Mango Leaf Disease Severity Measurement Using Image Processing Techniques

Amruta.D.Vangujare[#1], Sujata.G.Tuppad[*2]

[#]*CSE Department, BAMU University*

[1]amrutakanade44@gmail.com

[2]sujatat.20@gmail.com

ABSTRACT:

Different diseases are affecting the Mango plants, due to which the plants cannot survive for a long duration. To overcome the problem different pesticides are used, but the quantity of pesticides to be used is not known because the disease on the crop are seen by the naked eye and the results are subjective. If more number of pesticide sprayed on the Mango plants, then the Mango plants may get damage and it will affect the cost as well as the environment. In this paper we demonstrate an efficient and effective way of severity measurement of mango leaf disease in which Laplacian filter methods are used to segment the leaf area and disease region area respectively. Finally diseases are categorized by calculating the quotient of disease area and leaf area. and also In a research of identify and diagnosing mango disease, various features of the images are extracted using self organizing feature map together with is used to recognize colour of image.

KEYWORDS - ***white spot, Digital image, leaf severity, Image segmentation, leaf, Thresholding technique***

I. INTRODUCTION

In today's world, scientists are continuously trying to increase the cultivility of Mango plants. They have achieved this by developing the higher breed seeds and plants. But one problem still exist which is a major concern of the cultivation of crop and that is crop diseases and the pests problem. Due to these problems, the cultivation decreases and hence all the farmers and in turn the country suffers the lack of cultivation of crop. Mango is a long duration crop and it is attacked by a number of diseases. A fungi disease is a predominant disease which appears as spot on the leaves and it is mostly found on the mango leaves. . Naked eye observation technique is employed to make a decision sickness severity however result are subjective and it's out of the question to live the sickness extent exactly to acknowledge and classify mango fungi disease. In specific disease color shape and size of leaves also changes that have measured by Speeded Up Robust Features (SUFR), Scale Invariant and Feature Transformation (SIFT)[7]. In our paper we are developing the system which will measure severity the diseases in the early stage and the farmer will take the appropriate action and the crop can be secure from the diseases. In the similar way, this system will also enable the farmer to detect the pest attack on the crop in the crop in the early stage and using the appropriate pesticides the farmer can kill the pests and can increase the cultivation of the crop.

Different pesticides are used for different disease. Excessive uses of chemical for plant diseases treatment will increase the danger of nephrotoxic residue level on agricultural product and has been known as a serious contributor to spring watercontamination also pesticides are among the highest components in the production cost [2]. The severity is been calculated by taking the area of disease part of the leaf which we get after thresholding to the total leaf area which we got after segmentation. A strong demand now exists in many countries for non-chemical control methods for pests or diseases, and this issue has not been studied enough[9]. Study of diseases on the mango leaf can robustly studied by the image processing toolbox and also the diagnosis by using MATLAB helps us to suggest necessary remedy for that disease arises on the leaf of mango plantWe know that perception of the human eye isn't such a lot stronger that he will take issue minute variation pattern of colour can be a different disease present on the leaf of mango. Our software can provide the exactly differentiate the variation of colour

present on these leaves and depending upon that variation the further compare with database stored image features related to the colour.

II. DISEASES ON LEAVES OF MANGO

The diseases on the mango leaves are classified as:

A. Bacterial disease,
B. Fungal diseases
C. Viral disease
D. Diseases Due To insects:

Out of the above types of disease these are dramatically affect the leaf of mango plant and its leaves. We go through the selective type of diseases on the mango leaves. image segmentation method to detect the diseases on mango tree by scanning of mango leaves through our portable dedicated scanner. Various diseases are found on the mango tree out of this we discuss the disease some of the major diseases which are often found on the leaves of mango that are viz.fig.1and fig .2 shown below

1. Powdery Mildew (Oidium mangiferae) :

Figure 1. Mango panicles with powdery mildew

Figure 2. Characteristic symptoms of mango powdery mildew on mango leaves

diseases of mango affecting almost all the varieties. The characteristic pathology of the disease is the white superficial powdery fungal growth of diseases on leaves, flowers and young fruits. The affected flowers and fruits drop pre-maturely .Reducing the crop considerably yield.

2.Anthracnose (Colletotrichum gloeosporioides) :

It is of widespread occurrence in the field and in storage. The disease causes serious losses to leaf, flowers and fruits under good climatic conditions (high humidity, non-stop, rains and the temperature range of 25-35°C). Large brown lesions can affect flush leaves or older leaves. Small spots may coalesce into larger lesions. Lesions can occur on twigs and may cause tip dieback. Dark lesions may occur on young fruit or on near-mature green fruit. The disease is more common in areas where there is rain, fog and high humidity in the early dry season. Symptoms are worse in stressed trees.

