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EARLY DETECTION AND EXTRACTION OF DISEASE INFECTED AREA ON LITCHI FRUIT AND LEAF

Dr. R. Uma Rani* & P. Amsini**

* Associate Professor, Department of Computer Science, Sri Sarada College for Women (Autonomous), Salem, Tamilnadu

** Ph.D Research Scholar, Department of Computer Science, Sri Sarada College for Women (Autonomous), Salem, Tamilnadu

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Abstract:

The Litchi is a sub-tropical evergreen fruit crop which has highly specific climatic requirements. Probably due to this reason, its cultivation is restricted to only few subtropical countries in the world, where it is grown commercially and plays significant role in their economy. India is second largest producer of litchi and its productivity is higher as compared to china. Litchi fruits are used to prevent the cancer. It prevents from colon and liver cancer because the presence of adequate amount of fiber, pectin and water. Litchi contain amount of antioxidants, phyto-nutrients, vitamin C are used to preventing from many human diseases. The greenhouse staffs are manually observed and search the all diseased infested fruit in greenhouse, it is very time consuming. Automatic detection is very helpful to detect the litchi diseased fruit and leaf in early stage through applied the digital image processing techniques and it is used increases the economic level for litchi fruit production in India. To detect the infected area in litchi fruits and leaves using fuzzy set operation for otsu based color image segmentation is used to detect and extract the presence of diseases in litchi fruit and leaf images. This algorithm is developed in matlabR2013a.

Key Words: Segmentation, Fuzzy Set & Color Image Segmentation

1. Introduction:

Litchi is a sub-tropical fruit crop which has highly specific climatic requirements. Probably due to this reason, its cultivation is restricted to only few subtropical countries in the world, where it is grown commercially. World production of litchi is estimated to be around 2.11 million tons, with more than 95% of area and production share of Asia. The top five world litchi producing countries are china, India, Taiwan, Thailand, and Vietnam respectively. India and China account for 91 percent of the world litchi production. Pests cause enormous loss to litchi through direct and indirect invasion on various plant parts. The leaf disease name as Eriophyid Mite (Aceria Litchi), this symptom is undersurfaces of the infested leaves show abnormal growth of epidermal cells in the form of hair lay velvety growth of chocolate brown color. The name of fruit diseases is Anthracnose, caused by B. theobormae, irregular outlined, chocolate colored spots usually start from the tip or the margin of the lamina. Digital Image processing plays an important role in the agriculture field. The image processing techniques are used to detect the pest infected region of both fruits and leaf. Litchi disease infected area is detected and extracted from applied the fuzzy set operations in color based image segmentation technique. This automatic detection method is better than compare to manual method. It is used to easily detect accurately of litchi diseased fruit and leaf infected region. In manual method, the greenhouse staffs monitor the whole diseased fruits and leaf in greenhouse, it is very time consuming and cannot detect accurately on diseased leaf and fruit region.

2. Literature Review:

Digital image processing focuses on two major tasks, those are Improvement of pictorial information for human interpretation and Processing of image data for storage, transmission and representation for autonomous machine perception. During this period, Digital Image Processing plays an important role for an agricultural field. Weed classification, pest automatic count, diseased leaf detection and extraction with great accuracy. [1] Agriculture is useful to people survive and economic development. Avoid excess use of pesticides instead of use nature pesticides. Automatic early detection of the plant disease is also major role of agriculture cultivation. Because of plant and crop diseases are reduced Indian economic level, from this problem prevented by using automatic methods. RGB color image is converting to HSV, it is very good color identify. Then segmentation is applied through texture feature of GLCM matrix. [2] In fuzzy processing is used to extraction of edge from the input image, and proven the robustness of the presented algorithm and it is used to large set of images. Fuzzy membership function and two type of fuzzy set are created. Those are black and white. [3] The image noise is reduced by using fuzzification. This filter is performed better than compare to other filters. It is most useful to agriculture and medical field. To select the membership function correctly, for given fuzzy set as input. The image is smoothed on clearly. [4] The fuzzy crisp logic rules applied to uncertain inputs are equivalent to fuzzy rules applied to crisp inputs. Here, fixed rule based upon threshold or probability interval of the crisp rule. [5].

