"Neural Network Classifier Based Method for Leaves Disease Detection with Image Processing Technique"

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Abstract— The conventional technique for leaf disease detection involves of calling an expert person who can identify the diseases based on his understanding and that costs too much for an ordinary farmer in an emerging country such as India as stated above. Hence an alternative is mandatory for a country like India where a low cost but technology dependent system is required. To fulfill this, purpose a system is proposed which can identify the diseases on the plants with the help of technology. It will take input image from user which is to be processed. It will preprocess the image and then the green pixels from the image is removed which are nothing but the healthy part of the leaf. The GUI development of this project is done in Matlab. These methods result is shown in GUI. In the future work other part is segmented and the useful segments are selected for further analysis which consist of feature extraction and the statistical analysis of those features. After this the final information about disease of that plant is displayed. The classifier used in this proposed system is Neural Network classifier hence once trained such classifier can provide results in better manner compared to the conventional systems.

Key words: leaf image, image processing, segmentation, image histogram, feature extraction

I. INTRODUCTION

India being an agricultural and developing country there are lot of areas in that filed which are in need of uplifting with technology. There are many types of diseases on a leaf of a plant which need to be recognized again and again with more amount of efficiency. Detecting such detections on the plants by normal vision is quite hectic as well as contains low noise tolerance.

An alternative system with the help of image processing can be used to detect those diseases more accurately than normal human vision. To fulfill this purpose a system is proposed which can identify the diseases on the plants with the help of technology.

The method is efficient in following manner

1) It requires low cost than that of expert human in related task
2) The time required for detection is low
3) Can be used for different plants based on system design

The method consists of taking digital images of the leaf with a high resolution digital camera so that it can be processed quite certainly. All the acquired images are commonly in RGB form where each pixel is represented by Red Green and Blue intensity values. To ensure the feature extraction and texture identification accurately it is necessary that we should do some image pre-processing on that image. The image will be transformed into HSV image components. All components will have their distinctive features that are useful for diverse application as we are only intersted in the texture recognition we will therefore only use Hue image.

A Spatial Gray-level Dependence Matrices method is used for computing the parameters that will represent the whole image in some other but minimum hyper dimensions and by comparing the range of values of those dimensions for test images it is conceivable to differ images based on different texture. The whole parameter calculation method is known as statistical analysis of the image.

In view of the need of farmers the system focuses on the detection of the diseases of the plants and that too in fewer time related to conventional method and in efficient manner so that any person who wants to use the system should be able to use it easily with proper interactions with the system

II. LITERATURE REVIEW

Several methods used to study leaf disease detection using image processing are mention my Arti N Rathod, Bhavesh Tanaval and Vatsal Shah in their paper named as Image processing techniques for detection of leaf disease. The methods include detection using HPCCDD (Homogeneous pixel Counting Technique for Cotton disease detection) another method is mentioned where K-means clustering is used. Even a method involving artificial neural networks and support vector machines is mentioned in the above paper [1]. Dheeb Al Bashish, Malik Braik, and Sulieman Bani-Ahmad presented a research paper which describes a framework for plant and stem diseases classification the framework for image segmentation uses K=Means clustering method and the images are passed through a pretrained neural network and it was found that accuracy was around 93% [2]. 'Applying Image processing techniques to detect plant diseases' by Anand Kulkarni and Ashwin Patil states diverse image processing methods alongside with artificial neural networks for plant disease detection [3]. Kshitij Fulsoundar, Tushar Kadlag, Sanman Bhadale, Pratik Bharvirkar, Prof S.P.Godse in their Detection and classification of plant leaf diseases' paper an android application is used to identify plants spacies and their diseases based on their photographs[4].A similar research paper 'Leaf disease detection using image processing techniques' by Hrushikesh Marathe and Prerna Kothe states a method detect disease by calculating leaf area through pixel number statistics [5]..With the pure implementation of image processing without any flavours of other methods it is feasible as per the study made by Sachin D. Khirade A. B. Patil [7].

