Detection and Classification of Unhealthy Region of Grapes Plant using Texture

Prof. Swati Pawar[1] Ms. Shweta Patil[2] Ms. Tejaswini Patil[3] Mr. Nasruddin Shaikh[4]
[1,2,3,4]Department of Electronics and Telecommunication Engineering
[1,2,3,4]Sandip Foundation's, Sandip Institute of Technology and Research Center, Nashik

Abstract— This paper is based on identification and classification of grape leaves diseases. Plant diseases cause damage and economical losses in agricultural crops. The reduction in plant disease is needed to improve in quality of product. The goal of the proposed work is to automatically detect the plant disease as soon as it spread around all over the field and convey the message to the owner of the field area about the disease information. For detection of leaf disease, image processing is used and to convey the message, the hardware design with GSM module is used.
Key words: GLCM, K-mean Clustering, SVM, GSM

I. INTRODUCTION

India is an agriculture country and farmers have to select the suitable Crops and that Crops can be affected by Fungi, bacteria, viruses [4]. Grape (Vitis vinifera) cultivation-viticulture farming enterprises in India [12].

Grapes are needed a hot climate during its growth and also at the fruiting period. It is grown in the areas where the temperature ranging from 15° to 40° C. High temperature above 40° C at the time of fruit growth causes the reduction in fruit set and also in berry size. Low temperature below 15° C causes the bud break which is lead to crop failure.

Grapes having the major fungal diseases include downy mildew, powdery mildew and anthracnose which cause economical losses to grape sector every year. The naked eye observation of expert in practise for detection and identification of plant disease is very expensive and time consuming in large farm areas [3]. For this purpose, farmers may need to go long distance to contact experts. Diseases are managed by adjusting the pruning time and using various fungicides [12]. Since at 1970's, computerized image processing technology was applied in the agricultural engineering research such as quality of product inspection and classification of product, monitoring of crop growth, diseases on plant, identification of insect pests and so on. As the rapid development of software technology and hardware of computer, the application of image processing image processing in agriculture has developed [12].

Image can be captured and insert in the dataset folders of diseases and then part of leaf spot has been taken for train & test purpose. The image processing and advance computing technique will used to identify the diseases with the help of MATLAB software [10]. We are using grape Crops and work on their leaves diseases with image processing technique [9]. For this purpose, the image segmentation using k-mean clustering is used and features are exacted from the cluster showing the disease information and classification is done by SVM. This paper focus on grapes plant diseases detection and classification using image processing technique and algorithms and then the disease information has been send to the owner of the farm. For this purpose, we are designing hardware with the microcontroller to GSM module which is used to convey the message to the owner of field. Also displays the message which is to be conveying on the LCD screen.

II. SYSTEM DESIGN

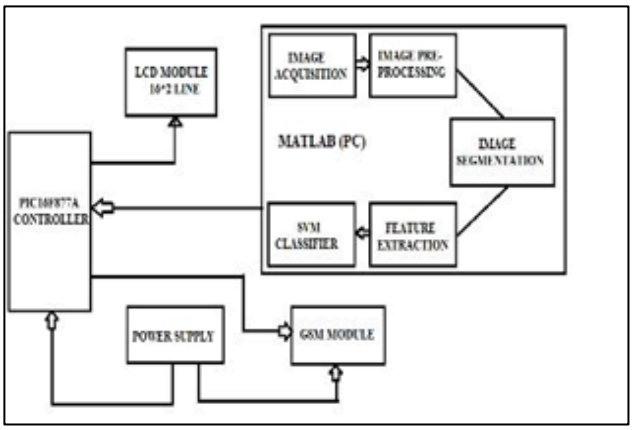


Fig. 1: Block diagram of system

To classification of diseases of grape leaf by MATLAB software we use the following methods/process:

A. Image Acquisition:

Image of leaf which to be classify is taken through camera or can be either store in databases ,so we are creating database for various grape leaf diseases and configure with MATLAB code . So the image is taken from database and sending for next process.

