IMAGE PROCESSING TECHNIQUES ON DISEASED LEAF: AN REVIEW

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***Abstract* :** Agriculture sector is one of the most important factor in our country which exports products like, fruits, vegetables, plants and ayurvedic medicines. Plants can be affected by fungal, bacterial and it cause to damage parts of the plant from top to bottom. It is very difficult to monitor and find the diseased plant manually. Image processing technology has been proved to be an efficient analysis to identify and detect the disease on a leaf. Identification of defected leaf is the way to preventing the loss occurred on agricultural product. This paper intends to focus on how image processing techniques are used to classify diseased leaf using preprocessing methods such as, k-means clustering, Segmentation using Canny Edge Detection, Threshold, Grabcut algorithm used for foreground extraction of the leaf and OpenCV Histogram is used to visualize graphical representation of a leaf. The proposed method seems to be the best image processing techniques to classify the diseased leaf and Python 3.7.1- OpenCV have been used as a programming tool for identification and classification of affected leaf in Image processing.

Index Terms: **Image Processing, Segmentation, Canny Edge Detection, Grabcut Algorithm, Foreground Extraction**

I. INTRODUCTION

Image processing plays an important role in agricultural field. Image processing techniques are which assist to perform some operation in image. These operations are such as enhancement, segmentation, clustering and classification. The agricultural field is suffered from climate change, deforestation, hereditary engineering, irrigation problems, pollution, soil deprivation, not sufficient medicine to cure disease. Image processing has many techniques and methods are followed to solve those problem. The image enhancement is used to improve the quality and decrease noise of the image. Images are stored in the computer memory and we can recover the images whenever needed. Digital Image Processing is having many applications in various fields of Computerized photography, Space image processing, Medical image, Automatic character recognition, Finger print ,Face, Iris recognition, Remote sensing: Satellite image analysis, Business applications.

The Fundamental steps of Digital Image Processing are,

(a) Image acquisition
(b) Image Enhancement
(c) Image Restoration
(d) Segmentation
(e) Object Recognition

In this paper used various techniques of image processing that are applied on a papaya leaf. Agriculture is the base of our country. Image processing placed an important role in various field especially agriculture. Most of the people are living depending on agriculture. But the disease of flu, bacteria, fungal affects the whole plant gradually. Once it started to spread over the plant we can't stop it at the early stage. It leads to affects the whole plant. The people those who are depends on agriculture will face the loss occurred on their cultivation. Thus, the Image processing technologies and methods are very advanced one to solve those situations. By using image processing we can identify the affected leaf as well as parts of affected area of the leaf. By using these methods people can save their plant in the early stage. Papaya leaf has been used as input image later on applied a range of techniques to identify and classify a papaya leaf. Papaya leaf is important edibles for health and skin benefits. It contains high amounts of vitamins A, C, E, K, and B and natural resources like calcium, magnesium and iron. This is the general therapy to cure all types of disease. Python 3.7.1 - OpenCV is a library of python bindings proposed to solve computer vision problems.

II. LITERATURE SURVEY

Earlier papers are referred various methods and algorithms for identification and classification to detect diseased leafs. The proposed system is creating efficient tools for identify and classify a mango fruits using feature extraction of mango and identify the quality of the mango is based on quality ratio [1]. An adaptive threshold method has been used for segmentation of mango from the background. Image processing methods were used to identify the quality of the fruits with the step of feature extractions, feature training and feature matching after segmentation of the fruits [2]. The accuracy level of this proposed paper is 80%. This early paper explained about the pest identification of the leaf using SVM. The input data set are pest infected leaf. Two types of leaves have been used to identify the pest leaf. One is whiteflies and second is aphids with whiteflies infected leaves [3]. The steps to be followed for these proposed papers are preprocessing, segmentation and SVM classifier. The pest infected area is calculated using k–means classification of regions in multiclass SVM in SVM Classifier with 98.38%. The proposed Methods and methodologies of the fruit grading system are based on the spectroscopy and narrow beams showed the inner seeds. The non invasive techniques capable of the tissues of the inner skin of the fruits like tomato[4]. Classification methods has been used fuzzy and neural network based classifiers that proved good result of segmenting and quality estimation as well as The IR sensors in triple axis directions and applying classifiers on multiple numbers of fruits.

Image processing methods are used to classify and detect the diseased leaf. Input of the diseased leaf image was followed by image acquisition, enhancement of the image, noise reduction, image segmentation, Feature extraction, classifier and the result is detection the leaf [5]. The proposed work of this paper tells about overview of using image processing methods to detect various plant diseases. Image processing is the technique which is more efficient methods to detect diseases caused by fungus, bacteria or virus. It helps to save huge loss of production to farmer [6].

