CLASSIFICATION OF RICE DISEASE USING DIGITAL IMAGE PROCESSING AND SVM CLASSIFIER

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ABSTRACT

The proposed methodology is an approach to identify the mostly occurring disease in rice plant namely Leaf blast using Support Vector Machine classifier (SVM). The images were taken from International Rice Research Institute (IRRI) database. Segmentation is carried out using K-mean clustering algorithm to acquire the infected portion of leaf. The texture feature vectors which were extracted from the segmented images were given as an input to the classifier. The Support Vector Machine is able to classify the disease more accurately (82%) compared to the other classifiers and neural network.

Keywords: IRRI, K-mean, Leaf blast, SVM

I. INTRODUCTION

Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure by accurate diagnosis and timely solution of the field problem. With the recent advancement in image processing and pattern recognition techniques, it is possible to develop an autonomous system for disease classification in crops. Most common rice diseases are leaf blast, brown spot, and leaf blight. We have restricted our work within the rice diseases only and considered the most common diseases in the North India, namely Leaf Blast. The paper has been divided into five sections. Section I deals with Image Acquisition. , Section II consists of Image Pre-processing Section III describes about Image segmentation technique, Section IV deals with Feature selection and Feature extraction and Section V describes about SVM classifier used for disease classification and VI consist of Result analysis and at last conclusion.

II. LEAF BLAST

Blast disease was first found for the first time in California rice. It is generally considered as the principal disease of rice because of its wide distribution and destructiveness and potential to cause more than 50% yield loss when condition is favourable. Blast can affect rice from seedling to maturity stage.

III. CAUSAL ORGANISM

Rice blast is caused by the fungus named Pyricularia Oryzae .The life cycle of the fungus starts when conidia are deposited on a rice plant.

IV. SYMPTOMS

Infection is followed by the colonization of host tissue, and after four to five days the first symptoms are visible to the naked eye. In susceptible host genotypes rapid whitish or grey lesions emerge that often develop a brown margin
and a yellow halo in a later stage. The lesions are elliptical or spindle-shaped. It get spread by wind or by rain splash.

V. FAVOURABLE ENVIRONMENTAL CONDITION

It include extended periods of free moisture on plant surfaces and temperatures at night between 63-73 F with little or no wind and high relative humidity.

VI. PROPOSED WORK

This section includes the brief explanation of the different stages of the image processing and at last classification. The flow of the work is given in fig 1

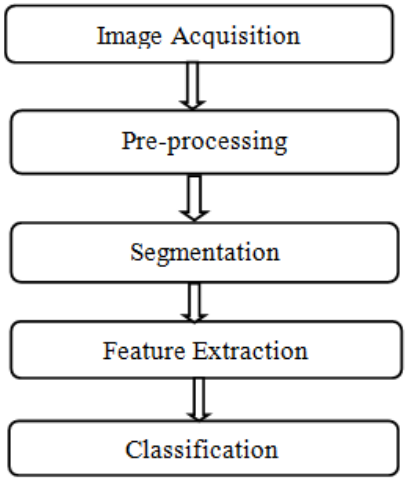


Figure 1: Block Diagram of the Proposed System

6.1 Image Acquisition

The input images of the rice leaf were acquired from the standard IRRI database or can directly be taken from a high
resolution camera to avoid preprocessing overload.

6.2 Preprocessing

Pre-processing deals with filtering of unwanted noise from the acquired image and contrast enhancement in order to acquire a high quality image for the analysis purpose. In the proposed work, preprocessing is carried out using Weiner filter to remove the blurring effect. Adaptive histogram is used in order to carry out contrast enhancement by equalizing the pixel intensity value .After equalization the image edges become more prominent compared to the original image.

6.3 Image Segmentation

K-means clustering is used as segmentation algorithm. Clustering is the process of organizing a set of data points into smaller number of clusters by randomly initializing the cluster head and parameter like Euclidean distance is used to form the clusters. In general, we have n data points xi, i=1...n that have to be partitioned into k clusters. The goal is to assign a cluster to each data point.

K-means is a clustering method, in which the image is clustered into the K- number of clusters which needs to be specified. Consider the positions xi, i=1...n of the clusters that minimize the *distance* from the data points to the cluster head.. K-means clustering is given by (1)

$$\mathbf{J}=\sum_{i=1}^{k}\sum_{x\in Ci}|x-\bar{x_i}|^2 \quad \text{.... (1)}$$

Where x is the point of the data set, $\bar{x_i}$ is the centroid of the *i*-th cluster. The K-means clustering uses the square of the Euclidean distance for clustering.