B. Image Pre-processing:

The image acquired is pre-processed. For classification purpose image first need to be clear which can easily identify the diseases spot so we can do pre-processing task like enhancement of contrast, smoothing etc. Image pre-processing is done by adjusting intensity values and increasing the contrast of image. For contrast enhancement, cumulative distribution function is used.

C. Segmentation:

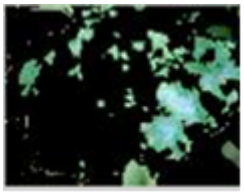
Image segmentation is the process of partitioning a digital image into multiple segments that is clusters. The result of image segmentation is set of segment that collectively covers the entire image. There are several methods for the image segmentation. One of the method for detection of leaf disease is K-mean clustering. It requires statistics and machine learning toolbox in MATLAB.

Step for K –mean:-

1) Convert the RGB image into L*a*b* colour space.
2) Classify the colours in 'a*b*' space using K-mean clustering.
3) Label every pixel in the image using the results from K-mean.
4) Create image of 3 clusters.

Cluster 1:

Cluster 2:



Cluster 3:

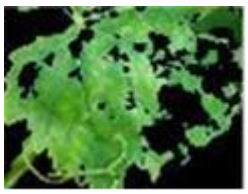


Fig. 2: Clusters formed by k-mean clustering

The above figure image shows the 3 clusters formed during the k-mean segmentation process.

D. Feature Extraction:

The features of the selected cluster are extracted. The selected image is converted to gray scale since the image is in RGB format. The required statistics are derived from Gray level co-occurrence Matrices (GLCM) [3]. The following 13features that are extracted and evaluated and are stored in an array: Contrast, Correlation, Energy, Homogeneity, Mean, Standard Deviation, Entropy, RMS. Variance, Smoothness, Kurtosis and Skewness.

1) Contrast - $\sum i,j\ |i-j|^2\ p(i, j)$ (1)

2) Correlation- $\sum i,j\ \frac{(i-\mu i)(j-\mu j)p(i,j)}{\sigma i \sigma j}$ (2)

3) Homogeneity- $\sum i,j\ \frac{p(i,j)}{1+|i-j}$ (3)

4) Energy- $\sum i,j\ p(i, j)$ (4)

5) Standard Deviation- $\sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$ (5)

E. SVM Classification:

Support Vector Machines are based on the concept of decision planes that define decision boundaries. SVM are set of related supervised learning method used for classification of various objects. Supervising learning technique involves analyzing of given training set and predicts labels of the test set. A support vector machine constructs hyper planes in infinity dimension space, which used for classification or other experiments. A better separation is achieved by the hyper plane which hall largest distance to nearest training data point of any class that is fictional margin. Functional margin minimize the generalization error of the classifier.

F. Message Retrieval:

When the disease is identified using MATLAB then its name is shown on LCD display which is configured with PIC microcontroller. Also message of diseases name is send to register mobile number of farmer through GSM module. After analyzing the image, the details of the disease and parameter is reset and ready for another process.

III. EXPERIMENTAL RESULT

The data consist of disease infected images of 3 grape diseases namely powdery mildew, downy mildew and anthracnose. In statistical toolbox of MATLAB 2010a, support vector machine is used to train the images and classify the diseases of grape leaf.

