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# Plant Disease Detection Techniques Using Canny Edge Detection & Color Histogram in Image Processing

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**Abstract:-Images form important data and information in biological sciences. Plant diseases have turned into a dilemma as it can cause significant reduction in both quality and quantity of agricultural products. Automatic detection of plant diseases is an essential research topic as it may prove benefits in monitoring fields of crops, and thus automatically detect the symptoms of diseases. This paper presents a method for identify plant disease based on color, edge detection and histogram matching. Farmers are suffering from the problem rising from various types of plant traits/diseases. Sometimes plant's doctors & Farmers are also unable to recognize the disease that results in lack of identification of right type of disease and this leads to crop spoil if not taken care of at right time. The most significant part of research on plant disease to identify the disease based on CBIR (content based image retrieval) that is mainly concerned with the accurate detection of diseased plant. This research describes effective; sample technique for identify plant disease. The method used in this research is divided into two major phases. 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 and histogram matching.**

**Keywords: Image processing, Dilemma, CBIR, Edge detection, Color histogram.**

## 1. 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. grayscale 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.

### 1.1 Image processing for detecting disease

Image processing is the enhancement of image that is processing an image so that the results are more suitable for a particular application. Processing an image means sharpening or de-blurring an out of focus image, highlighting edges, improving image
contrast, or brightening an image, removing noise. The image processing has some useful applications for detecting the various types of plant diseases such as:

- ✓ To detect edges of diseased leaf and stem
- ✓ To find shape of affected area
- ✓ To determine color of affected area
- ✓ To separate the layers of image
- ✓ For Image segmentation

### 1.2 Overview of Content Based Image retrieval (CBIR)

Content based image retrieval (CBIR) [2,5] offers efficient search and retrieval of images based on their content. The retrieval may involve the relatively simpler problem of finding images with low level characteristics (e.g. finding images of sunset) or high level concepts (e.g. finding pictures containing bicycles).With the development of the Internet, and the availability of image capturing devices such as digital cameras, image scanners, the size of digital image collection is increasing rapidly. Efficient image searching, browsing and retrieval tools are required by users from various domains, including remote sensing, fashion, crime prevention, publishing, medicine, architecture, etc. For this purpose, many general purpose image retrieval systems have been developed.

**PROPOSED SYSTEM :**

**PHASE-I**

**Step1.** In the initial step of phase-I of detection of plant diseases, the RBG images of healthy and infected plants are given. For this purpose, First we give two sample one for the healthy image and second for the diseased image. In the healthy image sample we choose a normal or uninfected image of leaf. And on the other hand, we choose infected images of disease.

**Step2.** The second step of detection of plant diseases start with the training process. In the training process, The edge detection technique can not apply directly on the RGB image. First, we need to convert RGB image into grayscale image then the CANNY's edge detection technique is applied. so, first I separate the layers of RGB image into Red, Green and Blue layers and then apply the CANNY's edge detection technique to detect the edges of layered images. This technique is applied on both the samples such that healthy sample as well as the diseased sample of same plant.

**PHASE-II**

**Step3.** In the second phase, choose the test sample of plant. When the testing sample is selected, the training process is started again on the testing image.

**Step4**: In the training process, first I separate the layers of tested image into Red, Green and Blue layers and again apply CANNY's edge detection technique to detect the edges of layer's images

**Step5:** Once the training process of first phase samples is finished the histogram is generated for both healthy leaf sample and diseased leaf sample and saves in the memory, these histogram are displayed, when we generate the histogram for the testing image. In the second phase, after the training process the histogram for testing sample is created or generated suddenly. Once the histograms are generated for both samples and the testing image, immediately we will applied the comparison technique based on the histogram and edge detection technique. The comparison is firstly with the testing sample and the healthy sample if the testing sample is diseased, it compare testing sample with the diseased sample and these steps take few minute to display the comparison result that is the testing sample is diseased or not.