Figure 3 mango panicle infected with anthracnose disease

Figure 4.Symptoms of both anthracnose (left) and bacterial black spot (right) on mango leaves

III. PROPOSED METHODOLOGY

Block diagram for calculating severity:-

The extraction of the features and image disease classification during this steps is as shown in the following fig.5. There are various features of the leaf of image, thresholding, Laplacian filter .etc

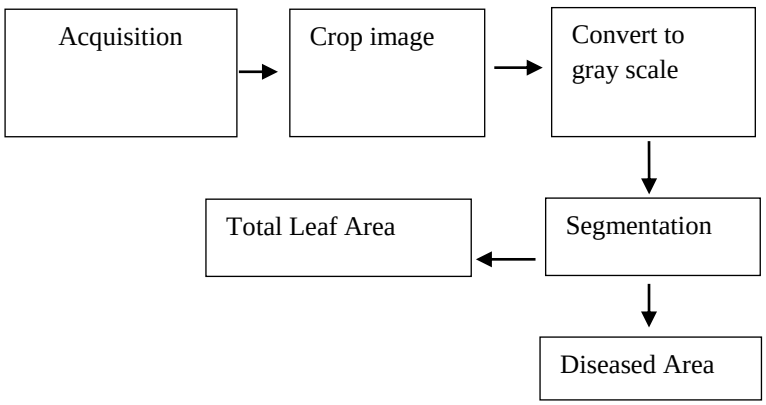

Figure.5 System architecture of calculating leaf disease severity

A. Materials and Equipments

Dark spot disease mango leaf sample, 12 Mega pixel digital camera, PC, MATLAB12 Version, healthy leaf for reference.

B. Principle

Disease severity is the area (relative or absolute) of the sampling unit (leaf) showing symptoms of disease. It is most often expressed as a percentage or proportion [1]. The disease severity of the plant leaves is measured by the disease area and total leaf area ratio. Using image processing toolbox. It can be given below

ST = DA / TA--(1)

= TPDA / TPA--(2)

Where, ST-Severity extent, P-Unit pixel value, DA-Diseased leaf area , TA- Total leaf area, DPDA-Total pixels in diseased area, TPA-Total pixels of leaf. In this Mango leaves digital images all pixel represent the same size so ratio 'ST'. it can be obtained by counting pixels of total leaf area .Diseased leaf area in the binary image format. Then we are calculating standard result table of final severity in percentage.

C. Image processing Method

Mango Image from database:- A total of 150 random samples of physiologically mature and green condition of mangoes were harvested from Kolhapur, Satara, Belgaon, Pune, Sangali, Ahmenagar, Auangabad, Nashik districts. Different type's disease leaves are taken for the study. The different type's disease leaves are taken from the different location of Maharashtra state.. They are stored in JPEG format in database folder. The disease leaf was placed flat on the white background, then leaf is zoomed or crop. so as to ensure that the images taken contains only the mango leaves. The background of image must be white color. Image segmentation:- Image segmentation is the very important step. In this we are separate the different regions. Image had classify different with special significance in the image. In this paper two different segmentation techniques. They had implemented to obtain total leaf pixels area and disease area leaf pixels.

Mango Leaf region segmentation:- Mango Image processing and analysis were performed by two way first is filtering and second is thresholding processes with using MATLAB software. Image filtering is an enhancement operation that alters pixel values on the basic of the grey values of its surrounding neighbors to correct problems such as poor contrast or noise Input image from database is first converted into grayscale image. Since mango leaves images is taken in controlled environment. Then it place diseased leaf on the white background. It's makes large difference in gray values of two groups, fist group is object and second group is background. After image segmentation, the binary image containing leaf region is getting by region replacement and removing holes in the white region. To measure the pixels in total leaf and scan the image fully from top to bottom and from left to right.

