

## Pest Detection on Leaves Using Poission's Thresholding Techniques

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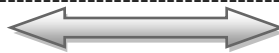
### -----ABSTRACT-----

*Different diseases and bioagressor are affecting the crops, due to which the plants cannot survive for a long duration. Mainly the bioagressor which is been frequently seen on the leaves of the plant is the whitefly. Our main aim is to count the number of whitefly on the leaves. Different techniques are used such as poission's minimum error thresholding, learning, layer labelling, to count the number of pest on the leaves. The automatic counting of pests on the leaf helps in deciding the amount of pesticides to be sprayed on the leaf. This system is useful not only to count the number of pest on its mature stage but also it can count the number of stages at its middle stage and starting stage. We have compared our result with the manual method and its has been seen that automatic counting gives the greater accuracy.*

**Keywords** - whitefly, Digital image, Image segmentation, leaf, Thresholding technique

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### I. INTRODUCTION

Our India is an agriculture country, most of the people in india are farmer and the other depends on the agriculture. Most of the scientists are doing research to increase the cultivity of crops. But one problem still exist which is a major concern of the cultivation of crop and that is crop diseases. Due to these problems, the cultivation decreases and hence all the farmers and in turn the country suffers the lack of cultivation of crop. Different types of pesticides are there in market which are used to avoid the damage to fruit and vegetable, but the amount of pesticides to be used is not known due to which the cost as well as the environmental pollution gets affected. Different methods are used to find the disease on the leaves; Cerco Spora-leaf Spot is again one type of disease in which it affects older leaves of mature plants. The spots are round or irregular in shape yellowish brown, with purple, dark brown or blackish borders and white centers affected leaves become pale in colour and finally fall off [1]. Uptill now the naked eye observation was used to calculate the number of pest on the leaves but the results were subjective and it was not possible to get the accurate results. Grid counting method was used to calculate the severity of the disease leaf, which improved the accuracy but this method has cumbersome operation process and time consuming [2]. To measure severity of Rust disease on Soybean, disease spot have segmented by Sobel operator to find out spot edge and plant disease severity has measured by calculating the quotient of disease spot area and leaf area [3]. To identify on line of pest damage in pip fruit in orchards they used a wavelet based image processing technique and neural network [4]. Different number of disease are affecting the cotton leaves and the color of the leaves are also changed, also there are different shapes of the holes on the leaves. So calculating the major and minor axis of the holes is the major task. They extracted the feature using the self organizing feature map together with a back-propagation neural network to recognize the color of image and by using these techniques they used to analyzed the image [1]. To detect and calculate automatically the number of pest they propose cognitive vision system that combines image processing, learning and knowledge based techniques. For automatic detection they used the digital remote sensor, then the object was identified. The main challenge was to identify the object for which the different techniques were used [5]. To calculate the severity of attack of herbivorous on the leaves the video digitizer is used. A Tekmatic system Video Van Gogh digitizer card was equipped with an IBM PC or compatible microcomputer and the card can the card can be interfaced with standard video camera for rapidly measuring the percentage of leaf area lost (LAL) to herbivorous insects [10]. Disease infection on fruits is also important to maintain the quality of the fruit, to increase the final yield. Many researches have been conducted for the same as - classification of grape fruit peel disease have been done using color texture feature sets through a discriminate function with 2.3 % standard deviation [7]. A strong demand now exists in many countries for non-chemical control methods for pests or diseases, and this issue have not been studied enough [9].

**II. Methodology**

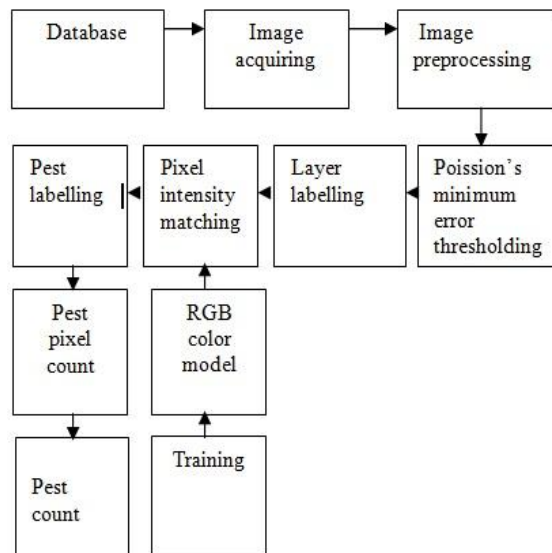


Fig. 1: block diagram

• **Image Acquisition:-**

A leaf containing the bioagressor i.e the pests is taken from the environment and its image is stored in computer in JPEG format. The pest leaf is kept on the white background and is zoomed so that the picture taken contains the leaf part and the white background.



Fig. 2: Image captured



Fig. 3: Gray image

• **Poisson's Minimum Error Thresholding:-**

For the initial binarization, we first compute the image into gray and then normalized image histogram, denoted  $h(i)$ , where  $i$  denotes the intensity of a pixel in the range  $\{0, I_{max}\}$ [8]. Here we use Poisson-distribution based on minimum error thresholding algorithm. The normalized image histogram for the mixture of Poisson distributions is written as[8] \_

$$h(i) = P_0 \times p(i | 0) + P_1 \times p(i | 1) \dots(1)$$

where  $P_0$  and  $P_1$  are the a priori probabilities of the background and foreground regions[8].  $p(i|j)$ ,  $j = 0, 1$  are Poisson distributions with means  $\mu_j$  [8].