Advantages of image processing techniques to detect and classify diseases in agricultural applications are helpful. The early proposal of the paper refers on tomato quality estimate with image processing. presented a appraisal of the main attributes such as color,maturity rate, firmness, shape, size and composition, that determine tomato fruit quality for final consumers and overview the methods (invasive destructive and invasive nondestructive) currently used to evaluate these attributes. The future work may involve the transferable development; take images directly from crops in the field to instantaneously resolve quality uniqueness [7].The paper mainly focused on plant disease in different methods in image processing. SVM classifier is given the better result to detect the diseased plant [8]. The development of the plant diseases prediction techniques and going to propose svm and knn classifier methodology completely unique approach for the detection rule [9]. The earlier paper performed k-means clustering technique, segmentation, multiple SVM classifiers and CLBP shows more accuracy on diseased apple [10].

III. PROPOSED METHODOLOGY

The stages in the proposed methodology are shown below. Image processing is the vital role to detect and classify a diseased leaf. The paper explains various methods that are followed to identify a leaf that has disease are not. Papaya leaf is the input of this proposed work to use image processing methodologies. The paper is implemented in Python 3.7- OpenCV.

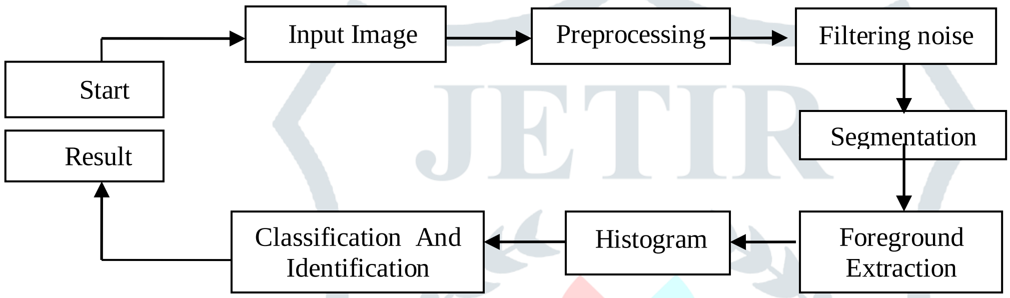


Figure 1: Basic steps followed for papaya leaf

3.1 Input Image

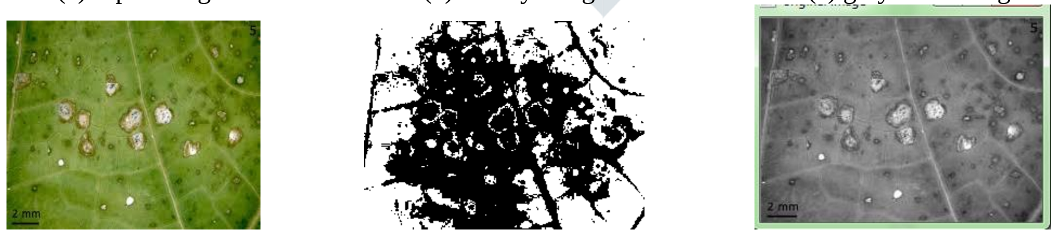
The data set for the proposed system is single image. The image of diseased papaya leaf. Papaya plays vital role is agricultural area that saves and cures many diseases in human life. Input image is essential to enhance some operation on a image.

3.2 Pre Processing

The Proposed algorithm for identification and classification of diseased papaya leaf involves three types of processing:

1. *Low-level processing*: In low-level processing input image is pre-processed. Pre-processing includes RGB to gray scale image conversion, binary image conversion and sharpening.
2. *Intermediate-level processing*: Intermediate level processing involves foreground subtraction to identification of defected region and filtering.
3. *High-level processing*: Classification of diseased papaya leaf has been performed in high-level processing.

(a) Input Image (b) Binary Image (c) gray scale image



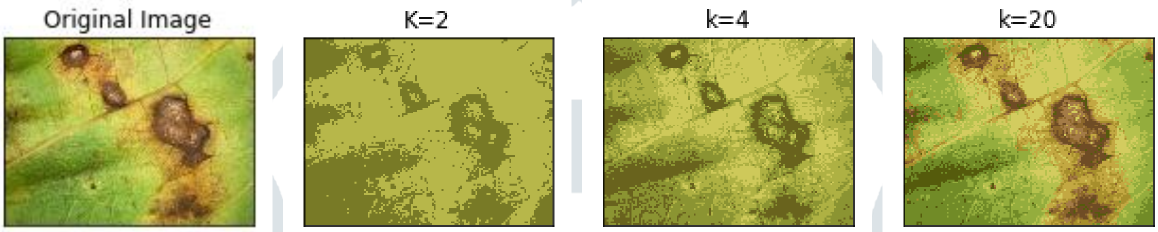
3.3 Filtering

In image processing the fundamental step is to improve the quality of the image. To make the image with high level resolution by perform sharpening, smoothing, filtering, removing noise and blur for better visual appearance. This is the main advantages of image processing. The proposed system of the diseased papaya leaf has Box Filter, Blur, and Gaussian Blur. These are basic steps to move forward to classify a diseased leaf.