III. PROPOSED SYSTEM

The mechanism by which the proposed system will work can be understood by the following diagram. The block diagram gives a brief idea about the overall system structure. The MATLAB GUI will be developed for the user interactions like taking input images, checking the output of the program as well as some other intermediate image options and some controls. The background program will work as per the user given tasks.

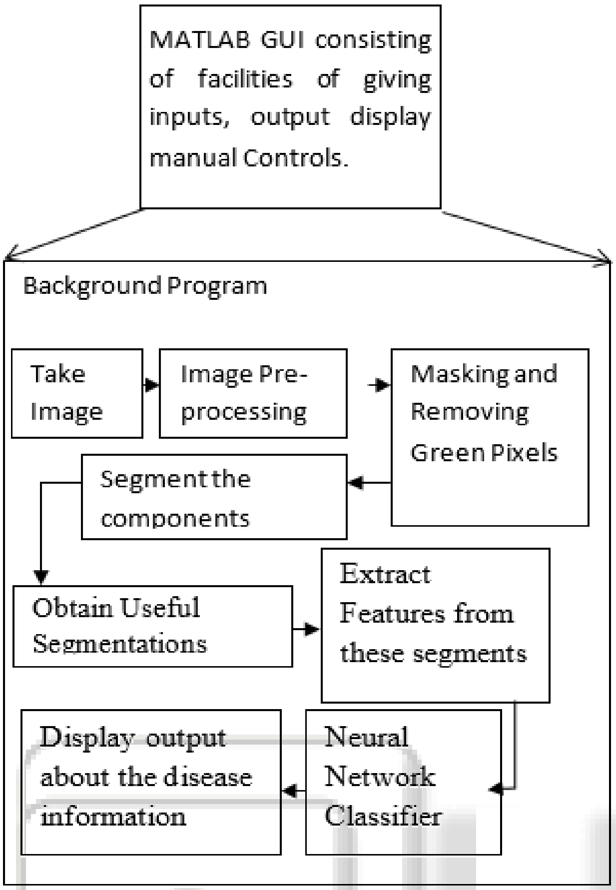

Fig. 1: The proposed approach

IV. Image Preprocessing

The first step in implementing of the project is that the user should take the required image in the workspace of MATLAB environment. The image can be read using inbuilt 'imread' function of MATLAB. The image gets stored in a 3 Dimensional matrix to represent the image pixels properly.

Fig. 2: Original leaf image

The next and very important thing in the project is to convert the image from RGB form to HSV form

The procedure to convert the image from the RGB to HSV form a specific mathematical procedure has to be followed. The procedure is as below.

The RGB values of pixels range from 0 to 155 to represent the image data, but as for suitability we need to convert that data for the range of 0 to 1. The conversion of the data ranges is generally known as normalization process.

0 will denote 0
128 will denote 0.5
256 will denote 1

- New values are called as R' G' & B' correspondingly to have appropriate nomenclature rules.
- The maximum value from R' G' & B' is taken alongside with the minimum values from them as well.
- The Delta() value is calculated that is nothing but the difference among Cmax and Cmin.
- With the variables in hand the values for the Hue Saturation and Value are calculated with proper formulations.

The whole algorithm for the image conversion can be understood by the following equations.

The R,G,B values are divided by 255 to alter the range from 0-255 to 0-1:

R' = R/255
G' = G/255
B' = B/255
Cmax = max(R', G', B')
Cmin = min(R', G', B')
Delta() = Cmax – Cmin

Hue calculation:

$$H = \begin{cases} 0^\circ & \Delta = 0 \\ 60^\circ \times \left(\frac{G'-B'}{\Delta} mod 6\right) & , C_{max} = R' \\ 60^\circ \times \left(\frac{B'-R'}{\Delta} + 2\right) & , C_{max} = G' \\ 60^\circ \times \left(\frac{R'-G'}{\Delta} + 4\right) & , C_{max} = B' \end{cases}$$

