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RESEARCH ARTICLE

IMAGE PROCESSING METHOD TO MEASURE THE SEVERITY OF FUNGI CAUSED DISEASE IN LEAF

***P.SARANYA[1], S.KARTHICK[2], C.THULASIYAMMAL[2]**

1. Doing II year ME(Embedded system) in The Kavery Engineering College, Mecheri

2. Assistant Professor of Electrical and Electronic Engineering,The Kavery Engineering College, Mecheri.

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Corresponding Author

P.SARANYA

Abstract

Fungi-caused diseases in leaves are the most predominant diseases which appear as spots on the leaves. If not treated on instance, causes the severe loss. Extreme use of pesticide for plant diseases treatment increases the cost and environmental pollution so their use must be minimized. This can be achieved by target the diseases places, with the correct quantity and concentration of pesticide by estimating disease severity using image processing method. Triangle thresholding and Simple threshold methods are used to segment the leaf area and disease region area correspondingly. Finally diseases are categorising by calculating the quotient of disease area and leaf area. The exactness of the experimentation is found to be 98.60 %. Research indicates that this method to estimate leaf disease severity is fast and perfect.

1. Introduction

The fungi caused diseases are the most predominant which appear as spots on the leaves. These spots stop the vital process of photosynthesis to take place, hence to a great extent affects the growth and thus the yield. In case of severe disease, the leaf becomes totally cover with spots. The various types of diseases on leaf determine the quality, amount, and constancy of yield. The diseases in leaves not only decrease the yield but also get worse of the variety and its withdrawal from cultivation. Extreme uses of pesticide for plant diseases dealing increases the danger of poisonous residue level on farming products and has been acknowledged as a major contributor to ground water corruption also pesticides are among the highest components in the production cost their use must be minimized. This can be controlled by estimating severity of disease and target the diseases places, with the appropriate amount and concentration of pesticide. Disease symptoms of the plant vary extensively under the different stages of the disease so to the exactness with which the severity of the disease measured is depends upon segmentation of the image .Simple threshold segmentation is used to estimate the leaf area but this method is not suitable to calculate the area of the disease region because of varying characteristics of the disease region.

2. IMAGE PROCESSING

Image processing is a method to transfer an image into digital form and do some operations on it, in order to get an enhanced image otherwise to extract some positive information from it. It is a type of signal allowance in which input is image, like video frame or photograph and amount produced may be image or characteristics connected with that image. Usually Image Processing method includes treating images as two dimensional signals as applying previously set signal processing methods to them.

It is along with fast growing technologies nowadays, with its applications in various aspects of a production. Image Processing forms center investigate area surrounded by engineering and computer science disciplines also.

Image Processing is nondestructive process that can capture, method and examine information from images. Using at present available image collection equipments like cameras, computers, scanners and image study programs. It is possible to obtain hundreds of quality images per hour, which can be analyzed shortly with a great degree of automation at the observer‘s ease. Other than these, images can be stored and used as and when required for a possible upcoming application [2, 3].

Farmers usually are alert that their fields have uneven yield across the land space. These variations can be traced by managing practices, soil property and environment character. The factors that affect the yield are input parameters like seed worth, irrigation water, manure and ecological parameters includes weeds, insects and diseases. Lastly by testing the maturity of crop it sends to marketplace. In marketplace there is great variation in rate, depends on the quality and amount of crops on hand [4].

To offer the better accepting of application of image processing method in agricultural, the article presents the current development of agricultural, particularly; the argument is focused on wide literature review of importance of leaf area, leaf disease severity measurement of the plant.

The naked eye examination method is usually used to decide diseases severity in the production put into practice but results are subjective and it is not likely to measure the disease extent accurately. Grid counting process can be used to pick up the accuracy but this method has unwieldy operation method and point in time consuming. Image processing tools in the agricultural study has made major growth.

