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APPLICATION OF IMAGE PROCESSING IN THE FIELD OF PRECISION FARMING FOR CLASSIFICATION OF CITRUS PLANT LEAF DISEASES

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ABSTRACT

The main work carried out in this paper is to exercise current automatic methods for detecting and identifying disease in digital images of citrus, where the presented solution involves analyzing individual pixels. The procedure consists of several stages namely, image acquisition, image segmentation, feature selection/extraction and classification. The image data of the leaves selected for this study were collected from field and some images taken from readily available datasets. Three different classes of citrus diseased leaves first Anthracnose, second Blight and third Canker were used for this study. This report incorporates the technique for image segmentation viz. Segmentation by RGB, HSV and Contrast. The disease segmentation has several key issues including, the diseases portion localization, separate diseased portion from leaf, background subtraction, imposing of diseased area on real leaf, color variation and segregation of touching diseased areas. In total, 21 features were extracted from each diseased portion, and it nucleus: Nine of these were shape-based features, while Thirteen were texture based features. Moreover, a conjugate gradient back-propagation type neural network with three different training functions used for classification stage to accurately categorize leaf diseases. The developed system proved effective in accurately classifying three plant diseases with accuracy starting from 46% to 94%.

Keywords : *pixel identification, processing of image, HSI, RGB, image threshold, image contrast*

INTRODUCTION

The system will be designed to process am image based on HSV color work. The program was programmed to read the images mechanically which allowed the examination of all image in one time. Firstly, each image was indistinct by Gaussian smoothed filter with an estimated discrete value. The image was then slanted from RGB color space to HSV. The *H* image of HSV color work was used in separation. After segmentation, the chocolate colored dots and spots on an image would standout obviously, though, there might exist some holes on each spot if the impairment is Spartan. The effect of these dumps was rejected by filling the void area of the holes using imfill function of the Image Processing Toolbox of MATLAB. In totaling, the separated image repeatedly contain noise, the noise reduction process was consequently accomplished. This was done by primary operation using round dish shaped structuring element with a radius of some pixels. Additional, the size of a spot was quantified ranging from some number of pixels of our interested area. Consequently, an object of size slighter or greater than the range would be renowned as non-diseased item. Further, in order to eradicate non-spot objects such as stem, the shape factor defined by aspect ratio between major and minor axis of every spot was observed. The ratio of greater will decide to keep or remove the part. After noise drop, each spot was collective by pixel connectivity in 2-D binary image which is an eight-connected object procedure. The edge detection was performed on every diseased spot and drawn on original image with the green line. The number of spot perceived and the number of authentic spots were calculated and equated.

OBJECTIVE

To study the application of image processing in the field of precision farming for classification of citrus plant leaf diseases