Mango leaf Disease region segmentation:- Segmentation of the mango leaf disease area should be accurately Segmentation may be wrong because of shallower midrib color than leaf color. Decreasing of Mango leaf color at early stages of unhealthy condition. Also in different types of disease occurs different stages of light, water, neutrino the disease manifest various symptoms,which bring difficulties to the segmentation. As shown figure.6 and figure.7

Figure 6.Brown spot disease mango leaf

Figure7.Gray scale image

Laplacian filter Laplacian filter are used to perform on the raster image, the laplacian filter can used to emphasize the edges in an image. This filter type is commonly used in edge-detection applications. The Laplacian filter is the second order derivative in which the second derivative is best suited than the first derivative for image increase because of the ability of the former to enhance fine detail. First-order derivatives generally produce closely together. edges in an image. Second-order derivatives have a stronger response to fine detail, such as thin lines and isolated points. First order derivatives generally have a stronger response to a gray-level step. Second- order derivatives produce a double response at step changes in gray level. The first order derivatives in image processing are for edge extraction, they do have important uses in image enhancement. The algorithm operates by convolving a kernel of weights with each grid cell and its neighbors in an image. Four 3x3 sized filters are available for selection. The simplest isotropic derivative operator is the Laplacian, which, for a function (image) f(x, y) of two variables, is defined as

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} \quad \text{……………………………………………………} (3.1)$$

because derivatives of any order are linear operations, the Laplacian is a linear operator. In order to be useful for digital image processing, this equation needs to be expressed in discrete form. There are several ways to define digital Laplacian using neighborhoods. Whatever the definition, it has to satisfy the properties of a second derivative. Taking into account two variables, we use the following notation for the partial second-order derivative in the x-direction [1]:

$$\frac{\partial^2 f}{\partial^2 x^2} = f(x+1,y) + f(x-1,y) - 2f(x,y) \quad \text{……………………………………………} (3.2)$$

and, similarly in the y-direction, as

$$\frac{\partial^2 f}{\partial^2 y^2} = f(x, y+1) + f(x, y-1) - 2f(x, y) \quad \text{..... (3.3)}$$

The digital implementation of two-dimensional Laplacian Eq. is obtained by summing these two components:

$$\nabla^2 f = [f(x+1, y) + f(x-1, y) + f(x, y+1) + f(x, y-1)] - 4f(x, y) \quad \text{...(3.4)}$$

The Eq. 3.4 can be implemented using the mask shown in figure 8(a) which gives an isotropic result for rotations in increments of 90°, figure 8(b) shown below used the mask to implement the extension of Eq. 3.4 that includes the diagonal neighbors.

0	1	0
1	-4	1
0	1	0

(a)

1	1	1
1	-8	1
1	1	1

(b)

0	-1	0
-1	4	-1
0	-1	0

(c)

-1	-1	-1
-1	8	-1
-1	-1	-1

(d)

Figure 8: (a) Filter mask used to implement the digital Laplacian, as defined in Eq. (3.4). (b) Mask used to implement an extension of Eq. (3.4) that includes the diagonal neighbors. (c) And (d) two other implementations of the Laplacian [1].

The above figure 8(c) and 8(d) shows the mask of other implementation of Laplacian. Laplacian is a derivative operator, its use highlights gray-level discontinuities in an image and deemphasizes regions with slowly varying gray levels. This will tend to produce images that have grayish edge lines and other discontinuities, all superimposed on a dark, featureless background.

Figure 9: Input image

Figure 10: Laplacian imag

The above image is obtained by using the Laplacian filter to the input image shown in figure 9 where the input image is shown in figure 10.

IV. RESULTS AND CONCLUSIONS

From the above figure 11, we get the third mode rejection image in which the background is kept black and the leaf part is kept white which is very much useful to calculate the total leaf area and it helps in calculating the severity. Figure 12 shows the image same as input image but the only difference is in the background which is been black. Figure 13 shows the disease part black in which we can calculate the area of disease leaf and calculate by taking the ratio of disease area to the total leaf area.The proposed algorithm is applied on infected leaf images and results are shown in figure.11,figure12,figure13,figure14.

Figure 11. Input image for Calculating severity

Figure 12 : Segmented image.

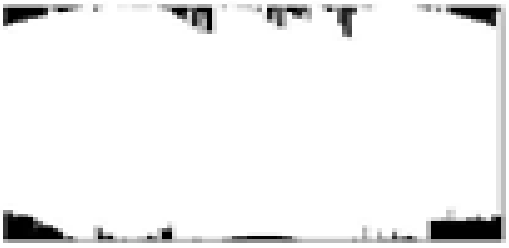

Figure 13 : Image with Third mode rejection

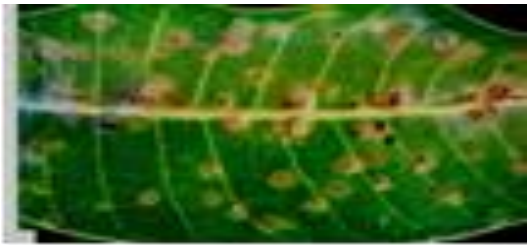

Figure 14:Image with black background

The severity of the disease is calculated as, Severity(ST) = [TPDA / TPA]* 100 The total number of pixels corresponding to the leave is noted as TPA, where " TPA " denotes the leaf part. The number of pixels corresponding to the disease affected part is noted as TPDA; where “TPDA " denotes the affected part. For this leaf , severity of disease in percentage(s): 7.63%