For a threshold  $t$ , the Poission mixture parameters are given by[8]

$$P_0(t) = \sum_{i=0}^t h(i) \quad \mu_0(t) = 1/P_0(t) \sum_{i=0}^t i \times h(i)$$

$$P_1(t) = \sum_{i=t+1}^{I_{MAX}} h(i) \quad \mu_1(t) = 1/P_1(t) \sum_{i=t+1}^{I_{MAX}} i \times h(i) \quad \dots(2)$$

The optimal threshold  $t^*$  is chosen to minimize an error criterion, as follows:[8]

$$t^* = \arg \min \{ \mu - p_0(t) (\ln p_0(t) + \mu_0(t) \ln \mu_0(t)) - p_1(t) (\ln p_1(t) + \mu_1(t) \ln \mu_1(t)) \}$$

where  $\mu$  is the mean intensity of the complete image. The result of thresholding  $IN(x, y)$  using  $t^*$  is refined by incorporating spatial continuity constraints.[8]



Fig. 4: poission's threshold image

- **Layer Labelling:-**

Layer labelling is used to label the connected components, the MATLAB has the direct instruction for labelling the object.  $L = \text{bwlabeln}(BW)$  is the instruction which returns a label matrix,  $L$ , containing labels for the connected components in  $BW$ . The input image  $BW$  can have any dimension;  $L$  is the same size as  $BW$ . The elements of  $L$  are integer values greater than or equal to 0. The pixels labeled 0 are the background. The pixels labeled 1 make up one object; the pixels labeled 2 make up a second object; and so on. Here the layer labelling is used to first label the background and the leaf part then labeled the pest on the leaves.

- **Training:-**

Training sets are created and they can be evaluated, deleted, renamed and merged with signature from other files training sets evaluation and editing permit complex classification with training that are derived from more than one training method (supervised and/or unsupervised ). The training set parameters includes following attributes in additional to standard attribute training sets.

- The number of bands in input image (as processed in program).
- The minimum and maximum data file value in each band for each sample or cluster.
- The mean data file value for each band for each sample or cluster.
- The number of pixel in the sample or cluster [11].

The training is done to get the RGB component of the input image. The number of select point is set to acquire the data set so that it can be used to match the data set acquired from processing the image.

- **Pixel intensity matching:-**

The pixel intensity used at the training data set is matched with the data set of the image which is processed. The Euclidean distance is used to match the image with the query image. The Euclidean is the ordinary distance between two points that one would measure with a ruler and is given by Pythagorean formula. Suppose there are two points  $p$  and  $q$  of the line segment then the Euclidean distance between two point is ( ) in Cartesian coordinates if  $p = (p_1, p_2, \dots, p_n)$  and  $q = (q_1, q_2, \dots, q_n)$  are two points in Euclidean  $n$ -space, then the distance from  $p$  to  $q$ , or from  $q$  to  $p$  is given by:

$$d(p,q) = d(q,p) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \dots + (q_n - p_n)^2}$$

hence the equation used to calculate the Euclidean distance between the training image and the image used for processing, the minimum distance achieved between the set of training image and processed image gives the disease part on the leaf.

### III. RESULTS

We have tested our system over the database which consist of 148 samples of images in which some of the images were infected with the disease and other images were having the pest on it. The images were captured when the leaves were infested with the whiteflies, which was found manily on the bottom of leaves. the main aim is to count the number of pest on the leaves. On training the numerical values of the pest were learned on the subset of 30 images for pests and 79 images for disease leaves. The image contain the pest on the leaf in which atleast one pest is been detected on the leaf.

Table I: Result table for detecting atleast one pest.

Types of leaves	FNR%	FPR%
1(79)	0.0	2.53
2(67)	7.46	1.49
Whole set(148)	3.42	2.09

Table II: Result table for detecting number of correct pest.

Types of leaves	FNR%	FPR%
1(79)	0.0	2.53
2(67)	25.3	1.49
Whole set(148)	11.8	2.09

To make use of our result table, we have separated it into two classes c1 and c2 , where the first class c1 has the 79 images which does not has a whitefly on the leaves but there are some disease on the leaves and the second class c2 consist of whitefly on its leaves. The FPR i.e., false positive rate means the images for which the number of detected whiteflies is greater than the actual whiteflies on the leaf (rate of over detection) and the FNR i.e., false negative rate means the images for which the number of detected whiteflies is less than the actual whiteflies on the leaf (rate of under detection) [5] Table 1 and Table 2 summarizes the detection results. The figures represent the mean values of FNR and FPR for class C1, C2, and for the whole image test set. Table 1 shows the result of detecting atleast one pest on the leaves i.e. the FNR and FPR calculated was to detect atleast one pest from the number of pest on the leaves. Table 2 shows the result of detecting the number of correct pest i.e. to detect the actual number of pest available on the leaves. The FNR are roughly similar for the two configurations. The two overlapping whitefly have been segmented into one region though there were two whitefly on the leaf, hence the system count one whitefly instead of two whitefly.

### IV. CONCLUSION

Hence using different techniques such as poission's minimum error thresholding which was used for segmentation, pixel labelling, the third mode rejection and extraction of ROI and so on. Certain training for the color model is performed which is used in the final part in classification, which uses linear Euclidean classifier for the purpose. There are some disadvantage i.e., different other bioaggressor are not extracted from the leaves and secondly if the pests are overlapped it is difficult to count automatically. This system will be helpful to get the accurate result and the time requirement for counting the pest will also get reduced.

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