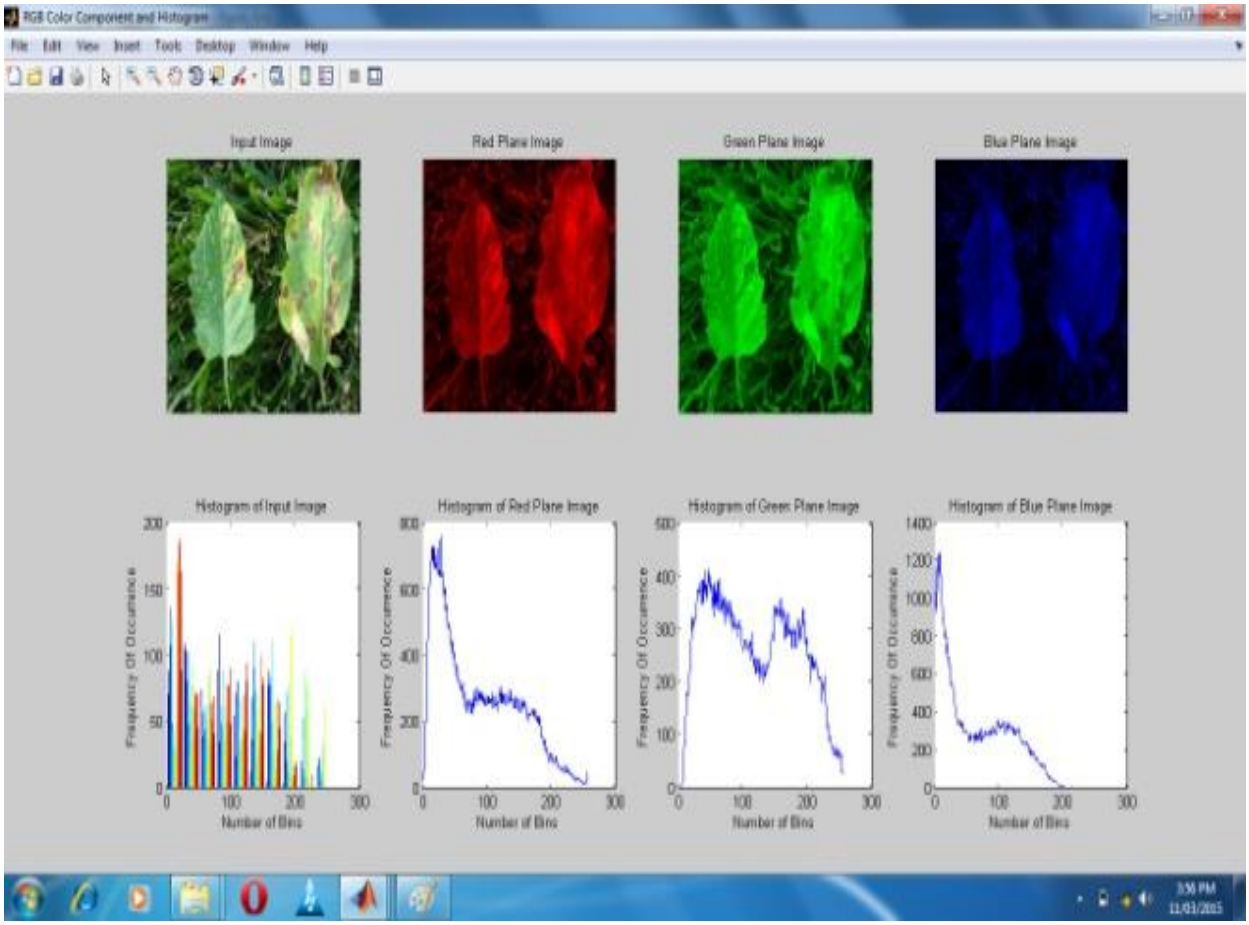


**Fig 5 Red, Green & Blue image**

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**e) Edge Detection:**

**i. Canny Edge Detection:**

Canny edge detection technique is one of the standard edge detection technique. It was first created by John Canny for his Master's thesis at MIT in 1983, and still out performs many of the newer algorithms that have been developed. To find edges by separating noise from the image before find edges of image the Canny is a very important method. Canny method is a better method without disturbing the features of the edges in the image afterwards it applying the tendency to find the edges and the serious value for threshold.