Figure 15:Image with disease area

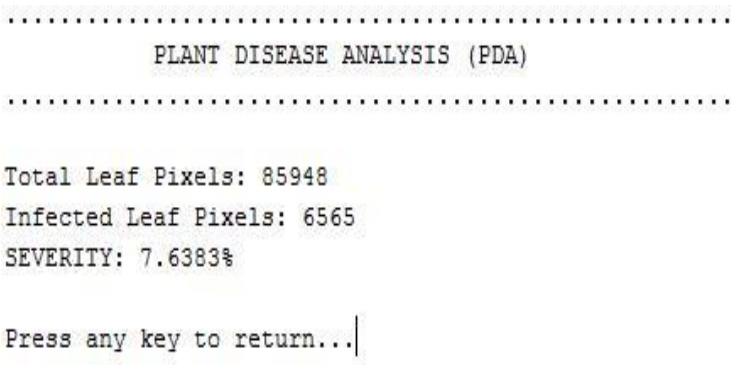

Figure 16.: The Severity of Diseased Leaf.

Table I show Pd-Total pixels in diseased area, PlTotal pixels of leaf.

sample	TPA –Total pixels in diseased area.	TPDA –Total pixels of leaf.
1	**6565**	**85948**
2	**3472**	**8821**
3	**1913**	**30259**
4	**8448**	**58388**
5	**1732**	**14135**

Table I: Result table to get the severity

Severity= (TPA TPDA)*100

Severity = (6565/85948)*100

Severity =7.63%

By using the above technique we can now easily calculate the severity of the disease leaf and in which it will be more useful to decide the amount of pesticides that is to be sprayed on the leaves, due to which the environment pollution and cost will reduce. Thus image processing technology used to measure the plant disease severity and the pest is convenient and accurate. These eliminate subjectivity of traditional methods and the human induced errors.

REFERENCES

[1] [*Sanjay B. Patil, Dr. Shrikant K. Bodhe, "Leaf Disease Severity Measurement using Image Processing."International Journal of Engineering and Technology Vol.3(5),2011.*

[2] *Vijay A. Gulhane and Ajay A. Gujar, "Detection of Diseases on Cotton Leaves and Its Possible Diagnosis", International Journal of Image Processing(IJIP), vol.(5), Issue(5), 2011.*

[3] *S. Ananthi, S. Vishnu Varthini ," Detection And Classification Of Plant Leaf Diseases "Vol.2(2),2012*

[4] *Yousef Al-Kofahi, Wiem Lassoued, William Lee, and Badrinath Roysam,'' Improved Automatic Detection and Segmentation Of Cell Nuclei in Histopathology Images"IEEE Transaction On Biomedical Engineering. Vol. 57. no. 4 april 2010.*

[5] *J. K. Jain, R.Rastogi,"Application of image processing in Biology and Agriculture," Nuclear India,1998,pp.12-13.*

[6] *Jennifer R. Aduwo, Ernest Mwebaze [at.el]," Automated vision based diagnosis of cassava mosaic diseases," Virus Research, 2004, pp.129-142.*

[7] *H.Bock, G.H.Poole [at.el]," Plant disease severity estimate visually and by Hyper spectral imaging, "Plant Science, 2010 pp.59-107*

[8] De Cui, Qin Zhang [at.el],"Detection of soybean rust using a multispectral image sensor," Springer Science, 2009, pp.49-56.

[9] Apan, A.Weld [at.el],"Detecting mango 'orange rust' disease using EO-1 Hyperion hyper spectral imagery, "International journal of remote sensing, 1998, pp.657-675.

[10] Kridsakron Auynirndronkool, Varinthon Jarnkoon,"Analysis of economic crop reflectance by field spectral signature, case study mango", Journal of plant physiol, 2008, pp.1-9.

[11] William W. Hargrave, D. A. Crosslacy," Video digitizer for the rapid measurement of leaf area lost due to Herbivorous insect", Journal of Entomological Society of America,1998,pp.591- 598.