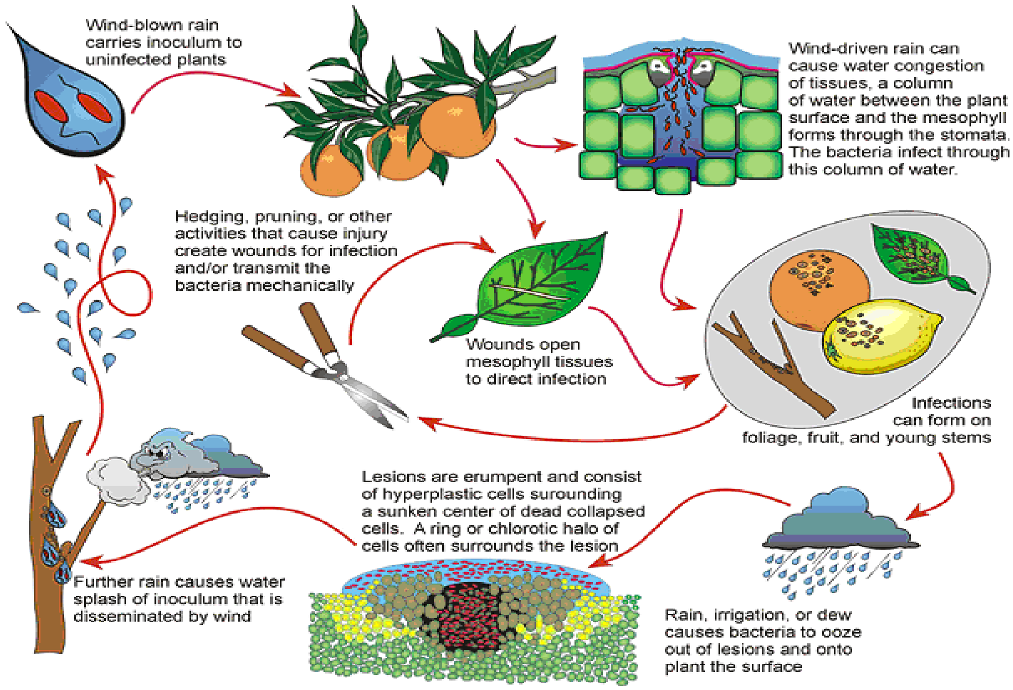


Fig. 1 : Disease cycle of citrus

METHODOLOGY

Here the experimentation aimed at emerging an image processing procedure which is capable of recognizing the exact positions of infected areas, i.e. spots, diseases on leaves. The algorithm must consequently be able to distinguish the lesion regions from healthy part of a leaf and other plant parts such as stems, residues, as well as background (e.g. soil etc.). For performing the practical the same images used as they were used for earlier experimentation so steady and uniform comparison can takes place. Here the procedure is talking about to process am image based on HSV/HSI colour model. In beginning every single image was distorted by gaussian smoothing filter at 5X5 with an approximation of discrete value of sigma = 10. The image was then transformed from RGB colour space to HSI as described earlier by Eq. 10 13. The H image of HSI colour space was used in segmentation. After the Gaussian filter to trace out and smoothing boundary the replicate filter got applied to all the images so boundary smoothed and very useful for the segmentation purpose. The following figure 2 presents the original image and filtered image after applying the Gaussian and replicate filters.

Here median and Gaussian filters are used in image enhancement to eliminate noise and unwanted details. The essence of the Median filter is to execute through the image pixel by pixel. The output image is then manufactured by substituting the median value for each pixel. Thus, Median filtering requires an arrangement of pixel connectively. But for the gaussian filtering, the algorithm can be designated by the following equations:

Here Guss(x, y) is a gaussian function, x and y are the distance from the origin in the horizontal and vertical axis respectively, is the standard deviation of the Gaussian distribution. A gaussian function with a higher value of is called low pass filter and it is usually forms the first stage of an edge detection algorithm. The algorithm assumes that the image to be thresholded comprises two classes of pixels called bimodal histogram (like background and foreground then computes the optimum threshold separating these two classes.

Fig. 2.(a) Original Image

Fig. 2.(b) Filtered Image

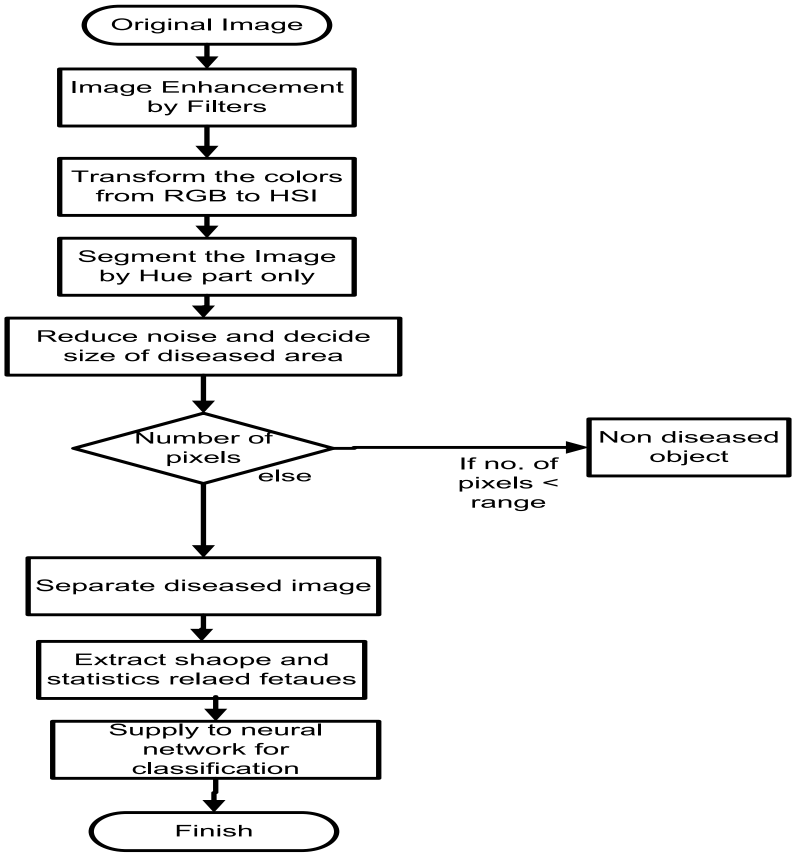


Fig. 3 : Flowchart for segmentation with RGB and HSI channel separation

Now in MATLAB the result of these holes were eliminated by filling that area of the holes with imfill command of the Image Processing Toolbox for MATLAB. In addition to that, the image got segmented often has noise, so the noise reduction process was performed. So for that in MATLAB the opening morphological operation by using disk-shaped structuring element with a radius of some pixels got used and the possible noise removed. The answer is in order to remove non-spot objects such as petiole or stem, the shape factor defined by aspect ratio among major and minor axis of each spot was evaluated. The ratio of greater than three was measured a non-spot and hence eliminated. Once noise is removed each spot was joined by pixel connectivity in 2-D binary image which is an 8 connected object technique. The edge detection was performed on each disease spot and drawn on original image. The number of spots perceived and the number of actual spots were calculated and equated.

