Detection of plant leaf diseases using Image Processing

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ABSTRACT

In India around 70% of people depend on agriculture for their livelihood. Nowadays crops are damaged due to many types of diseases. The damage caused by insects is a primary diseases. Insecticides may be poisonous to some kind of birds as they are not always very efficient. It also effects natural animal food chains. Farmers have extensive range of variety to choose suitable Fruit and Vegetable crops. The plant diseases effects the human by health or economically. To identify these plant diseases we need an efficient approach. Using image processing the various diseases can be analyzed. The focus of this paper is to combine image processing technology for developing smart agriculture based system. The accuracy of prediction can be improved by using image processing technology. This article analyses two major aspects: detecting, disease classification according to the diseased images and comparative study of classification methods used. To detect these plant diseases we require a fast automatic technique.

Keywords: Gaussian filter, threshold, RGB, HSV.

I.   INTRODUCTION

India is an agriculture dependent country, farmers have varied range of diversity to choose appropriate fruit and vegetable crop. Plants become an important and only a primary source of energy to overcome the problem of global warming. The destruction caused by emergent, and endemic pathogens is vital in plant systems.

Crop diseases is cause which directly and indirectly spreads and creates damage to surroundings. These diseases will affect the economy. The quality of the crop will be greatly affected. Sometimes the damage or defect it is not seen by human eyes. Farmers guess the diseases by their prior experience.

In the traditional method i.e. naked eye observation required continuous monitoring. But the cost will be more especially with large farms. Farmers have no touch with technology people who can help them. To consult expert's farmers need to pay much. This method is very difficult, time consuming and inaccurate. There are diseases that do not have any visible symptoms and farmers are not having enough knowledge of few diseases, in these cases human vision fails to identify the disease. Diseases occurs due to various reasons like climatic changes, natural disasters, pesticides and by various disease. Below the examples of defected leaves are given in figure 1.
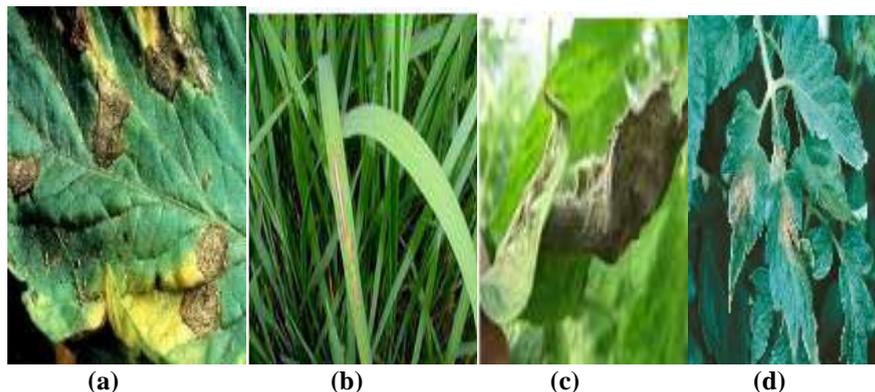

(a)   **(b)**   **(c)**   **(d)**
Figure 1: a)Early scorch b) Cottony mold c)Ashen mold d)Late scorch

II.   LITERATURE REVIEW

Digital image processing is a technique which is used and implemented in various areas of biology. Plant leaf disease detection methodology is a scientific method which uses the photo-graphic images to detect diseases in the leaves. The digital images are transferred into a particular form and pre-processed using pre-processing method which are used to transfer the original images into useful form. In plant leaves disease detection, captured photographic images are used. When there are noises in the images, the regions of interest in the image is not clear or other interference appears in the image. The image pre-processing is done to get sharpened, noiseless images. This improved images are used to leaf disease detection and classification. The selection of image type differs based on the processing area, implementation of mathematical calculation and application. Generally, color and texture are unique features of a plant used to detect and classify the diseases.