3. PRINCIPLE AND MODULES

3.1 Principle

Disease severity is the part of the sampling unit of leaf showing symptoms of lesion. It is most often expressed as a percentage [7]. The disease severity of the leaves is calculated by the lesion area and leaf area part. Using image processing technique it can be expressed as below

$$DSE = LA / AL \quad (1)$$

$$= PV \Sigma 1 / PV \Sigma 1$$

$$(x, y) \in LR (x, y) \in RL$$

$$= PL / PA \quad (2)$$

Where,

DSE-disease Severity extent	PV- pixel value
LA-lesion area	AL- Total leaf area
LR- lesion region	Rl- Leaf region
PL-Total pixels in lesion area	PA-Total pixels of leaf area

In the image every pixel correspond to the same size so ratio ‘S’ can be obtained by counting pixels of total leaf area and lesion area in the binary image. Then according to disease type standard check with table the final severity level can be approximation.

3.2 Image Acquisition*:*

Images are taken in controlled background and are stored in the JPEG format. Infected leaf is located horizontal on a white background; Light sources are placed at 45 grades on each side of the leaf so as to reduce any reflection and to get even light all over the place, thus a better sight and intensity. The leaf is zoomed on so as to make sure that the picture taken contains only the leaf and white background.

3.3 Image Segmentation

Image segmentation is the important step to split the different regions with special significance in the image, these regions do not meet each other and each region should meet consistency conditions in specific regions [14, 15]. In this learn two different segmentation methods are implemented to acquire total leaf pixels and lesion (disease) area leaf pixels.

3.4 Leaf region Segmentation

Input image is first changed into grayscale image. Since image is taken in controlled background placing diseased leaf on the white backdrop, it makes large difference in gray values of object and background. Later than image segmentation, the binary image contain leaf region is obtained by region filling and eliminating holes in the

white region. To count the pixels in total leaf, examine the image from top to bottom and left to right, to calculate the number of pixels in the region.

3.5 Disease region segmentation

Leaf disease symptoms can be predictable or calculated in different ways that measure the intensity, prevalence, incidence and severity of disease.

- Leaf Disease intensity is a general term used to illustrate the quantity of infection present in population.
- Leaf Disease prevalence is the amount of fields, countries, states etc. where the disease is detected and reveals disease at grander level than incidence.
- Leaf Disease incidence is the quantity or percent of plants diseased out of a whole amount assessed.
- Leaf Disease severity is the area (relative or absolute) of the sampling unit (leaf or fruit) screening symptoms of disease. It is mainly often spoken as a percentage or quantity [12].

Disease severity can be calculated in three different way that are Visual ranking, Image Analysis and Hyper spectral Imaging [16].Using multispectral images thresholding process Ratio of Infected Area (RIA), Lesion Color Index (LCI) and Severity Index of Soybean rust have been calculated [17].Likewise by reflectance value in the green and NIR regions, same time the SWIR domains, orange rust of sugarcane has detected [18]. Leaf, B-F: different image processing process as specify in the heading made before obtaining the last count up. This spectral reflectance rate is also helpful to decide chlorophyll index which is useful for sugarcane infected plots finding monitoring from Satellite descriptions [19].Generally experimental infection in wheat plant has detected in near the beginning stage using spectral reflectance of plant and neural network [20].

In leaf disease severity measurement two algorithms are used to calculate the lesion area. They were

- Thresholding method
- Triangle thresholding method

- **Thresholding method**

The simplest approaches of segmentation are based on the pixel values. The method is to make use of the thresholding based segmentation which can help to simple region growing steps. Thresholding algorithms can be selected physically as per a priori data or automatically by image information. Thresholding algorithms further separated as edge-based, hybrid and region-based. Edge-based are related with the edging information. The Structures of a thing can be depicted by edging points. General edge detection algorithms such as canny edge detector and Laplacian edge detector can be classified to this kind of regions. These algorithms are used to get the edge pixels while eliminating the noise control. Thresholding is an older, easy and popular method for image segmentation. Image segmentation by thresholding is a simple but powerful approach for segmenting images having illumination objects on dark background. Thresholding technique is based on image space region i.e. on individuality of image. Thresholding process convert a multilevel image into a binary image i.e., it choose a suitable threshold T, to divide image pixels into several regions and divide objects from background. Thresholding process used to decide as intensity value called as threshold, and threshold separates the desires module. The segmentation is gained by grouping all pixels with intensity better than the threshold into one class, and all other pixels into a different class. As per the collection of thresholding assessment, two types of thresholding methods are in subsistence worldwide and local thresholding.