3.4 Segmentation

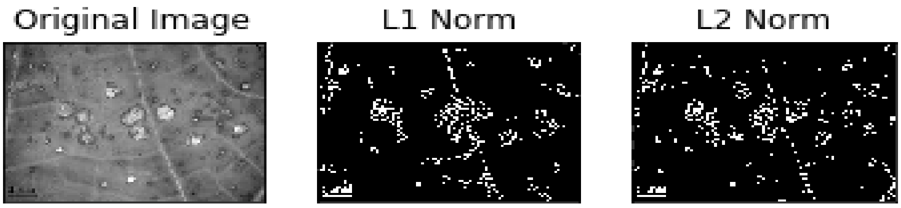
Segmentation is the process of dividing the images into multiple parts (pixel). The purpose of segmentation is to modify a presence of the image and make it with meaningful and easy to analyze. The result of image segmentation is a set of segments that cover the entire image based on shape, color, intensity and texture. Image processing has various segmentation algorithm are there used to detect a leaf. In this paper, segmentation techniques used to identify a diseased papaya leaf are K-means Clustering, Canny Edge Detection and Threshold.

3.4.1 K-Means Clustering: k-means clustering is one of the algorithms to segmenting the images. It is unsupervised learning and partitioning method for clustering analysis used in various applications.



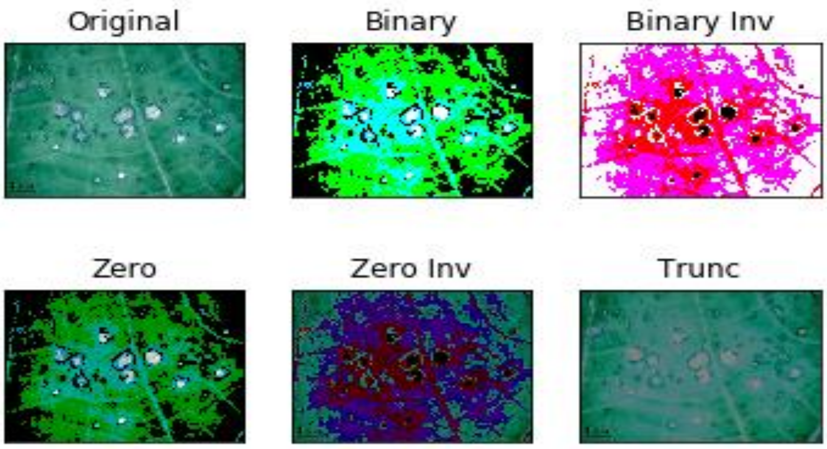
3.4.2 Canny Edge Detection:

It is the process of identify and locating sharp discontinuities in an image. Canny edge detection is a technique to take out useful structural data from various vision objects and it reduce the amount of data to be processed. It has been widely applied in various computer vision systems. The Purpose of this algorithms is used to find intensity gradient in the image. The result of using Canny based edge detection to get accurate edges of the image. Here, is the example for defected papaya leaf using canny edge detection.



3.4.3 Threshold:

Threshold is a way of separation of image into foreground and background. The images can be converted into a binary image. If pixel value is greater than a threshold value, it is assigned one value may be white, else it is assigned another value may be black. The function used is cv.threshold. The value of threshold used for diseased papaya leaf is th=127 and max_val=255. Here, the value of threshold is fixed constant. The example of papaya leaf, diseased affected part of a leaf is converted into black and the remains background of the leaf are converted into white and color pixel. The binary inverse carries out opposite reaction of binary images.



3.5 Grabcut Algorithm

The grabcut algorithm is very essential for classifying the images. The purpose of this algorithm is foreground extraction and it is a user interaction. The process of this algorithm is initially selecting a rectangle area in an image that need to extract individually. The rectangle size of papaya leaf is 'rect = (50,50,450,290)' using matplotlib. Image processing is the advanced techniques whatever operations can do on an image and can improve it to advanced one. The below figure shows the diseased area separately that is foreground extraction of a leaf and the whole leaf is considered as a background.