 In paper [1] authors found an image processing technique for Rice disease identification and considered the two most common diseases in the north east India, namely Leaf Blast and Brown Spot. Image acquisition is initial step, then followed by segmentation, spot and boundary detection method for feature extraction are the phases to detect the infected parts of the leaves. In this paper the author introduces zooming algorithm in which SOM (Self Organizing Map) neural network is used for segmenting rice images with defects. The zooming algorithm gives satisfactory results of classification for test images.

 In paper [2] authors used both LABVIEW and MATLAB software to process the images to detect chili plant disease. This combined method detects leaf disease by inspecting leaf at initial stage. The image is taken using LABVIEW IMAQ Vision and MATLAB is used for processing. Image pre-processing operations are Fourier filtering, edge detection and morphological operations. The color feature is used to distinguish between chili and non-chilly leaves.

In paper [3] author presented image processing methods for recognizing the bacterial infection in plant. The usual infection seen on plant is bacterial leaf scorch and early stage detection helps in progress of plant growth. Then clustering technique will be undergone to separate foreground and background image with help of K-means clustering method in image segmentation. K-means clustering algorithm is simple and effective as compared with Fuzzy logic, in detection and also reduces manual clustering.

In paper [4] discusses Orchid leaf disease detection. Black leaf spot and Sun scorch are popular orchid leaf diseases. Image pre-processing includes histogram equalization, adjusting intensity t and applying filtering techniques. Three morphological methods are used to separate only small object and to hold large objects in image. Thresholding is applied in segmentation to trace the edges. Classification is performed by calculating white pixels in image. This system gives high accuracy and low percentage of error in result.

In paper [5] presents a method to detect unhealthy region of Citrus leaf. The types of citrus diseases are (i) Citrus canker, (ii) Anthracnose, (iii) Overwatering, (iv) Citrus greening. During pre-processing, the image is enhanced and RGB image is converted into YCbCr color space. Discrete cosine transform domain is employed for color image enhancement. YCbCr color system and L*a*b* color space are utilized for color space conversion. Using Gray-Level Co-Occurrence Matrix (GLCM), features are extracted such as contrast, energy, homogeneity and entropy. Two (SVM) classifiers: SVMRBF and SVMPOLY are used for classification.

Table 1 depicts the existing techniques used.

Table1: Existing Methods

Paper	Techniques Used
[1] Rice Disease identification using Pattern Recognition Techniques	Zooming algorithm, SOM neural network
[2] Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques	Morphological processing, Color clustering, LABVIEW IMAQ Vision
[3] A Novel Algorithm for Detecting Bacterial Leaf Scorch (BLS) of Shade Trees Using Image Processing	K-means clustering algorithm, Intensity mapping
[4] Orchid Leaf Disease Detection using Border Segmentation Techniques	Border segmentation, Pattern classification
[5] Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques	GLCM, SF-CES, SVMRBF & SVMPOLY classifier

III. PROPOSED METHODOLODY

Digital camera or similar devices are used to capture images of different types of leaves, and then are used to identify the affected / defected area in the leaves. Image Processing is a set of process, where each process is important, the output of one acts as an input for the next stage. In this proposed work we have collected image from internet. A collection of healthy and unhealthy images act as a dataset in proposed method.

We can also capture image from digital cameras or even get the dataset which is already available. By passing images as an input we perform various image processing operations to get the leaf detected.

Algorithm
1. RGB image acquisition
2. Apply Gaussian filter to remove unwanted pixels.
3. Apply K-means clustering
4. Apply histogram equalization and histogram matching.
5. Perform morphological operation by giving threshold value.
6. Store the output obtained.

Following stages illustrates the step by step approach for the proposed method: -

1. Image Acquisition
To get any leaf images, image acquisition is must. A leaf images with the RGB color is obtained by using digital camera. Sample images are collected from the internet with the pixel resolution of 109*310 with the size about 225kb each.

2. Image Preprocessing
The image usually contains noise which deprives the quality. The image pre-processing results in image enhancement of any leaf image with dimensions of 109*310 pixels. It is in RGB color format. In this paper Gaussian filter is used to enhance the image by removing unwanted data like removing noise. Noise can occur during image capturing and transformation.

