IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 34-37

Study on Plant Leaf Disease Detection using Segmentation and Clustering

Suhasini Parvatikar[1], Dr. Deepa Parasar [2]
[1](Computer Department, Saraswati College/ Mumbai University, India)
[2](Computer Department, Saraswati College/ Mumbai University, India)

Abstract: *Plants play an important role in our environment. Plants maintain the balance of O2 and CO2 of earth's atmosphere. Without plants, there will be no existence of the earth's ecology. In addition to the conservation aspect, identification of the plant diseases is also necessary to utilize their medicinal properties and using them as sources of alternative energy sources like bio-fuel. It is very difficult to monitor the plant diseases manually. It requires tremendous amount of work, expertise in the plant diseases, and require the excessive processing time. Hence, in this paper we are studying about image processing concept for the detection of plant diseases. It involves the steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification.*

Keywords: *Clustering, Feature Extraction, Image Processing, Preprocessing, Segmentation.*

I. Introduction

India is a cultivated country and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant. Disease on plant leads to the significant reduction in both the quality and quantity of agricultural products. The studies of plant disease refer to the studies of visually observable patterns on the plants.

Monitoring of health and disease on plant plays an important role in successful cultivation of crops in the farm. In early days, the monitoring and analysis of plant diseases were done manually by the expertise person in that field. This requires tremendous amount of work and requires excessive processing time. The image processing techniques can be used in the plant disease detection [1].The purpose of Agriculture is not only to feed ever growing population but it's an important source of energy and a solution to solve the problem of global warming [2], Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit, which has received importance in recent time [3]. The focus on enhancing the productivity, without considering the ecological impacts has resulted into environmental degradation. Without any adverse consequences, enhancement of the productivity can be done in a sustainable manner. Plants exist everywhere we live, as well as places without us. Many of them carry significant information for the development of human society. As diseases of the plants are inevitable, detecting disease plays a major role in the field of Agriculture. Plant disease is one of the crucial causes that reduces quantity and degrades quality of the agricultural products [11]. In this paper, we make use of image processing techniques as well as machine learning techniques for the identification of the plant disease. This paper explains Literature Survey in Section II, Proposed Methodology in Section III and Conclusion in Section IV.

II. Literature Survey

A literature review [13] is a description of the literature relevant to a field or topic. It gives an overview of what has been said, who the key writers are, what are the prevailing theories and hypotheses, what questions are being asked, and what methods and methodologies are appropriate and useful. As such, it is not in itself primary research, but rather it reports on other findings. In this section brief description about various techniques to design the Plant Disease Detection is carried out.

Sanjay B. Patil, Dr. Shrikant K. Bodhe [8] mentioned in their research that Fungi-caused diseases in sugarcane are the most predominant diseases which appear as spots on the leaves. If not treated on time, causes the severe loss. Excessive use of pesticide for plant diseases treatment increases the cost and environmental pollution so their use must be minimized. This can be achieved by targeting the diseases places, with the appropriate quantity and concentration of pesticide by estimating disease severity using image processing technique. Simple threshold and Triangle thresh holding methods are used to segment the leaf area and lesion region area respectively. Finally, diseases are categories by calculating the quotient of lesion area and leaf area. The accuracy of the experiment is found to be 98.60 %.

Priti Badar, Suchitra [7] this paper describes image acquisition, image pre-processing, image segmentation, and feature extraction. In this paper spatial filter, K means clustering discussed. This paper gives the implementation results of plant disease detection. This present the 90% accurate results in disease detection.

III. Proposed Methodology

In this section, the basic steps for plant disease detection and classification using image processing are shown in Fig 1.

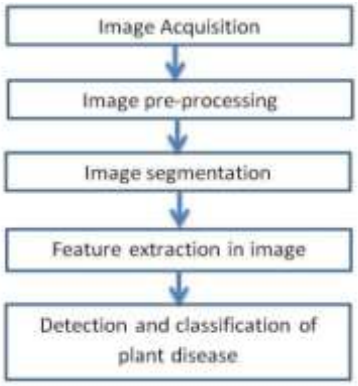

Fig 1: Steps in Disease Detection

The Algorithm can be given as:
Step 1: RGB image acquisition
Step 2: Create the color transformation structure
Step 3: Convert the color values in RGB to the space specified in the color transformation structure
Step 4: Apply K-means clustering
Step 5: Masking green-pixels
Step 6: Remove the masked cells inside the boundaries of the infected clusters
Step 7: Convert the infected (cluster / clusters) from RGB to HSI Translation
Step 8: SGDM Matrix Generation for H and S. (Another name for gray-level co-occurrence matrix is gray-level spatial dependence matrix.)
Step 9: Calling the GLCM function to calculate the features
Texture Statistics Computation
Step 10: Configuring Neural Networks for Classification.

