IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 7, Issue 4, April 2020

Plant Leaf Disease Detection Using Image Segmentation

Elakeyaa P V[1], Keerthana A[2], Bharathi P[3], Ezhilmani S[4], Dr.V. Mohan[5]

UG Final Year Student, Department of Electronics and Communication Engineering,

Saranathan College of Engineering, Trichy, Tamilnadu, India[1,2,3,4]

Associate Professor, Department of Electronics and Communication Engineering,

Saranathan College of Engineering, Trichy, Tamilnadu, India[5]

Abstract: Agriculture plays an especial role in the Indian economy. Since it is one of the major contributors to Gross Domestic Product (GDP) and national income of the country, decrease in the productivity of the crops leads to a major loss. To identify the plant diseases in a short span of time with greater accuracy remains as a major challenge. To overcome this, we provide a software solution for the automatic analysis and detection of plant leaf diseases using Support Vector Machine (SVM) and image processing techniques like image acquisition, image pre-processing, image segmentation, feature extraction and classification with the help of MATLAB. Initially the images of various leaves are fed and then varied image processing techniques are applied to the acquired images to extract useful features and for further analysis and classification. Here specifically we concentrate on diseases like Alternaria alternata, Cercospora leaf spot and Bacterial blight and Anthrocnose. In addition with the detection of the disease, infected area and affected region percentage is also measured.

Keywords: Feature Extraction, Gray Level Co-occurrence Matrix (GLCM), K-means clustering algorithm, Image Segmentation, Support Vector Machine (SVM) classification

I. INTRODUCTION

Agriculture is the backbone of the Indian economy. Almost 45% of the total population and nearly 70% of the rural people mainly depends on it. Monitoring of health and disease of plant plays a vital role in successful cultivation of crops. If adequate plant care is not taken, it creates severe plant impacts and affects the productivity of the corresponding crops. Crops are affected by various diseases which are caused by pathogens, virus, bacteria and fungus which reduces the quantity and quality of the crops. Usually monitoring and analysis of plant diseases is done manually, which is not precise and requires excessive processing time. This process is tedious and time consuming. To overcome the drawbacks of the traditional eye observing technique, we used digital image processing technique for precise and quick detection of disease of the plant. We used K-means clustering algorithm with multi SVM and GLCM in MATLAB software for disease detection.

In our proposed system we detect diseases by converting the RGB images into gray scale and the images are enhanced by removing the distortions by resizing, reshaping and filtering. K-means clustering is done for segmenting the images. Then the features are extracted using Gray Level Co-occurrence Matrix (GLCM), which is used for further classification of disease done by Support Vector Machine (SVM) classifier.

II. PROPOSED METHOD

Our proposed system includes the process involved in identification of plant diseases by the features of leaf. The methodology involved in the identification of leaf diseases include steps like image acquisition, image pre-processing, image segmentation, feature extraction and classification based on the features.

In this process, the image acquisition is done initially in which the image is given as input either directly or from the collected dataset. Then pre-processing of the image is done, in which the quality of the image is enhanced. After the enhancement of the image, clustering is done by K-means clustering algorithm by dividing the image into different clusters. In that green pixels are masked and only the infected portion is left. Masking is done to get more accuracy. After segmentation, feature extraction is done. Then classification is done using SVM classifier.

IARJSET
ISSN (Online) 2393-8021
ISSN (Print) 2394-1588
International Advanced Research Journal in Science, Engineering and Technology
Vol. 7, Issue 4, April 2020