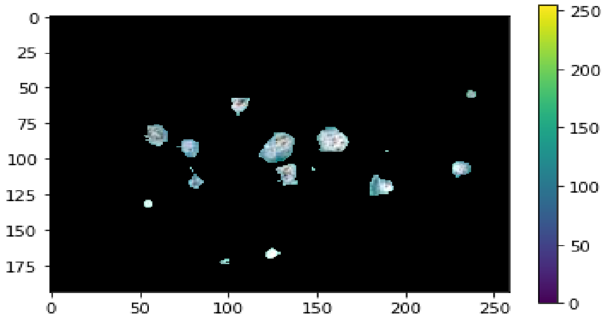


Figure 2: Grabcut method used on papaya leaf

3.6 Histogram

Histogram is a graphical representation of the image. While looking at a histogram of a image the user can clearly view tonal distribution of a image. OpenCV histogram has been used to identify a RGB color occupied in a image. How the computer understand the images based on color in computer vision. The Types of histogram are, Numpy Histogram, Matplotlib Histogram and OpenCV Histogram. Each histogram has unique advantages. The calculation of RGB color OpenCV histogram,

- Red histogram => red_hist = cv2.calcHist([img], [0], None, [256], [0, 255])
- Green histogram => green_hist = cv2.calcHist([img], [1], None, [256], [0, 255])
- Blue histogram => blue_hist = cv2.calcHist([img], [2], None, [256], [0, 255])

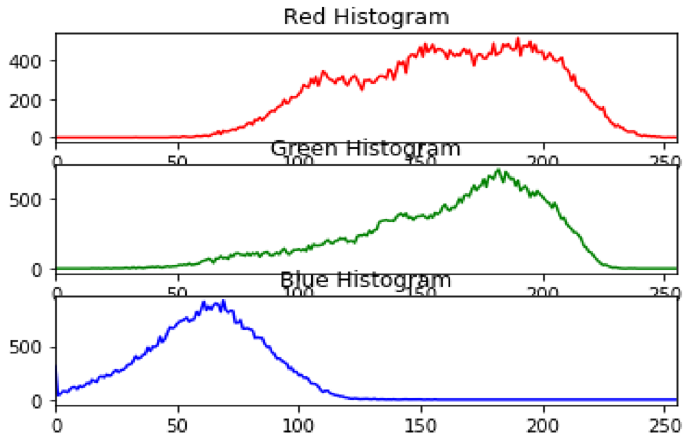


Figure : 3 Graphical representation of OpenCV Histogram

3.7 Classification of diseased papaya leaf

In this paper the simplest algorithm has been implemented for classification and identification of diseased papaya leaf. The above methodologies are the stepwise process to use the algorithm for identifies a diseased leaf. There are many earlier proposed papers have been explained a different algorithms and methods to identify a diseased leaf [1]. This paper used simplest algorithm to identify a leaf whether it is affected or not.

Algorithm 1: Classification of Diseased Papaya Leaf

Start

Step 1: Read the input image of papaya leaf using Python-OpenCV from the folder where it is located.

Step 2: preprocessing: Convert the original image grayscale image as well as binary image.

Step 3: Filter the Noise in a image using Gaussian filter

Step 4: Segmenting the image using k-means cluster.

Step 5: Remove background extraction using Grab cut algorithm from Preprocessed image.

Step 6: detecting the edges using Canny edge detector

Step 7: find the area of a papaya leaf image.

Step 8: find quality of a papaya using this formula [b= a/(x*y)]

Step 9: Apply state

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        if (b>0)
                papaya leaf is defected
        else
                papaya leaf is not defected
        End

    Step 10: The output result will be displayed.
Stop
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IV. RESULT AND DISCUSSION

The proposed algorithm is the simplest one for identifying a diseased leaf. Here, a variety of methods that are preprocessing the images, filtering, segmenting the images using k-means clustering and histogram for visual representation. Those techniques have been implemented for classify a leaf is defected or not. The step 7 refers about to calculate the area of a papaya leaf. The area of the papaya leaf is

Area (a) => 50246
Mean value => 93.559
Min value => 3
Max value => 254

The value of area (a) is 50246 and the value of x and y refers about the pixel of the image. This is the example have been used to find a quality of a papaya leaf that, (X x Y) defines the pixel value is 259x194 and RGB : 196K, it represents and counts the primary color of a image. The proposed algorithm is b=a/ (X x Y). Thus the result to find quality b=0.256357. Here is the one example used to find quality of a diseased papaya leaf. According to step 7 the quality of a leaf is above 0. Thus, the output result indicates 'it is a defected leaf'.

V. CONCLUSION

This paper analysis the image processing technology for identify a diseased leaf affected by fungal, bacteria, flu etc,. The Indian economy is still growing and depends on agricultural application. Most of the people in our country are living with agriculture. The plant disease is increasing every year. Disease in the plant is very difficult to find manually at a starting stage of the plant. Image processing techniques are much helpful for farmers to save the plant and people life. In many earlier paper have solved those problem in image processing. Used various techniques to identify a diseased leaf and deep learning with various applications. The same proposed system can be developed with vegetables and fruits to classify and identify a defected product.

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