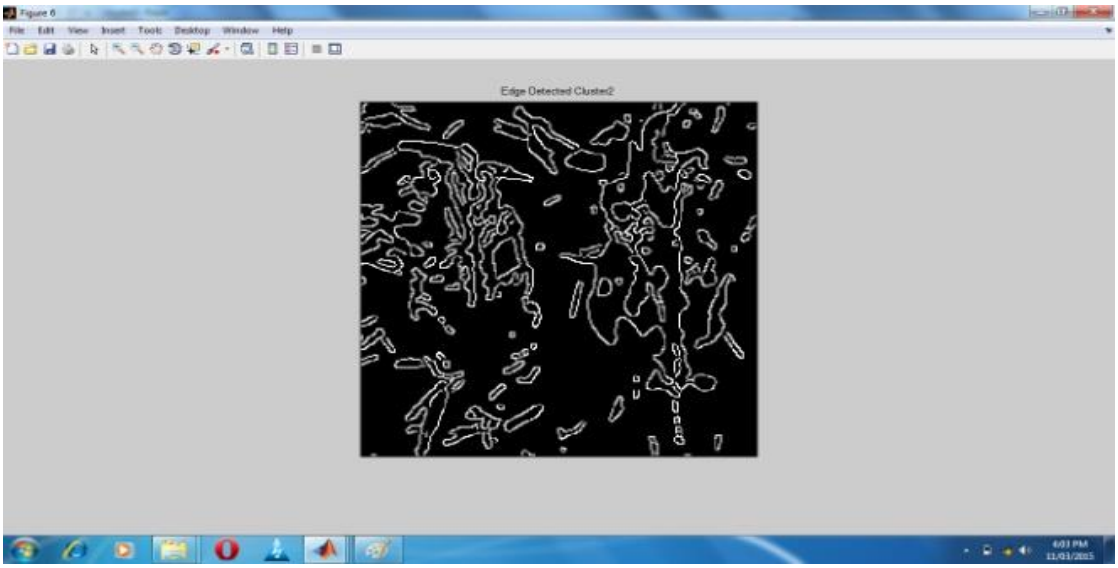


**Fig. 6 Edge detection using Canny**

**ii. Sobel Edge Detection:**

The Sobel edge detection method is introduced by Sobel in 1970. In general it is used to find the estimated absolute gradient magnitude at each point in n input grayscale image. The Sobel method of edge detection for image segmentation finds edges using the Sobel approximation to the derivative. It precedes the edges at those points where the gradient is highest. The Sobel technique performs a 2-D spatial gradient quantity on an image and so highlights regions of high spatial frequency that correspond to edges.

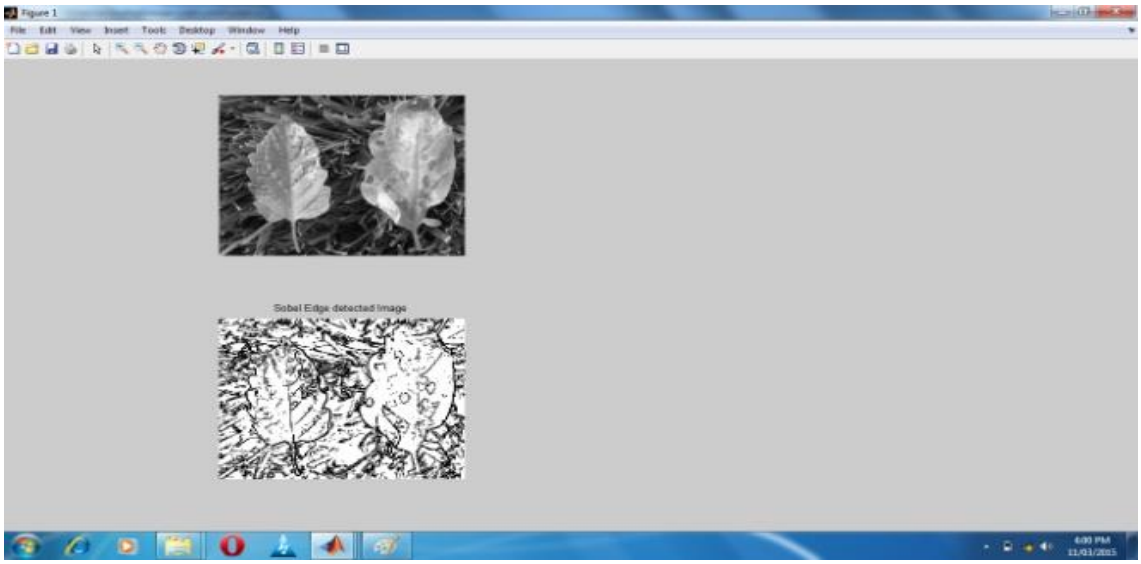


**Fig. 7 Edge detection using Sobel**

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**f) Clustering:**

With the help of K-Means clustering the yellow portion of the leaf i.e., affected part of leaf was extracted with their respective histogram (see fig. 8(a)) and % of affected area was determined also the adges were dectected with the help of Canny Edge Detection algorithm (see fig. 8(b)).