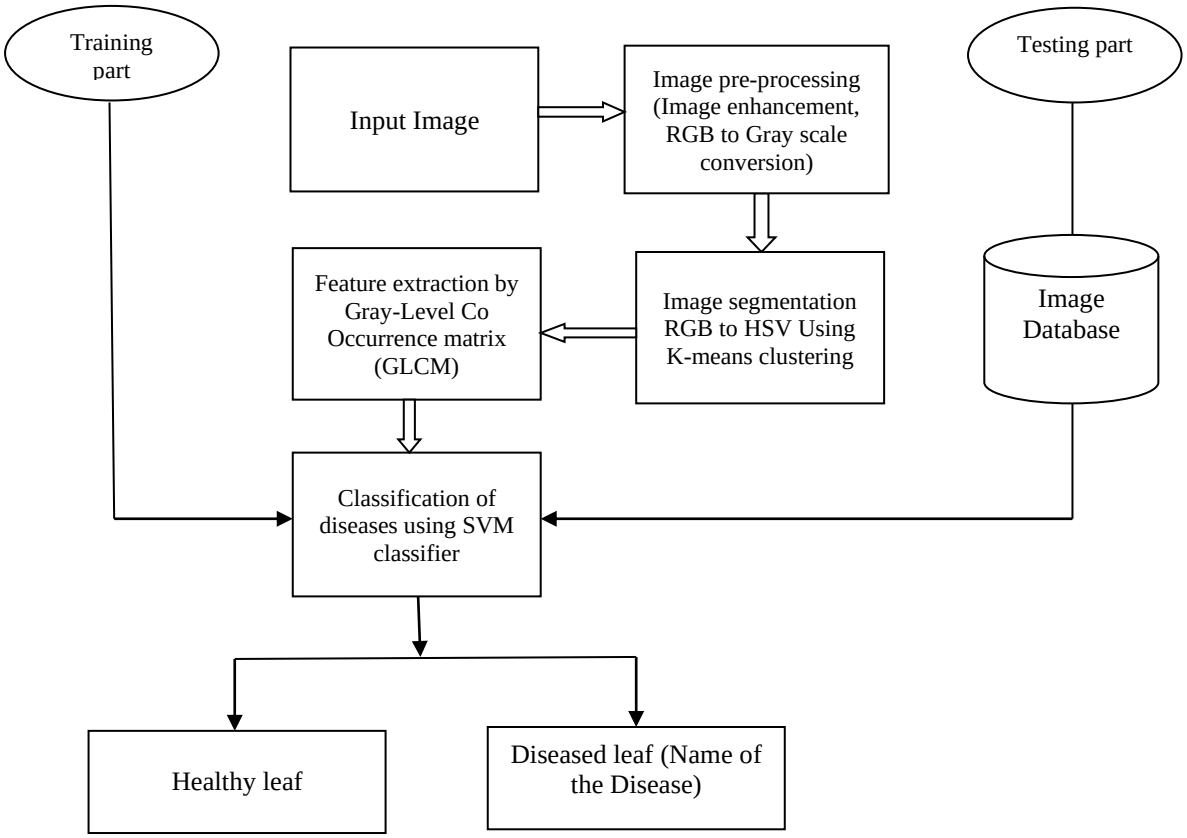

Fig.1 Block diagram of a plant leaf disease detection using Image segmentation, K-means clustering, GLCM,SVM

III. IMPLEMENTATION

A. IMAGE ACQUISITION

Image acquisition is the initial step in plant leaf disease detection. In acquisition process, the images are captured using high resolution cameras or the already captured images from the collected dataset is fed directly from the camera as mentioned in Fig.2

Fig.2 Input Image

B. IMAGE PRE-PROCESSING

The acquired images may include noise. In this pre-processing process, image enhancement and suppression of unwanted distortions are done. This process uses varied techniques like resizing, reshaping, filtering of noise, image conversion, enhancing the image etc. We tend to use varied MATLAB code to resize the image, to strengthen distinction and RGB to grayscale conversion. Image is converted from RGB Color Space to L*a*b* Color Space in which the L*a*b* space consists of a luminosity layer 'L*', chromaticity-layer 'a*' and 'b*'. All the color information is in the 'a*' and 'b*' layers and colors are classified by K-Means clustering in 'a*b*' space. The enhanced image of the input leaf image is shown in Fig.3

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 7, Issue 4, April 2020

Fig.3 Enhanced Image

C. IMAGE SEGMENTATION

Image segmentation is the process for conversion of digital image into various segments and rendering of an image for further analysis. Image segmentation is done for locating the objects and bounding line of that image. In this, we used K-means clustering method for partitioning the images into clusters in which at least one part of the cluster contains image with major area of the diseased part. The k-means clustering algorithm is applied to classify the objects into K number of classes according to the set of features. The classification is done by minimizing the sum of square of distances between data objects and the corresponding cluster. From the results of K-means, labeling of each pixel in the image is done and segmented images are also generated which contain diseases. In this system, we used segmentation technique, as a result input image is partitioned into three clusters for better segmentation results. The segmented clusters of the leaf image is shown in Fig.4

