SVM Based Classification Approach for Identifying Bacterial and Fungal Diseases in Plant Leaves

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***Abstract*-The leaves of a plant provides the most important information or data which provides us to know which type of plant it is and which type of disease is infected on that leaf. The plants play an important role in the biological field. In this paper we have described the development of a system that identifies the plant leaf diseases based on the images of plant leaves. Detecting diseases on leaf at an initial stage of a plant helps the farmer to prevent and take necessary actions to avoid loss in yield. Image processing techniques are applied for discovering and recognition of plant leaf unhealthiness. The system identifies the disease using shape, colors and texture features extracted by using Gray level Co-Occurrence Matrix (GLCM) algorithm. These features are classified using SVM classifier. An accuracy of 90.86% was achieved.**

***Keywords*-GLCM, k-means segmentation, SVM Classifier.**

I. INTRODUCTION

India is an agricultural country and the position of any country in the world depends on its agricultural production. In India the farmers have wide variety of to select their plant for cultivation to maximum yield depending on environment available. Then also the production gets affected by diseases of the crop. The diseases of the plant are caused by pathogens, insufficiency of nutrients, fungus etc. Detecting diseases at early stages enables to overcome it and treat it appropriately. For this an expert is required for identifying the disease, describe the method of treatment and protection. Identifying the plant disease is not easy task. It requires experience and knowledge of plants and their diseases. It also requires correct result in describing the symptoms of plant diseases. The expert systems are smart computer programs that are capable of serving solutions or suggestion related to specific problems in given area. One of the advantages of using Electronic expert systems is its capability to reduce the information that users need to process, reduce personnel costs and increase throughput. Expert system performs work more consistently than human experts.

II. RELATED WORK

The survey of research paper shows related work reported. Some of them are mentioned below.

A.I. De Castro et al. evaluate spectral data to detect accurately and quickly laurel wilt diseases. 2-class and 4-class classification system is used. 2-class system differentiates only healthy and laurel wilt diseased leaf image. 4-class system classifies healthy and 3 stages (early, intermediate and late) of laurel wilt [3]. M. Jafari et al. proposed a thermal vision for detection of pre-symptomatic gray-mold and powdery mildew diseases. Maximum temperature difference, median, kurtosis and skewness features extracted and get 80% accuracy with neuro-fuzzy classification [4]. A. Camargoa and J.S. Smith developed a digital image processing based algorithm to identify plant disease visual symptoms automatically. Transform RGB image into H, I3a and I3b to meet plant disease data set requirement then transformed image segmented using distribution of intensities in the histogram. Region is post processed to remove pixel which is not consider target region [5].

Shanwen Zhang et al. uses k-means segmentation then color and shape feature is extracted. Sparse representation takes for classification and gets 85.70% accuracy [6]. Kuo-Yi Huang presents an application to detect phalaenopsis seedling diseases using color and texture features. Classify bacterial soft rot (BSR), bacterial brown spot (BBS) and phytophthora black rot (PBR) with 89.6% accuracy using artificial neural network [7]. A. Camargo and J.S. Smith proposed a machine vision system to identify symptom of plant disease. Cotton leaf images enhanced and segmented then set of features extracted toclassify disease. By using shape feature get 55%, texture feature 83% and combination of shape + texture feature get 90% accuracy [8]. Shitala Prasad et al. proposed a multiresolution mobile vision system for plant leaf disease diagnosis. Texture features extracted using gray level co-occurrence matrix and classify disease using k-nearest neighbor with 93% accuracy [9]. Santanu Phadikar et al. develop an automation system to classify rice diseases. Fermy energy based segmentation propose then shape and color feature extracted and classify with rule base classifier with 94.21% accuracy [10]. S. Arivazhagan et al. mask green pixel then texture feature computed of segmented region and classify disease with 94.74% accuracy [11]. Vijai Singh and A.K. Misra develop genetic algorithm for disease detection then texture feature are

used for disease classification using svm classifier with 95.71% accuracy [12].

All the above given methods do not classify diseased and healthy leaf, some detect only disease. Our proposed method classifies healthy and diseased leaf uses three combinational features to improve classification accuracy. Also both bacterial and fungal diseases are considered.

III. PROPOSED METHODLOGY

In existing system agricultural advisor is very costly and time consuming so to overcome this system we proposed the computerized expert system. The proposed system as shown in fig1the method aims to develop an application that classifies plant leaf disease and finds the amount of area affected. This system identifies the disease using shape color and texture extracted using GLCM algorithm. These features are classified using SVM classifier.

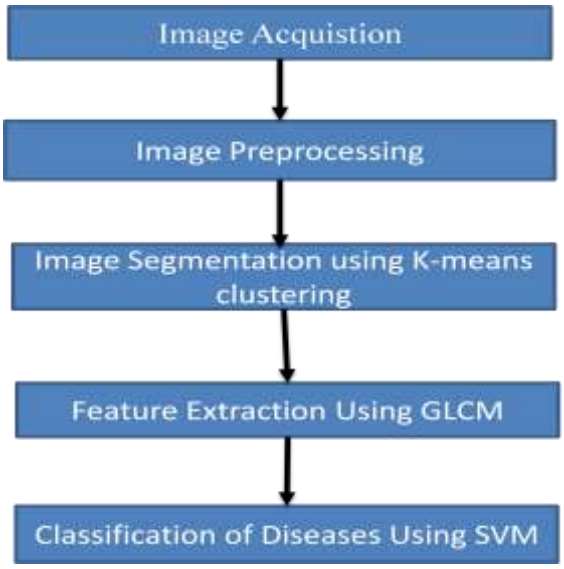


Fig 1 System architecture of Proposed System

A. *Image Collection and Acquisition*

The set of 500 leaf images was collected as dataset. The dataset comprises of 100 each for disease Bacterial Blight, Anthracose, Alternaria Alternata, Cercospora respectively. Also 100 healthy images are collected from an open access repository of images on the plant health.