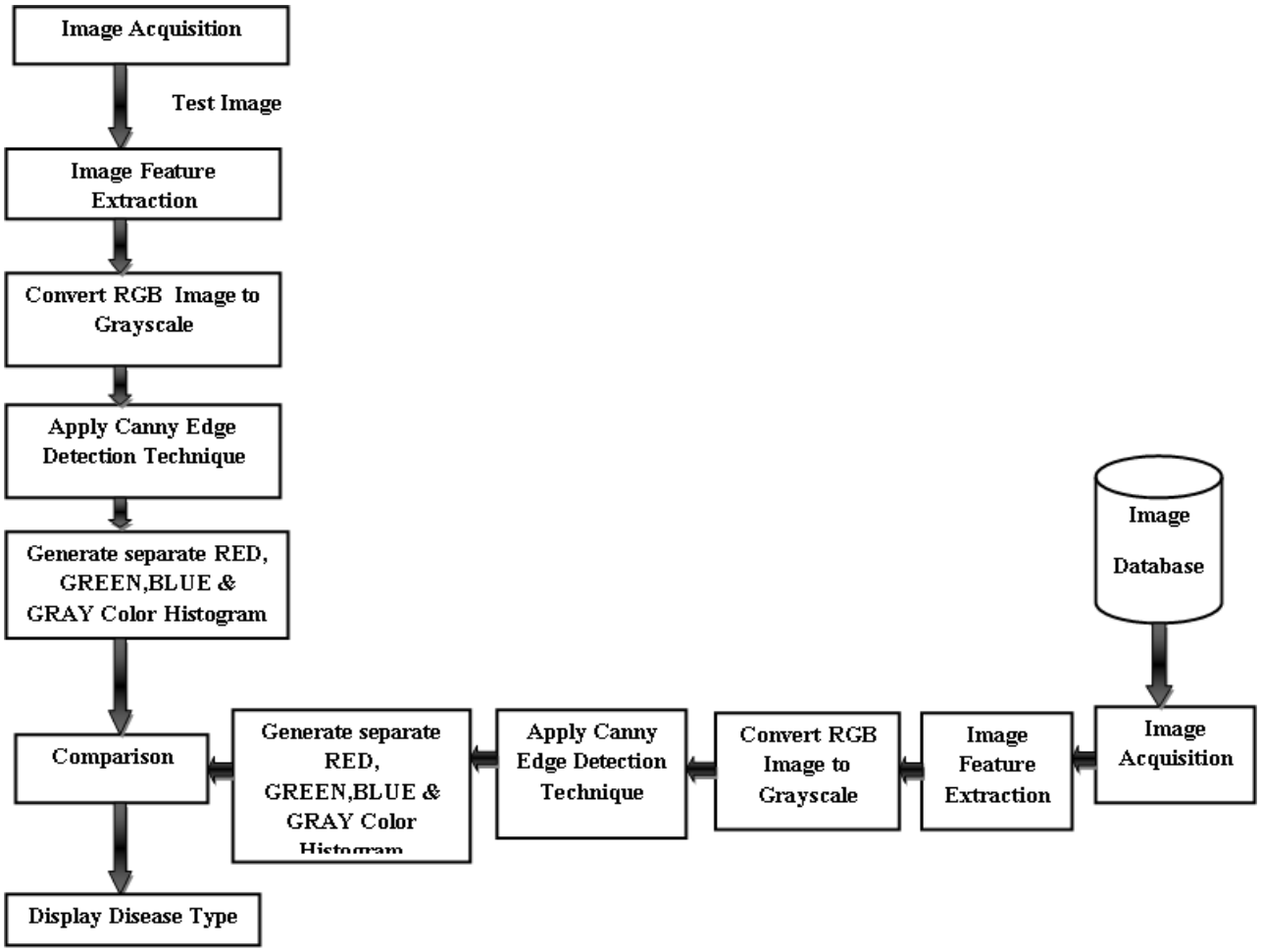


**Figure-1: system block diagram**

**FEATURE EXTRACTION**

➢ ***Area of Leaf***

In this process, the area of coin is taken as the reference. Adjust the distance between the camera and the coin (nominal distance) and capture an image. Specifically one rupee coin is chosen as reference whose area is:

Area of coin= π (d/2) 2; where'd' is diameter of the coin.
= π (2.5 cm/2) 2
= 4.9063 cm2

Convert this color image of coin to its grayscale and hence to its binary equivalent image. Calculate number of pixels occupying the vicinity of the coin. Suppose the pixel count of the coin from the image is 148 then:

1 pixel value= area of coin/pixel count
= 4.9063/148
= 0.03315 cm2

Consider the leaf case. Maintain the same nominal distance as for the case of coin. Convert the color image to its grayscale equivalent. Hence convert to binary and calculate the number of pixels occupying the area of the leaf. Suppose for leaf, the pixel count of the area is 3724 pixels, then:

Area of leaf= pixel count* 1 pixel value
= 3724*0.03315
= 123.4506 cm2

➢ **Grayscale Conversion Algorithm:**

Step 1: start
Step 2: acquire the leaf image
Step 3: convert color image to grayscale
Step 4: convert grayscale to binary
Step 5: count number of pixels in the leaf vicinity
Step 6: multiply pixel count with one pixel value
Step 7: compare with database image
Step 8: stop

➢ **CANNY's edge detection technique**

The following shows the canny edge detection algorithm steps. The algorithm runs in 5 separate steps.