3. Conversion of RGB to HSV
RGB image is compound of three independent grayscale images that tends to the intensity of red, green, and blue light. These three individual images can be handled distinctly and then recombined into a single image that humans will observe. In RGB all the colors are correlated to the color luminance. Hue Saturation Value is employed to segment the image luminance from color information.

4. Image Segmentation

Image segmentation is the process of dividing an image into multiple parts. This is typically used to identify objects or other relevant information in digital images. Image thresholding is a simple and efficient method to partition the image into a foreground and background. Image thresholding plays vital role where there exists high levels of contrast.

5. Morphological Operation

In a morphological operation, each pixel in the input image is compared to its neighbors which changes the value of output. By using morphological operation size and shape can be detected. The most elementary morphological operations are dilation and erosion. Dilation adds pixels to the borders of objects in an image, while erosion eliminates pixels on object margins.

IV.   IMPLEMENTATION

Environmental Setup

This research is implemented in matlab version MATLAB\R2017a. It works on Windows OS and it is user friendly Matlab license has to be renewed periodically to continuously work with.Trial version of Matlab is easily available in the internet, by following simple steps we can get them installed in our PC with simple configuration.

Experimental Results

In plant leaf disease detection, we have taken any types of leaf disease for processing and getting the results for input leaf. Gaussian filters gives a better analysis when compared to others. HSV color space has given better results than RGB color space.

The color of plant leaves is important for analysis. Because changed with the color is a major indicator of plant leaves diseases. This can be used and measured for diseases level easily.
Morphological operation like dilution and erosion helped in detecting boundaries of the defected portions. As shown below the output of the healthy and unhealthy leaf gives a clear picture of the proposed method for further improvement we can demonstrate with huge dataset to get a better and accurate results. ANN can be implemented for better results.
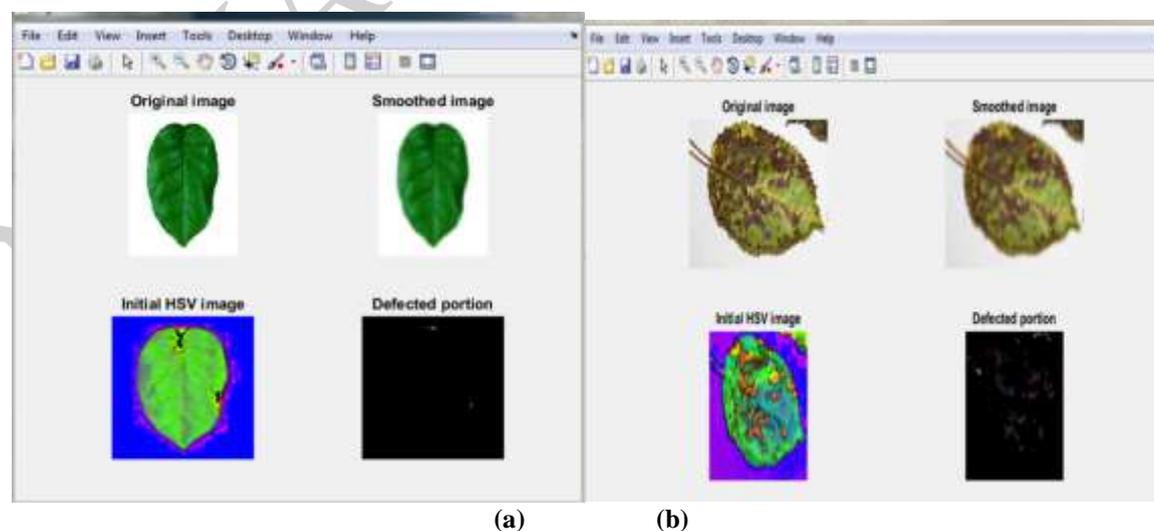

(a)   (b)
Figure 2: a) Output of healthy leaf a) Output of unhealthy leaf

V.   SCOPES AND APPLICATION

India is an agricultural country hence there is no less scope as far as utilization is concerned. The applications will range from different fields. Some of them are as follows

- Agriculture
- Nursery
- Bio-technology labs
- Gardening
- Forest Department

VI.   CONCLUSION

Image processing is applicable in every field of science of this modern era. Image processing in agriculture is one of major sector to work with. As technology grows, our agricultural system also should evolve, this could be done by automation i.e. automatic detection of diseases and protect them accordingly. By doing this we can yield more products and exports products to other countries.