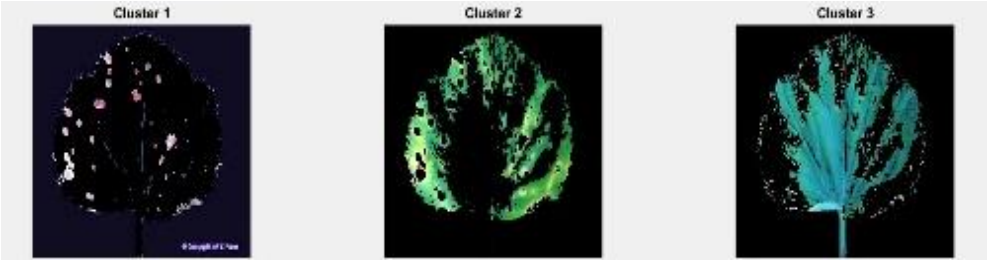

Fig.4 Segmented Clusters

D. FEATURE EXTRACTION

In feature extraction, desired features such as color, texture, morphology and structure are extracted. It is the method for involving number of resources required to describe a large set of data accurately. Statistical texture features are obtained by using Gray level co-occurrence matrix (GLCM) formula for texture analysis and texture features are calculated from statistical distribution of observed intensity combinations at the specified position relative to others. The statistical texture features of GLCM are energy, sum entropy, covariance, information measure of correlation, entropy, contrast and inverse difference and difference entropy.

1) MEAN:

$$\mu = \frac{1}{N}\sum_{i=1}^{N} A_i$$

2) STANDARD DEVIATION:

$$s = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N} |A_i - \mu|^2}$$

3) RMS:

$$x_{RMS} = \sqrt{\frac{1}{N}\sum_{n=1}^{N} |x_n|^2}$$

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 7, Issue 4, April 2020

4) VARIANCE:

$$v = \frac{1}{N-1}\sum_{i=1}^{N}|A_i - \mu|^2$$

5) CORRELATION:

$$\rho(A,B) = \frac{1}{N-1}\sum_{i=1}^{N}\left(\frac{A_i - \mu_A}{\sigma_A}\right)\left(\frac{B_i - \mu_B}{\sigma_B}\right)$$

6) SKEWNESS:

$$S = \frac{E(x-\mu)^3}{\sigma^3}$$

7) KURTOSIS:

$$k = \frac{E(x-\mu)^4}{\sigma^4}$$

8) ENTROPY:

Entropy = - sum (p.*log2(p))

E. CLASSIFICATION

Classification is an important phase, in which we will detect, by what disease the plant gets affected using the classification algorithm support vector machine(SVM). We can identify whether it is a healthy leaf or a diseased leaf. If it is diseased it will detect the type of disease. Here in our proposed system, we have designed to identify three diseases namely,

- Alternaria alternata
- Bacterial blight
- Cercospora leaf spot
- Anthrocnose

IV. RESULT

The leaf image is loaded from the database and then it is enhanced and segmented. Then the k-means clustering is applied as a result we get different clustering images. Features like mean, standard deviation, entropy, RMS, variance, smoothness, kurtosis, skewness, IDM, contrast, correlation, energy and homogeneity is also obtained. Finally the diseases like alternaria alternata, cercospora leaf spot and bacterial blight is identified and the percentage of the affected region is also obtained as shown in Fig.5 region is also obtained as shown in Fig.5.