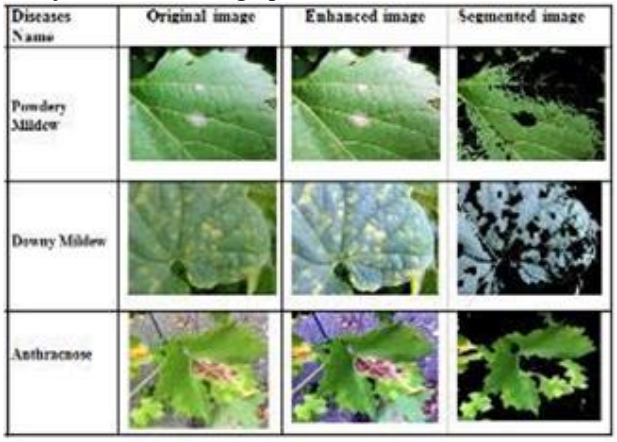


Table 1: Resultant Images

Features	Powdery diseases	Downy diseases	Anthracnose diseases
Means	55.4609	86.7166	47.5912
Standard deviation	62.5473	87.1123	65.5429
Entropy	4.78995	4.62049	4.32686
RMS	7.21984	9.08887	6.54372
Variance	3184.54	6570.92	3702.54
Smoothness	1	1	1
Kurtosis	2.13562	1.29406	3.2279
Skewness	0.658824	0.157209	1.16706
Internal data message	255	255	255
Contrast	1.34614	2.06203	0.543704
Correlation	0.807483	0.827007	0.931218
Energy	0.255647	0.241414	0.324175
Homogeneity	0.898429	0.8675	0.93228

Table 2: Extracted Features Values

13 features are calculated for the accurate result like entropy, RMS, variance, smoothness, kurtosis, skewness, contrast, correlation, energy, homogeneity. The result was occurred by classifying the diseases using support vector machine for the disease recognition.

IV. CONCLUSION

After collecting the leaf images, the work was carried out. There are 3 classes of grape leaves collected which are anthracnose, powdery mildew, downy mildew considered in the experiments of project. Homogeneity, Energy, Contrast, Standard deviation, Correlation are the main features to detect the disease infected area. The feature extraction process is used gray level co-occurrence methodology to calculate each feature in the images of diseases. The message retrieval system was design for convey the message.

REFERENCES

[1] K. Padmavathiand and K. Thangadurai. Implementation of RGB and Grayscale Images in Plant Leaves Disease Detection.Indian Journal of Science and Technology. February 2016; 9(6): 1-6.
[2] Harshal Waghmare and RadhaKokare. Detection and Classification of Diseases of Grape Plant Using Opposite Colour Local Binary Pattern Feature and Machine Learning for Automated Decision Support System. 3rd International Conference on Signal Processing and Integrated Networks (SPIN), 2016.
[3] Surender Kumar, Rupinder Kaur. Plant Disease Detection using Image Processing. International Journal of Computer Applications. August 2015; 124(16): 6-9.
[4] Prof. Atul Shire, Prof. UmeshJawarkar, Mr. ManojManmode. Agricultural Plant Leaf Disease Detection Using Image Processing. IJISET - International Journal of Innovative Science, Engineering & Technology. January 2015; 2(1): 282-285.
[5] Dr. Sandeep Singh Kang, Rajleen Kaur. An Enhancement in Classifier Support Vector Machine to Improve Plant Disease Detection. IEEE- 2015.
[6] Sachin D. Khirade, A. B. Patil. Plant Disease Detection Using Image Processing.International Conference on Computing Communication Control and Automation, IEEE- 2015.
[7] Jagadeesh D. Pujari, Rajesh Yakkundimath. Identification and Classification of Fungal disease Affected on Agriculture/Horticulture Crops using Image Processing Techniques. IEEE- 2014.
[8] Viraj A. Gulhane and Maheshkumar H. Kolekar. Diagnosis of Diseases on Cotton Leaves Using Principal Component Analysis Classifier. Annual IEEE India Conference (INDICON), 2014.
[9] Sanjeev S Sannakki, Vijay S Rajpurohit, V B Nargund, Pallavi Kulkarni. Diagnosis and Classification of Grape Leaf Diseases using Neural Networks. IEEE- July 4-6, 2013, Tiruchengode, India.
[10] 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. November 2013; 3(11): 397-399.
[11] Shen Weizheng, Wu Yachun, Chen zhanliang. Grading Method of Leaf Spot Disease Based on Image Processing. 2008 International Conference on Computer Science and Software Engineering, IEEE-2008.
[12] K. Soytong, W. Srinon, S. Kanokmedhakul. Application of antagonistic fungi to control anthracnose disease of grape. .Journal of Agricultural Technology, May 2005.