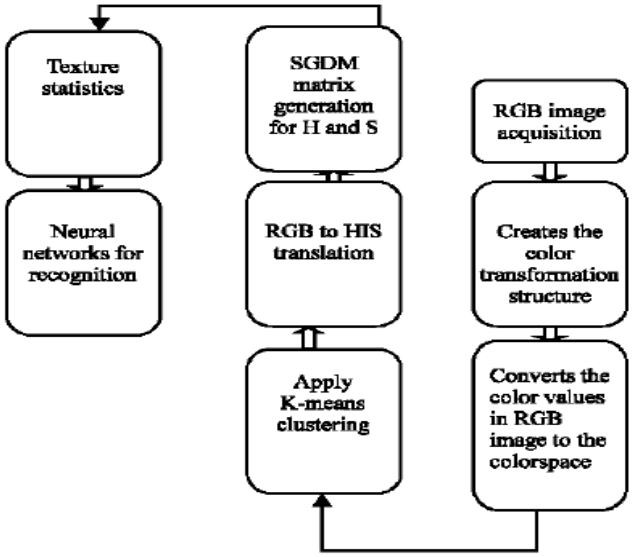

Fig 2: Block Diagram for Detecting Disease in Plant Leaf.

The steps used can be used described as :

A. Image Acquisition: The leaf images are captured through the camera. This image is in RGB (Red, Green and Blue) form. A color transformation structure for the image is created, then, a device-independent colour space transformation for the colour transformation structure is used [9].

B. Image Pre-processing: Noise elimination from an image or other object removal, different pre-processing techniques are used. Image clipping i.e. cropping the leaf image to get the desired image region. Image smoothing is attained using the smoothing filter. Image enhancement is carried out for increasing image contrast. The transformation of the RGB images into the grey images using colour conversion using equation (1).

f(x)=0.2989*R + 0.5870*G + 0.114 *B ---------- (1)

The histogram equalization which distributes the intensities of the images is applied on the image to improve the plant disease images. The increasing distribution function is used to distribute amount value [2].

C. Image Segmentation: Segmentation is the partitioning of an image into various parts of same features or having some similarity. Segmentation can be done using several methods like Otsu's method, k-means clustering, converting RGB image into HIS model etc. We have used K-means Clustering for this :

i. Segmentation using Boundary and spot detection algorithm: The RGB image is converted into the HIS model for segmentation. Boundary finding and spot finding helps to find the infected part of the leaf [12]. For boundary detection the 8 connectivity of pixels is considered and the boundary detection algorithm is then applied [12].

ii. K-means Clustering: The K-means clustering is used for the classification of objects based on a set of features into K number of classes. The classification of objects is done by minimizing the sum of the squares of the distance between the object and the corresponding cluster.

K –means Clustering algorithm:

1. Find center of K cluster, either randomly or based on some heuristic.
2. Assign each pixel in the image to the cluster that minimizes the distance between the pixel and the cluster's center.
3. Again compute the cluster centers by averaging all of the pixels in the cluster. perform steps 2 and 3 until convergence is achieved

iii. Otsu Threshold Algorithm: Thresholding creates binary images from grey-level images by setting all pixels above that threshold to one and all pixels below some threshold to zero. The Otsu algorithm is described below:

1. Separate pixels into two clusters
2. Find the mean of each cluster.
3. Square the difference between the means.
4. Multiply the number of pixels in one cluster times the number in the other cluster.

The infected leaf shows symptoms of the disease by changing the color of the leaf. Hence the amount of green colour of the leaves can be used for the detection of the infected portion of the leaf. The R, G and B constituent are extracted from the image. The threshold is calculated using Otsu's method. Then the green pixels are covered and removed if the green pixel intensities are less than the calculated threshold.