Saturation calculation:

$$S = \begin{cases} 0 & , C_{max} = 0 \\ \frac{\Delta}{C_{max}} & , C_{max} \neq 0 \end{cases}$$

Value calculation:
V = Cmax

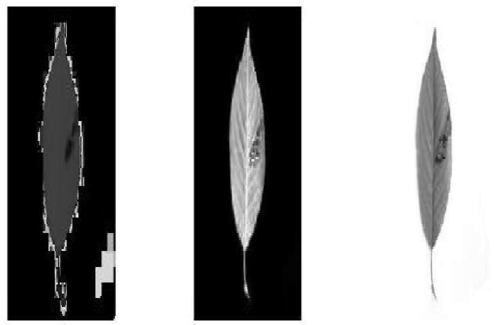

Fig. 3: Hue, Saturation and Value of an original image

V. Extraction of Required Components

As per the calculation of the H S & V values, the image is now represented completely in this new format. Though the dimensionality of the image representation by the MATLAB is Three Dimensional, the first 2 columns represents the location of the pixel and the third coloum represents HSV values for that corresponding pixels. In order to implement an important part of the project i.e. for detecting specific type of color requires images which only contains H or S or V values rather a separate image only for Saturation Hue and Value are required.

To achieve this goal the dimensions of the images helps as the one column of third dimension of each pixel gives us the required images separately. Such Hue saturation and Value components of images are taken separately by choosing each column of third dimension for every pixel respectively. As the need demands , the specific part of an image necessity to be extracted since that part is going to be used in the subsequent analysis section. The first step in the direction of this is acquire the component of H S & V images. The next part of this seek out is to have similar hue pixels accumulate in the locality of each other. The best clarification to get this consequence would be to plot the histogram of those image components[8].

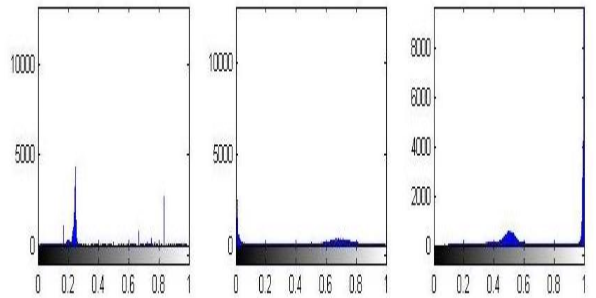

Fig. 4: Histograms of Hue, Saturation, and Value Component

To extract the necessary part of the image use definite certain low threshold and high threshold values for the histogram and filter out the middle section which will yield in the required image part. A similar approach has been used but only on the HSV component images and their filtered out part will be the required part of the original image. Filtered out HSV component images acts as the Hue Saturation and Value masks for the original image when applied to it.

The main goal of the procedure is to apply green mask so that all the green pixels in the original image can be eliminated[8] . To create the green mask, all the HSV comment mask and used together as their particular values will represent green color. Above steps extracts the required colors of the leaf image which important because for the disease detection we probably need to remove all the green colored pixels as they usually represent the healthy section of the leaf.

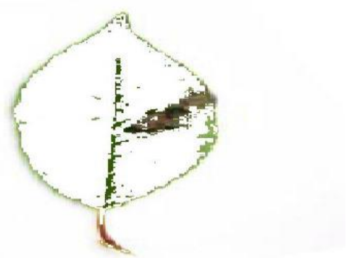

Fig. 5: Green Masked Image.

Above steps extracts the required colors of the leaf image which important because for the disease detection we probably need to remove all the green colored pixels as they usually represent the healthy section of the leaf. The next part focuses on feature extraction of the important section of the acquired image. To make the process more efficient the parts obtained are divided into chunks of 32x32 pixel for simplicity. Each chunk will be examined weather it contains important information or not. The chunks with more than 50% information are selected for further process and the remaining chunks are discarded.