3. Methodology:

A. Image Acquisition: The diseased litchi fruit and leaf images are taken from the Internet, image is stored in jpeg format. The input images are RGB image, each color appears in its primary spectral components of red, green, and blue. The range of the image [0 255], an image can be defined as a two-dimensional function, f(x,y), where x and y are spatial coordinates, and the amplitude of f at any pair coordinates (x,y) is called intensity of the image at that point.

B. Image Pre-Processing: In the next step, the input image is converting to hsv (hue, saturation, Intensity) color map. The hsv image intensity level is 0-255.

C. Image Segmentation: Image segmentation is a process used to detect the infected area in diseased image. After preprocessing applied the otsu threshold technique. It is used extract the hue component. The segmentation of color means isolating the areas of

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a certain color from the rest of the image. To separated the area of objects colored in red from an image. Almost red is image closed to darker, the shades of grey is closed to white. Now, Depending on the type of membership function, different types of fuzzy sets will be obtained. Here used the Triangular membership function in fuzzy set. The fuzzy set is used to segment the image from foreground and background based upon colors and detects the defect area in the diseased leaf and fruit. Then infected region should be extracted clearly.

- ✓ **Compute a Triangular Membership Function and Fuzzy Set:** The triangular membership function is used as input image. The standard triangular membership function is defined as triangle (x; a, b, c) = $\left(max(min\left(\frac{x-a}{b-a},\frac{c-x}{c-b}\right),0)\right)$
  Here, to define a fuzzy set is based on triangular membership function for each pixel. There are, given below,
  Defected area_read_l=trimf(H, [0 0 21]);
  Defected area _red_r=trimf(H, [234 255 255]);
  Defected area=max (Defected area_read_l, Defected area _red_);
  Defected fruit_ Orange=trimf(H, [0 21 43]);
  Defected leaf_yellow=trimf(H, [0 21 43]);
- ✓ **To Define Fuzzy Set is Closed to Red Color:** Those fuzzy set is closed to Disease infected. The color of black is related to red color and shade of gray is related to white color, so easily separated the background and foreground in color image, and detected the infected area.
  NOT_ Defected leaf_yellow =1- Defected leaf_yellow;
  Non_Defected area=min (Defected fruit_ Orange, NOT_ Defected leaf_yellow);
  Disease infected=max (Defected area, Non_Defected area);
  In matlab, this fuzzy set named as disease infected is applied to detect the infected region clearly. Finally measure values of GLCM (Gray level Co-Occurrence Matrices).

D. Find a GLCM Values for Diseased Litchi Fruit and Leaf: A GLCM is a matrix where the number of rows and columns is equal to the number of distinct gray levels or pixel values in the image of that surface. Given an image, each with an intensity, the GLCM is a tabulation of how often different combinations of gray levels co-occur in an image. The GLCM Consist of Contrast, Energy, homogeneity, and correlation are computed for the Hue content of the image as given in following Equations.

- ✓ **Correlation:** Correlation is a measure of gray level linear dependence between the pixels at the specified positions relative to each other. A measure of how correlated a pixel is to its neighbor over the entire image. Range of value is 1 to -1, corresponding to perfect positive and perfect negative correlations. This measure is not defined if either standard deviation is zero.
  - $\text{correlation} = \sum_{i,j} \frac{(i-\mu i)(j-\mu j)p(i,j)}{\{\sigma_i \sigma_j\}}$ (1)
- ✓ **Contrast:** Contrast returns a measure of the intensity contrast between a pixel and its neighbor over the entire image. This measure of contrast or local intensity variation will favor contributions from p(i, j) away from the diagonal.
  - $\text{Contrast} = \sum_{i,j=0} |i-j|^2\, p(i,j)$ (2)