D. Feature Extraction: Feature extraction is an important part for identification of an object. Many applications of image processing use feature extraction. Colour, texture, morphology, edges etc. are the kind which can be used in plant disease detection. Texture determines how the colour is distributed in the image, the roughness and hardness of the image. It can also be used for the detection of infected plant areas. There are various methods for this, we have used:

Color co-occurrence Method: This method uses both color and texture to get unique features for the image. For that the RGB image is converted into the HSI translation using mathematical formulas.

First, we convert RGB color [13] space image to HSI space beginning with normalizing RGB values:

$$r = \frac{R}{R+G+B} \quad \text{.....(1)}$$

$$g = \frac{G}{R+G+B} \quad \text{.....(2)}$$

$$b = \frac{B}{R+G+B} \quad \text{.....(3)}$$

Each normalized H, S and I components are then obtained by from eq(1),(2),(3).

$$h = \cos^{-1}\{\frac{0.5*[(r-g)+(r-b)]}{(r-g)^2+(r-b)(g-b)^{1/2}}$$ ….. h ε [0,π] for b<g

s = 1 – 3. min(r,g,b) …… s ε [0,1]

$$i = \frac{R+G+B}{3.255}$$ …… i ε [0,1]

For convenience, h, s and i values are converted in the ranges of [0,360], [0,100], [0, 255], respectively by:
H =h ×180 /π;
S =s ×100
I =i × 255.

E. Classification: Neural network is chosen as a classification tool due to its well-known technique as a successful classifier for many real applications. The training and validation processes are among the important steps in developing an accurate process model using NNs. The dataset for training and validation processes consists of two parts; the training feature set which are used to train the NN model; whilst a testing features sets are used to verify the accuracy of the trained NN model. Before the data can be fed to the ANN model, the proper network design must be set up, including type of the network and method of training. This was followed by the optimal parameter selection phase. However, this phase was carried out simultaneously with the network training phase, in which the network was trained using the feed-forward back propagation network. In the training phase, connection weights were always updated until they reached the defined iteration number or acceptable error.

IV. Conclusion

The aim of this work is threefold. Identifying the infected object(s) based upon K-means clustering procedure extracting the features set of the infected objects using color co-occurrence methodology for texture analysis. Detecting and classifying the type of disease using ANNs.

References

Journal Papers:

[1]. H.Al-Hiary,S.Bani-Ahmad, M.Reyalat,M.Braik &Z.AlRahamneh, "Fast & accurate detection & classification of plant diseases", *International journal of computer applications(0975-8887), volume 17- no.1*,2011, pp-31-38.

[2]. Al-Bashish, D., M. Braik and S. Bani-Ahmad, " Detection and classification of leaf diseases using Kmeans- based segmentation and neural-networks-based classification" *Information Technology Journal 10: 267-275. DOI: 10.3923/itj.2011.267.275*

[3]. Ali, S. A., Sulaiman, N., Mustapha, A. and Mustapha, N, " K-means clustering to improve the accuracy of decision tree response classification" *Information Technology Journal, 8:1256-1262.DOI:10.3923/itj.2009.1256.1262*

[4]. J. K. Sainis, R. Rastogi, V. K. Chadda "Applications of image processing in biology and agriculture", *BARC newsletter,2009.*

[5]. S. Ananthi and S. Vishnu Varthini, " Detection And Classification Of Plant Leaf Diseases",*IJREAS Volume 2, Issue 2 (February 2012) ISSN: 2249-3905.*

[6]. Jayamala K. Patil1 , Raj Kumar, "Advances in image processing for detection of plant diseases", *Journal of Advanced Bioinformatics Applications and Research ISSN 0976-2604 Vol 2, Issue 2, June-2011*, pp 135-141.

[7]. Priti Badar ,Suchitra C, " Disease Detection Of Pomegranate Plant Using Image Processing", *International Journal of Computer Science and Mobile Computing, Vol.5 Issue.5*, May- 2016, pg. 328-334.

[8]. Sanjay B. Patil , Dr. Shrikant , K. Bodhe, " Leaf Disease Severity Measurement Using Image Processing", *International Journal of Engineering and Technology Vol.3 (5), 2011, 297-301.*

[9]. Agriculture in India From Wikipedia, the free encyclopedia

[10]. Digital image processing From Wikipedia, the free encyclopedia

[11]. Mango - Wikipedia, the free encyclopedia

[12]. Tapioca - Wikipedia, the free encyclopedia

[13]. www.google.com.