A statistical method for calculating the gray-level co-occurrence matrix (GLCM), also known as the gray-level spatial dependence matrix[9]. The GLCM functions characterize the texture of an image by calculating how often reference and neighbourhood pixel in a specified spatial relationship occur in an image. After getting c the GLCMs, you can derive quite a few of statistics from them using the graycoprops function. These statistics such as contrast, energy, correlation, energy etc. provide information about the texture of an image. These features are applied to the Artificial Neural Network and after these the unhealthy greenery leaves kind is identified.

VI. EXPERIMENTAL RESULT

All the procedure mention above has been implemented on the images of leaves to separate out the non-green part and to detect the type of diseased leaf. All the results are shown in this section.

1) The original image looks like below

Fig. 6: Acquired Leaf image.

2) Following diagram shows that after converting original RGB image into HSV and its corresponding histogram.

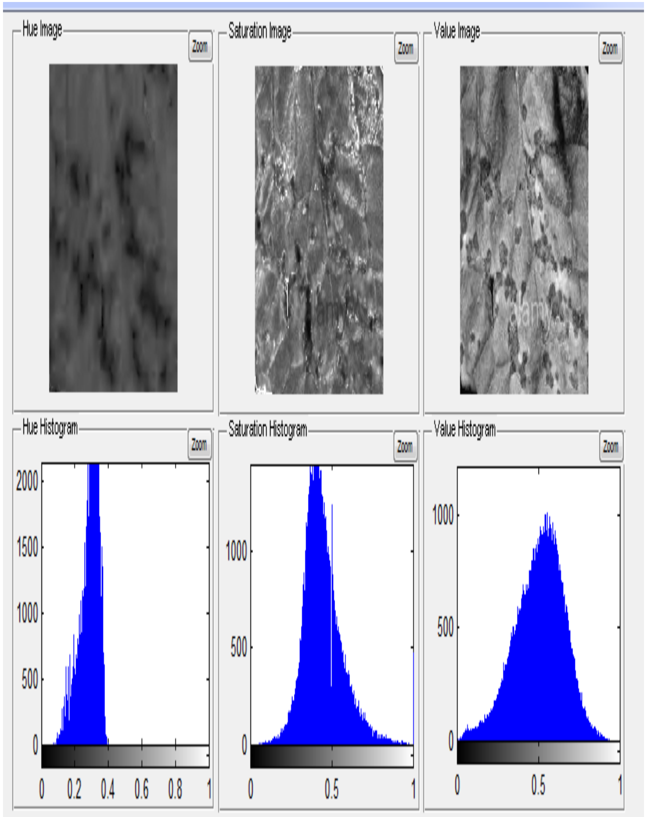

Fig. 7: Hue, Saturation And Value Images And It's Corrsponding Histogram.

3) To extract the required part of the image use certain low threshold and high threshold values for the histogram and finally we get green masked image.

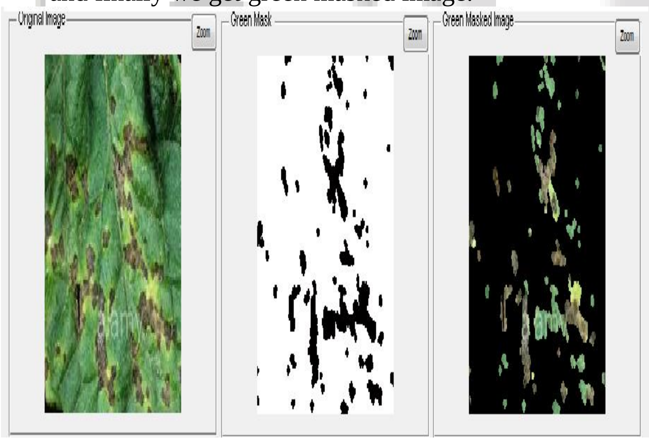

Fig. 8: Original and Green Masked Images.