1. **Smoothing**: Blurring of the image to remove noise.
2. **Finding gradients**: The edges should be marked where the gradients of the image have large magnitudes.
3. **Non-maximum suppression**: Only local maxima should be marked as edges.
4. **Double thresholding**: Potential edges are determined by thresholding.
5. **Edge tracking by hysteresis**: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge.

❖ **Canny Detection :**

**1.** The canny operator works in a multi-stage process. Then a simple 2-D first derivative operator is applied to the smoothed image to highlight regions of the image with high first spatial derivatives.

**2.** Gradient is the first – order derivatives of image for each direction. Which is non maximal suppression . the gradient can be computed using central difference .

$\partial X(x,y)=[(x+1,y)-(x-1,y)]/2$
$\partial Y(x,y)=[(x,y+1)-(x,y\_1)]/2$

3. Magnitude of horizontal and vertical gradient is used for non maximal suppression process. The magnitude can be computed by :

$Magnitude=(\partial X(x) * \partial X(y)+ \partial Y(x)* \partial Y(y))$

➢ **Edge histogram**

Every leaf is having its own edge features. Some leaf boundaries are saw tooth, some are smooth and some are wavy so on. Also midrib alignment and vein pattern of leaves are different. Hence this algorithm is used to extract this information. Here Canny edge detection algorithm is used.

***Algorithm:***

***Step 1***: start
***Step 2***: acquire the leaf image
***Step 3***: convert color image to grayscale
***Step 4***: apply Canny edge detection algorithm
***Step 5***: calculate histogram
***Step 6***: compare with edge histogram of the database image
***Step 7***: stop

➢ **Color Histogram**

Every leaf is having its own color with varying intensity. Some are green; some are yellow, red so on. Even though we consider green colored leaf its intensity will be different. Hence this part of algorithm extracts this information from an input leaf as shown in figure 4.

***Algorithm:***

***Step 1:*** start
***Step 2:*** acquire the leaf image
***Step 3:*** calculate the green histogram, blue histogram and red histogram separately of the image.
***Step 4:*** calculate the difference with the database image
***Step 5:*** stop.

➢ **Proposed System Algorithm**

***Step 1***: Read test image and database image.
***Step 2***: Resize the images
***Step 3***: Crop region of interest in both images.
***Step 4***: Convert both images into grayscale.
***Step 5***: Convert image to black and white respectively.
***Step 6***: Count the number of pixels i.e., in the vicinity of the area covered by the leaf respectively.
***Step 7***: Calculate the area of both images and find the difference in area.
***Step 8***: Apply the Canny edge detection method to the leaf grayscale images.
***Step 9***: Remove the background edges keeping only leaf edge details.
***Step 10***: Calculate the edge histogram of both the images.
***Step 11***: Calculate the difference in the edge histograms of both the images.
***Step 12***: Extract the red plane, blue plane and green plane from the un-cropped test image.
***Step 13***: Calculate red histogram, blue histogram and green histogram separately.
***Step 14***: Repeat Step 12 and Step 13 for the image in database.
***Step 15***: Find the difference in color histograms for the test and database image. Let this be value "**OVERALL**".
***Step 16***: Find the average of difference in area, difference in edge histogram and difference in the color histogram values.
***Step 17***: Repeat Step 1 to Step 15 for all the images in the database.
***Step 18***: Least value of "**OVERALL**" between the test and database image is the identified leaf.
***Step 19***: Stop.

## CONCLUSION AND FUTURE WORK

This is a accurate and efficient technique for automatically detection of plant diseased. The color features extraction are applied on samples that are healthy leaf of plant and the diseased leaf of the plant. Plant diseased is detected by using histogram matching. The histogram matching is based on the color feature and the edge detection technique. The training process includes the training of these samples by using layers separation technique which separate the layers of RGB image into red, green, and blue layers and edge detection technique which detecting edges of the layered images.

Once the histograms are generated for both samples and the testing image, immediately we applied the comparison technique based on the histogram. The comparison is firstly with the testing sample and the healthy sample if the testing sample is diseased, it compare testing sample with the diseased sample and these steps take few minute to display the comparison result that is the testing sample is diseased or not. This is beneficial for us because we are easily understood the processing of implementation phase. The future work mainly concerns with the large database. After Detecting disease shows medicine on that disease. Another work is a particular field with advance features and technology.

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