REFERENCES

1. Santanu Phadikar and Jaya Sil "Rice Disease identification using Pattern Recognition Techniques" Proceedings of 11th International Conference on Computer and Information Technology (ICCIT 2008)25-27 December, 2008, Khulna, Bangladesh, pp. 1-4244-2136-7/08.
2. Zulkifli Bin Husin, Abdul Hallis Bin Abdul Aziz, Ali Yeon Bin Md Shakaff and Rohani Binti S Mohamed Farook "Feasibility Study on Plant Chili Disease Detection Using Image Processing Techniques" 2012 IEEE Third International Conference on Intelligent Systems Modelling and Simulation, pp. 978-0-7695-4668-1/12.
3. Murali Krishnan and Dr.M.G.Sumithra "A Novel Algorithm for Detecting Bacterial Leaf Scorch (BLS) of Shade Trees Using Image Processing" 2013 IEEE 11th Malaysia International Conference on Communications 26th - 28th November 2013, Kuala Lumpur, Malaysia pp. 978-1-4799-1532-3/13.
4. Wan Mohd Fadzil W.M.N, Shah Rizam M.S.B and R. Jailani, Nooritawati M.T "Orchid Leaf Disease Detection using Border Segmentation Techniques" 2014 IEEE Conference on Systems, Process and Control (ICSPC 2014), 12 - 14 December 2014, Kuala Lumpur, Malaysia, pp. 978-1-4799-6106-1/14.
5. Ms. Kiran R. Gavhale, Prof. Ujwalla Gawande and Mr. Kamal O. Hajari "Unhealthy Region of Citrus Leaf Detection Using Image Processing Techniques" 2014 IEEE International Conference for Convergence of Technology, pp. 978-1-4799-3759-2/14.
6. Mrunalini R. Badnakhe, Prashant R. Deshmukh, ―Infected Leaf Analysis and Comparison by Otsu Threshold and k-Means Clusteringǁ, IJARCSSE, 2012, 2(3), 449-452.
7. Qing Yao; Zexin Guan; Yingfeng Zhou; Jian Tang; Yang Hu; Baojun Yang, "Application of Support Vector Machine for Detecting Rice Diseases Using Shape and Color Texture Features," in Engineering Computation, 2009. ICEC '09. International Conference on , vol., no., pp.79-83, 2-3 May 2009
8. Ajay A. Gurjar, Viraj A. Gulhane," Disease Detection on Cotton Leaves by Eigenfeature Regularization and Extraction Technique", International Journal of Electronics, Communication & Soft Computing Science and Engineering (IJECSCSE) Volume 1, Issue 1.
9. P.Revathi, M.Hemalatha, "Classification of Cotton Leaf Spot Diseases Using Image Processing Edge Detection Technique", ISBN, 2012, 169-173, IEEE.
10. Prof. Sanjay B. Dhaygude, Mr.Nitin P.Kumbhar, "Agricultural plant Leaf Disease Detection Using Image Processing" IJAREEIE, vol. 2(1), pp. 599-602, January 2013.
11. Jayamala K. Patil, Raj Kumar, "Advances In Image Processing For Detection of Plant Diseases" JABAR, vol. 2(2), pp. 135-141, June-2011.
12. Joanna Sekulska-Nalewajko, Jaroslaw Goclawski, "A semi-automatic method for the discrimination of diseased regions in detached leaf images using fuzzy c-means clustering". Polyana-Svalyava (zakarpattya), Ukraine: pp.172-175, 2011 IEEE.