4) Further the contrast, energy and all other parameters are calculated which will act as the features extracted from the image.

stats =

Contrast: 0.0651
Correlation: 0.8867
Energy: 0.7605
Homogeneity: 0.9852

5) Following figure shows the detected disease type

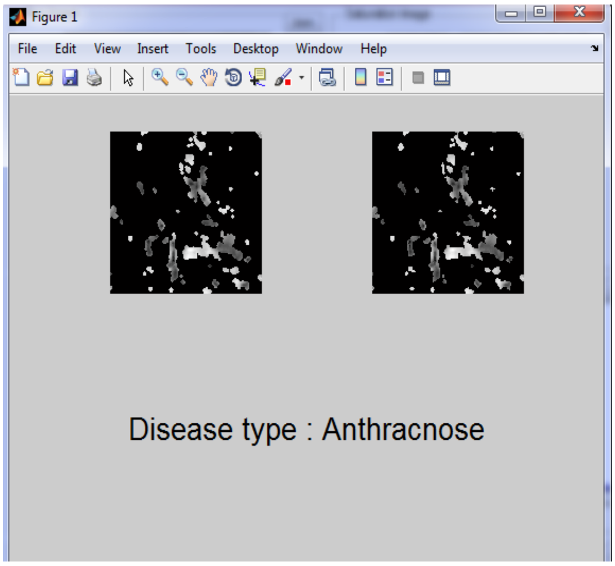

Fig. 9: Detected Disease Type.

VII. CONCLUSION

As per the requirement the RGB images has been successfully converted into HSV image for its processing. All the H S and V components are separated and their corruponding histograms are used for the creation of the green mask.

Green mask is used to remove the green pixels from the original image as only non-green pixels are required for further processing. The Final masked image is compared with the original image and the green pixels are successfully maked. Further the contrast, energy and all other parameters are calculated and the features extracted from the image. These features can be used for comparison directly for detecting the leaf disease.

REFERANCES

[1] Arti N. Rathod, Bhavesh Tanawal, Vatsal Shah, "Image Processing Techniques for Detection of Leaf Disease", International Journal of Advanced Research in Computer Science and Software Engineering, Vol-3, Issue- 11, 2013.

[2] Dheeb Al Bashish, Malik Braik, and Sulieman Bani-Ahmad, "A Framework for Detection and Classification of Plant Leaf and Stem Diseases", International Conference on Signal and Image Processing, 2010.

[3] Anand.H.Kulkarni, Ashwin Patil R. K., "Applying image processing technique to detect plant diseases", International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.5, 2012.

[4] Kshitij Fulsoundar, Tushar Kadlag, Sanman Bhadale, Pratik Bharvirkar, Prof S.P.Godse, "DETECTION AND CLASSIFICATION OF PLANT LEAF DISEASES", International Journal of Engineering Research and General Science Volume 2, Issue 6, October-November, 2014.

[5] Hrushikesh Dattatray Marathe, Prerna Namdeorao Kothe, "Leaf Disease Detection Using Image Processing Techniques", International Journal of Engineering Research & Technology (IJERT), Vol. 2 Issue 3, 2013.

[6] Sabah Bashir, Navdeep Sharma, "Remote Area Plant Disease Detection Using Image Processing",IOSR

Journal of Electronics and Communication Engineering (IOSRJECE), Vol-2, Issue 6, 2012.
[7] Sachin D. Khirade A. B. Patil, "Plant Disease Detection Using Image Processing", International Conference on Computing Communication Control and Automation,2015.
[8] S. Arivazhagan, R. Newlin Shebiah, S. Ananthi, S. Vishnu Varthini, "Detection of unhealthy region of plant leaves and classification of plant leaf diseases using texture features", International journal on Agricultural Engineering (CIGR), vol-5, 2013.
[9] Yinmao Song, Zhihua Diao, Yunpeng Wang, Huan Wang, "Image Feature Extraction of Crop Disease", IEEE Symposium on Electrical & Electronics Engineering (EEESYM), 2012.