- **Triangle thresholding method**

Triangle way of the thresholding used here to segment the disease region. Because of unstable characteristics of the leaf region like water and reflection of light it is difficult to calculate the disease severity by using thresholding method to replace this we use triangle method of thresholding. The average accurateness of the experiment is 98.67 %.Thus image processing tools to measure plant disease severity is suitable and perfect. This eliminates subjectivity of usual methods and human induced errors. It will helps to farmers to choose the exact amount for pesticide use which reduces the price and ecological contamination.

3.5.1 Lesion region segmentation

For success of research it is essential to segment the lesion region exactly. Segmentation may be incorrect because of shallower midrib color than leaf color and fading of leaf color at near the beginning stages of infection. Also in different stages of the disease under the control of light, water, neutrino the lesion manifest different symptoms, which carry difficulties to the segmentation. Based on the above factor, the, image changed from RGB color space to HSI color space, which is more suitable for visual character of human beings. Since the clarity

component is free of the color component and the vision of the human being is more receptive to Hue compared to Saturation, the color element can be good to reduce glare, shadow and other light factors during color image segmentation. The like gray value of the shallow color of the midrib and the leaf in color component can reduce the intrusion of the midrib in the follow up lesion image segmentation to a great extent. If the lesion characteristics are varied the margins between the lesion and the healthy part are also vary so there is weak border. Hence triangle thresholding method is used here for selection of thresholding value of gray image. Fig.3.5.1 (a) shows input original image of leaf. Fig.3.5.1 (b) shows gray image of leaf. Fig3.5.1 (c) shows the thresholded image. In lesion region segmentation image transformation and extraction takes place.

3.6 Simulation and discussions

The exactness of the algorithm is experienced by estimate the fraction average known area covered by average known area. Expected values are compared with real area covered to calculate Percentage Deviation (PD) and Percentage Accuracy (PA).

Where,

$$PD = (AM - EM) \times 100 / AM \quad (3)$$

$$PA = 100 - D \quad (4)$$

$$PD = (6.81-6.60)x100/6.81$$

$$PD = 3.0837$$

$$PA = 100-3.0837$$

$$PA = 96.91\%$$

AM- Average Measurement,

TM- Test Measurement.

The testing proved that the algorithm developed has average accuracy is 96.91 %. The above data confirms the Percentage accuracy (validity) of the system for measurement of the infection severity.

4. CONCLUSION

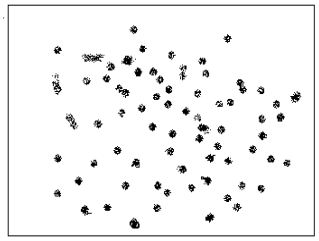
Disease symptoms of the plant differ considerably in the different stages of the infection so to the accurateness among which the severity of the disease calculated is depends upon segmentation of the picture. Threshold segmentation is used to compute the leaf region other than this process is not proper to calculate the area of the lesion region because of unstable characteristics of the lesion region. The average accuracy of the experiment is 96.91 %.

Thus image processing tools to measure plant disease severity is suitable and correct. This eliminates subjectivity of usual methods and person induced errors. It will helps to farmers to make a decision the specific amount for pesticide use which reduces the price and ecological pollution

Fig 3.5.1 (a) Diseased mulberry leaves

Fig3.5.1 (b) Gray scale image of mulberry leaves

Fig3.5.1 (c) Thresholded image



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