B. *Preprocessing*

The collected images in RGB color format were converted into L*a*b color space.

C. *K-means Segmentation*

In segmentation the diseased area is extracted using k-means algorithm. The affected area in query image is segmented from the disease affected leaf.

D. *GLCM Feature Extraction*

The GLCM texture features – Contrast, Correlation, Energy and Homogeneity are extracted and stored for all the images. The method includes extracting the GLCM features from the query image and dataset images. Then comparing the feature vectors and computing the distance values. The values help in classification process.

E. *SVM Classification*

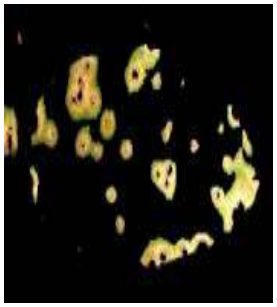
Multi-class SVM is used for classification. It uses a polynomial kernel of third order to implement the classification process.

IV. RESULT AND DISCUSSION

First, the dataset is constructed using 600 images of leaves, with 500 diseased leaves and 100 normal leaves. The images in RGB color format are converted into L*a*b* color space and segmented using K-Means algorithm. The number of clusters is selected as three. Segmentation of diseased leaves using K-Means algorithm after color space conversion. The segmentation of the diseased leaves results in identifying the diseased parts of the leaves. Segmentation of diseased leaves using K-Means algorithm after color space conversion is as shown in the fig 2 (a), (e) and (i) are Input images; (b), (f) and (j) are Cluster 1; (c), (g) and (k) are Cluster 2; (d), (h) and (l) are Cluster 3 segmented images. The segmentation of the diseased leaves results in identifying the diseased parts of the leaves.

(a)

(b)



(c)

(d)

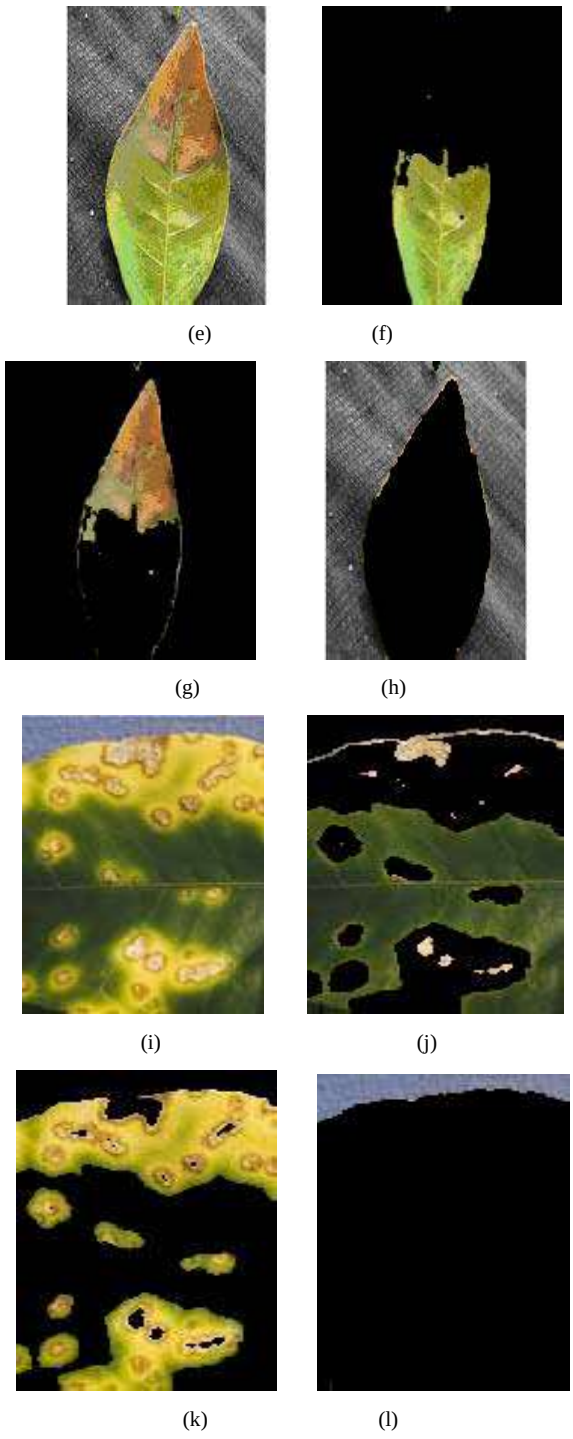


Fig 2(a to l). Segmentation process of diseased leaves using K-Means algorithm after color space conversion.

The classification of the leaves into diseased or not is done by classification using SVM. Classification accuracy of 0.9 to 1.0 is obtained using the proposed method.

V. CONCLUSIONS

The recognition of the disease in leaf images with extracted shape, color and texture features is proposed and presented in this paper. The features were extracted using the gray-level co-occurrence matrix (GLCM) algorithm. This method is designed and tested for texture images then developed for any type of images. Multi-class SVM is used for classification. Recognition accuracy of 90% was achieved for five types of leaf diseases.

VI. FUTURE SCOPE

In agriculture research of automatic leaf disease detection is essential research topic as it may prove benefits in monitoring large fields of crops. The future work is to automate the system and can be implemented as a mobile application. The system can be applied for more crops such as cereals, fruits and vegetables.

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