Fig. 4.(a) Original Image

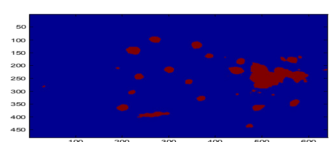


Fig. 4.(b) Diseased Image

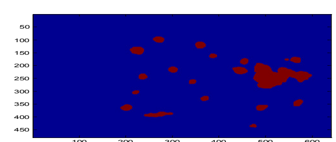
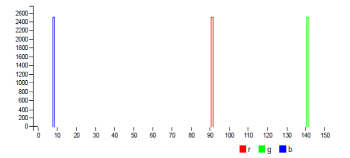
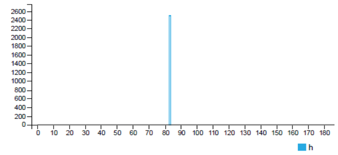
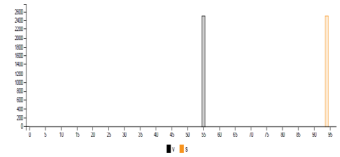
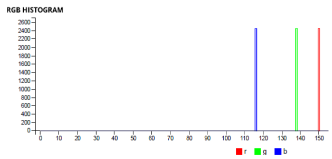
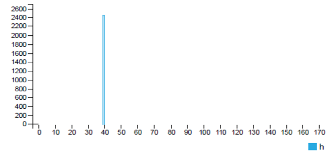
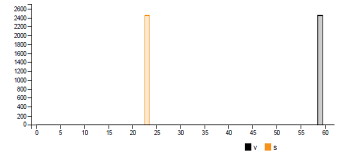
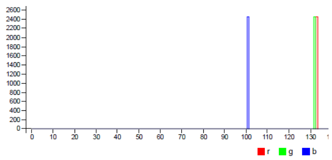
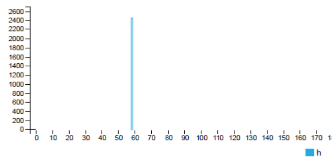
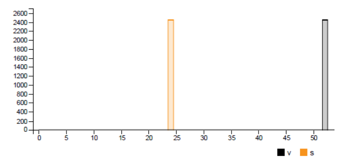


Fig. 4.(c) Small pixels Removal

RESULTS AND DISCUSSION

At the time of result analysis, in case of healthy green leaf, RGB results shows the more value for G channel that says that this image contains more green pixels, so to segment green leaf this range of pixels were to be considered. In case of HSV the saturation channel presents more values so green channel in RGB and saturation channel in HSV are correlated and are directly proportional to each other. Now at last for background or occluded part, both red and green channels shown almost nearest values for RGB image so set red and green values in such a way that they can be easily segment the background part from the leaf part. At the time of HSV image the hue and value channels are given very nearer results and at the time of segmentation for HSV image the hue and value channels are to be considered. And the below figure shows the histogram of RGB and HSV images for easy understanding of the values shown in the table 1.

Table 1 Histogram for RGB and HSV channels

	RGB Histogram	Hue Channel	S, V Channel
			
			
			

The same procedure was applied for the healthy leaves, diseased leaves and for background or occluded leaves, and that comparison shown in the table 1 along with their histogram.

Segment of image	No. of Pixels	Percentage		Diseased Image	Disease Segmented
	9213921	36.71%			
	12415947	28.53%			
	6710613	17.76%			
	13616991	10.30%			
	136141101	4.45%			
	776415	2.25%			

Here in the above table the last rows presents the separate segments according to colours along with their percentage values, so as to calculate the diseased portion area.

CONCLUSION

This data obtainable an approach to mechanically detecting citrus canker from citrus leaf images collected. A stepwise detection strategy was generated to segment scratch leaf images collected with background. Then a citrus canker attribute descriptor was planned by mixing leaf image colour and consistency information to model citrus canker scratches. Local descriptors were used to expose the spatial characteristics of citrus canker in each scratch zone. Different attribute operators and categorization techniques were evaluated and compared based on citrus leaf samples in this research counting some kinds of citrus diseases and usual citrus leaves in dissimilar conditions. Leaf disease severity classification using neural network (specially multilayer perceptron back propagation) was very promising with a disease grade classification accuracy of almost 93.7%. for the diseases Blight and Canker with 10 neurons and at a single run. In the meantime the practical will be analyzed the proposed approach with human rater classification, and the outcome showed that the categorization accuracy of the planned approach is similar to citrus plant's raters who checked the image of each citrus leaf on computer screen. Disease can be categorized by calculating sizes of disease spot. In this research work, veins consuming color alike the spot is not measured. The results are very promising, and should open new paths for plant disease detection. To avoid the spread of disease by identifying the intensity of leaf disease, farmers can take quick decision and urgent action for variable rate fertilizer application also. To ensure healthy growth, the system can be used to monitor changes in the intensity of the leaf diseases over time.

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