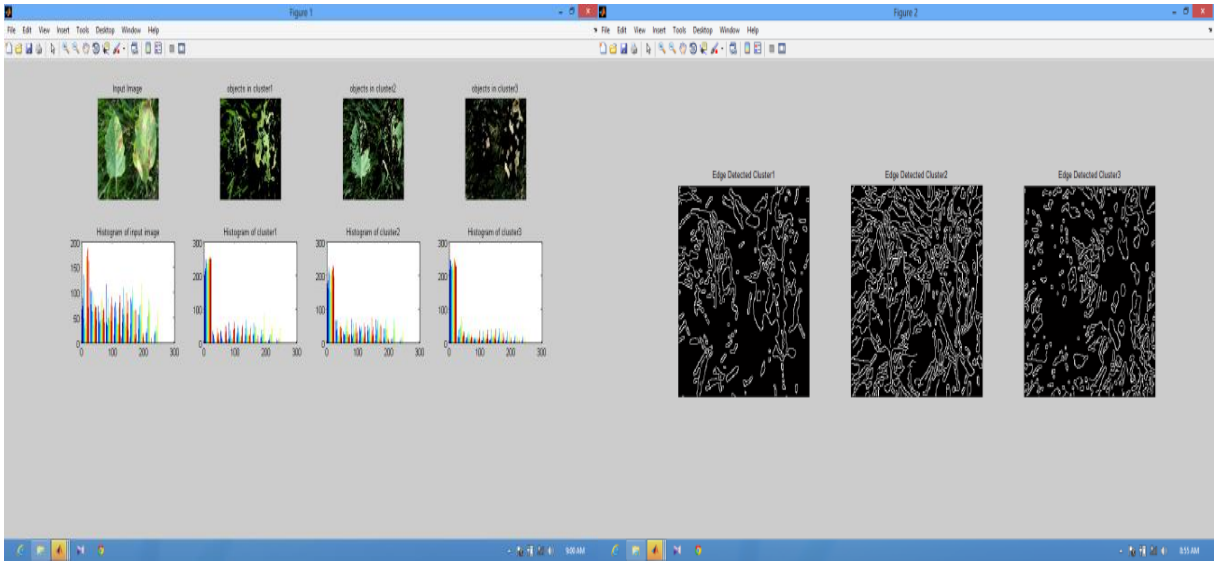


**Fig. 8 (a) Objects in cluster** **Fig. 8 (b) Canny edge detection on K-means clustering**

## V. FEATURE EXTRACTION

The features extracted from the leaf (fig 9) with the help of above techniques are

I. Total Leaf Area.

II. Leaf Perimeter.

III. Yellow/fungus Portion Area.

IV. Yellow/fungus Portion Perimeter.

V. % Infected Area.

**Fig. 9 Sample Image**

The image is analyzed by using k-means algorirthm (from fig 8(a)), the percentage of fungus area can be show below:

Total Leaf Area: = zeros(size(color))

=16796 sq.pixels units.

Leaf Perimeter: = (Leaf_Area/4)

=4199 Pixels Units.

Yellow Portion Area: =4131 Sq.Pixels Units.

Yellow Portion Perimeter:=(Yellow_Area/4)

=1032.75 Pixels Units

% Infected Area: =(Yellow_Area/Leaf_Area)*100

=24.5951%

## VI. CONCLUSION

An application of texture analysis in detecting and classifying the plant leaf fungus has been explained in this work. Thus the algorithm was tested on sample image of tomato leaf. The fungus infected area is 24.5951%. From the comparative analysis of edge detection techniques it is found that Canny Edge Detection technique is more accurate than the Sobel Edge Detection Technique. The exact quantification is quite possible with suggested methodology. In future, the amount of pesticides to be use can be detrmined with the help of this work.

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