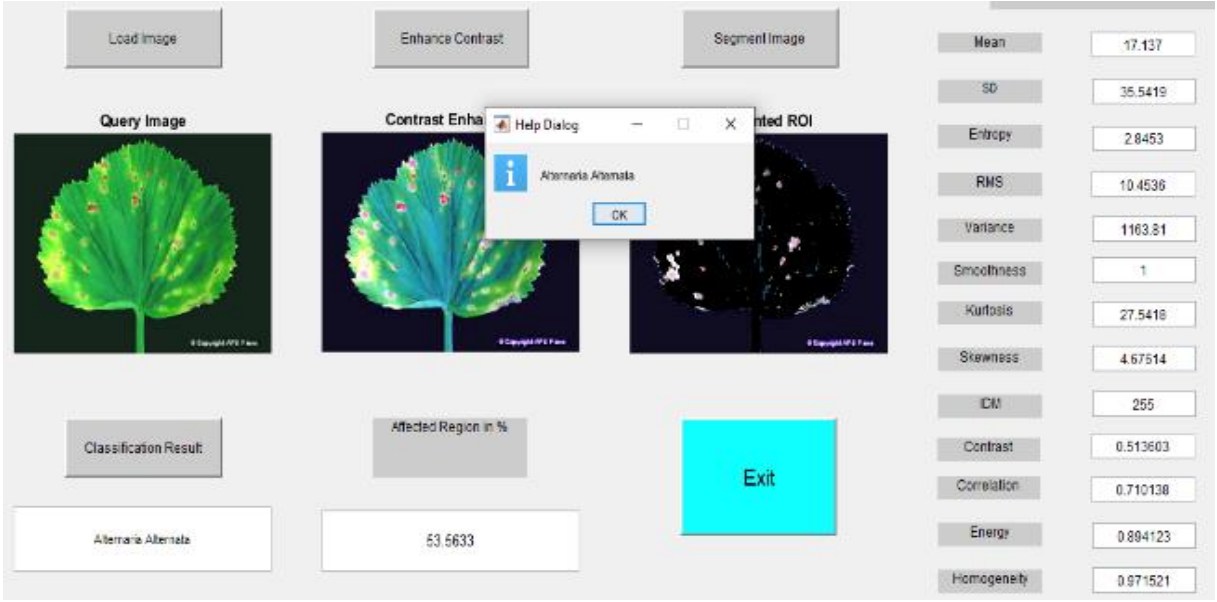

Fig.5 Experimental Result

V. FUTURE SCOPE

In our proposed work we have developed a prototype for detecting four diseases namely Alternaria alternata, Cercospora leaf spot and Bacterial blight and Anthrocnose. In our future work we will develop for more diseases with more improved technologies.

VI. CONCLUSION

The accurate detection and classification of disease affected leaf became easy with the help of digital image processing techniques and MATLAB software by implementing K-means clustering and SVM algorithm which made it possible to automatically detect the plant disease. This automatic detection using image processing techniques help farmers to know about the disease in early stage and to take necessary preventive measures.

REFERENCES

[1]. Dhivya.R, Latha.S, R.Rajesh , Saradhambal.G (2018), "Plant disease detection and its solution using image classification", International Journal of Pure and Applied Mathematics Volume 119 No. 14 2018
[2]. Kurniawati, N.N. Abdullah, S.N.H.S. Abdullah.S (2009), "Investigation on Image Processing Techniques for Diagnosing Paddy Diseases", International Conference of Soft Computing and Pattern Recognition 2009.
[3]. A.B Patil, Sachin D. Khirade (2015), "Plant Disease Detection Using Image Processing", International Conference on Computing Communication Control and Automation.
[4]. Nitin P.Kumbhar, Sanjay B. Dhaygude (2013), "Agricultural plant Leaf Disease Detection Using Image Processing", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 2, Issue 1, January 2013.
[5]. Andras Anderla, Darko Stefanovic, Marko Arsenovic , Mirjana Karanovic and Srdjan Sladojevic (2019), "Solving Current Limitations of Deep Learning Based Approaches for Plant Disease Detection".
[6]. Arnal Barbedo, Jayme Garcia(2016), "A review on the main challenges in automatic plant disease identification based on visible range images".
[7]. A.K. Misra, Vijai Singh (2016), " Detection of plant leaf diseases using image segmentation and soft computing techniques".
[8]. Amandeep Singh, Maninder Lal Singh (2015), "Automated Color Prediction of Paddy Crop Leaf using Image Processing", International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015).
[9]. Ashwath Sivasamy, Y.Sanjana, SriJayanth (2015), "Plant Disease Detection Using Image Processing Techniques", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, May 2015.
[10]. Dheeb Al Bashish, Malik Braik, and Sulieman Bani-Ahmad (2010), "A Frame work for Detection and Classification of Plant Leaf and Stem Diseases", IEEE 2010.
[11]. Bhumika S.Prajapati, B.Prajapati, Vipul K.Dabhi Harshadkumar (2016), "A Survey on Detection and Classification of Cotton Leaf Diseases", International Conference on Electrical, Electronics, and Optimization Techniques (ICEEOT).
[12]. MarekSchikora, Satish Madhgoria and Wolfgang Koch (2009), "Pixel-Based Classification Method for Detecting Unhealthy Regions in Leaf Images".
[13]. M.Hemalatha, P.Revathi (2012), "Advance Computing Enrichment Evaluation of Cotton Leaf Spot Disease Detection Using Image Edge detection", ICCCNT'12.
[14]. Dhanashree S. Khot, Pramod S. landge, Sushil A. Patil (2013), "Automatic Detection and Classification of Plant Disease through Image Processing", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 3, Issue 7, 2013.
[15]. BalramNeupane, MarekSchikora, SatishMadhogaria, Wolfgang Koch (2012), "An image classification approach to analyze the suppression of plant immunity by the human pathogen Salmonella Typhimurium", BMC Bioinformatics 2012.
[16]. K.Aruli, M.Malathi, S.Mohamed Nizar, A.Sagaya Selvaraj (2015), "A Survey on Plant Leaf Disease Detection Using Image Processing Techniques", International Research Journal of Engineering and Technology (IRJET),Volume: 02 Issue: 09, Dec 2015.
[17]. A.B. Ingole, Malvika Ranjan, Manasi Rajiv Weginwar, Neha Joshi (2015), "Detection and classification of leaf disease using artificial neural network", International Journal of Technical Research and Applications.