  Range = [0 (size (SGDM, 1)-1) ^2], Contrast is 0 for a contrast image.
- ✓ **Energy:** Inhomogeneous scenes have low first order entropy, while a homogeneous scene has high entropy. Energy is 1 for a constant image.
  - $\text{Energy} = \sum_{i,j}^{n} p(i,j)^2$ (3)
- ✓ **Homogeneity:** A homogeneous scene will contain only a few gray levels, giving a GLCM with only a few but relatively high values of p (i, j). Thus, the sum of squares will be high. Range = [0 1].
  - $\text{Homogeneity} = \sum_{i,j=0}^{N-1} p(i,j)/(1+(i-j)^2)$ (4)

Table 1 shows the values of correlation, contrast, energy and homogeneity for both on diseased leaf and fruit image values.

Table 1: GLCM Values for Both on Litchi Diseased Leaf and Fruit

S.No	Parameters	Litchi Fruit Image	Litchi Leaf Image
1	Correlation	0.9324	0.91266
2	Contrast	0.5948	0.71552
3	Energy	0.5635	0.55133
4	Homogeneity	0.9268	0.90997

4. Results and Discussion:

From this automatic system is used to detect the diseased leaf and fruit region accurately. Automatic method is better than compare to manual method. In manual method the greenhouse staff not possible to monitor the large field. It is very time consuming. The diseased litchi leaf and fruit is taken as input image is shown in Figure1 and 2. Then, input image is converting to hsv image. After that, applied otsu threshold and fuzzy set. Triangular membership function is used to generate the fuzzy set. This algorithm is used to segment and extract the region is shows in figure2 and figure3, finally extract the infected region shows in figure4 and figure5. Those sample images are collected from the internet and the algorithm is implemented in MATLAB.

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Figure 1: Anthracnose diseased infected on Litchi fruit Image

Figure 2: Diseased litchi leaf image

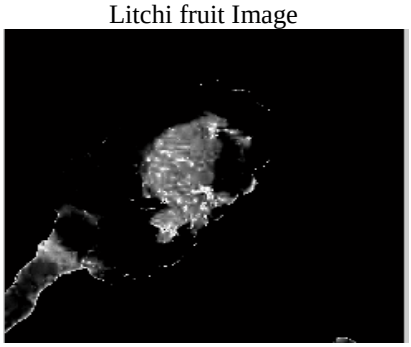

Figure 3: After segmentation detect chocolate colored spots

Figure 4:Detected the infected region after segmenation

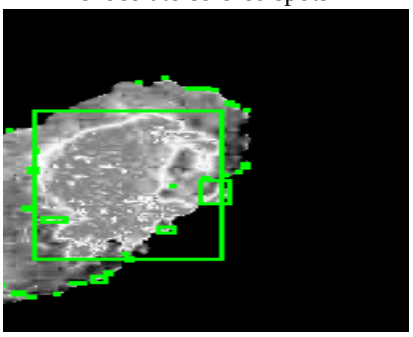

Figure 5: Extract the infection area

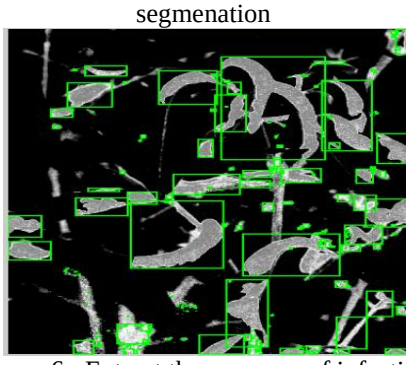

Figure 6 : Extract the presence of infection

5. Conclusion:

In this paper, addressed how the disease analysis is possible for the litchi leaf and fruit diseases detection, the analysis of the diseases present on the litchi fruit and leaves can be effectively detected in the early stage before it will damage the whole plant. Here the technique presented can able to detect the disease more accurate, In Bihar state produces 71% of annual production in India. This automatic detection is better than compare to manual method. If this model is applied, to prevent the plant diseases from various diseases.

6. Future Work:

In future, the proposed algorithm can be applied on video images of litchi greenhouse and the diseased leaf, fruit and root disease may be identified earlier.

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