The algorithm is composed of the following steps:

1. Specify the number of clusters.
2. Randomly initialize the cluster head for each cluster and calculate the distance of each member from the cluster head.
3. Once the initial clusters were generated the member of the clusters then again calculates the Euclidean distance from the different cluster head.
4. If the distance of the members comes closer to other cluster then the members change their cluster and again a new cluster heads were selected per cluster till we get an optimized result

The optimal cluster heads will be calculated by repeating the steps 2 to 4. The iteration will be continued until it converges, that is the difference between the i -th and (i-1) th iteration is very low. This gives a separation between the clusters.

VII. FEATURE SELECTION AND EXTRACTION

Feature selection is the process of selecting the features which can efficiently determine the characteristic of an image followed by feature extraction .In feature extraction the selected features were extracted from the images for classification of the disease. The features have to be selected efficiently in order to reduce the computational complexity.

There are texture features which are taken from the output cluster images :

7.1 Entropy

It gives us information about the spatial arrangement of color or intensities in an image or selected region of an image.

E {k} =entropy (segmented image {k});

7.2 Standard Deviation

It is a measure that is used to quantify the amount of variation of a set of data points. Low standard deviation indicates that the data point tends to be very close to the mean or the expected value of the set.

B {k} = std2 (segmented image {k});

7.3 Classification

Classification is the process of analyzing the various properties of image features and categorizing them into various declared classes.

VIII. SUPPORT VECTOR MACHINE (SVM)

Support Vector Machine which is used as a classifier is a nonlinear classifier which is able to classify the features into two classes. The feature vectors were separated into classes by introducing a hyper plane. The main objective of SVM is to achieve maximum distance between the hyper plane and the class boundary to avoid the misclassification of the vectors into other class .The feature vectors which are present at the border of the class and based on which the distance of the hyper plane is decided are called as support vector.

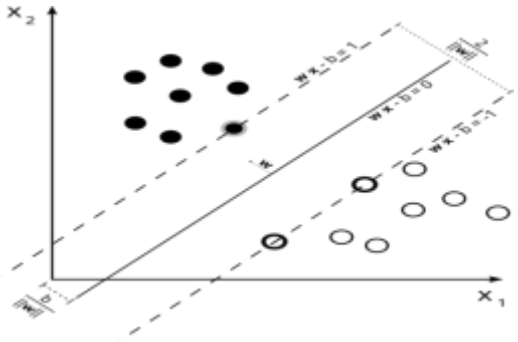
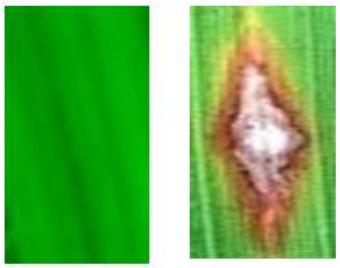


Figure 2: SVM Classification

IX. RESULT ANALYSIS

In this section, the result of the stages involved in detection of the Leaf blast disease was shown:

9.1 Normal and Infected Image



(a) **(b)**

Figure 3: Input Image (a) Normal leaf (b) Infected leaf

9.2 Image Preprocessing

Figure 4: Contrast Enchancement

9.3. Segmentation Output

(a) **(b)**

Figure 5: Segmented Image (a) Normal image (b) Infected image.

9.4. Classification Output

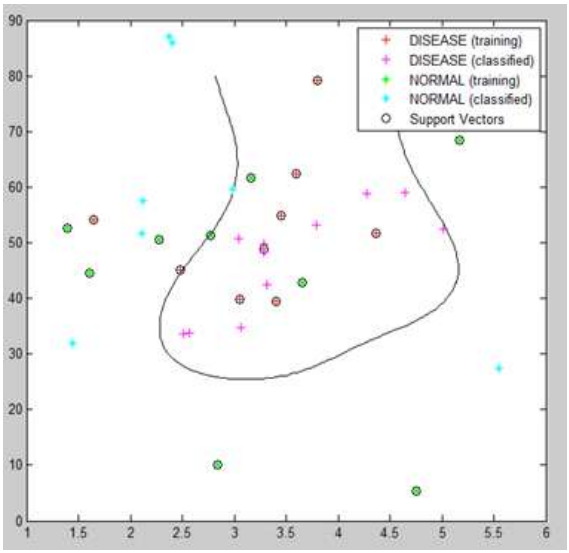


Figure 6: SVM Output

X. CONCLUSION AND FUTURE SCOPE

The proposed work is able to classify the disease more efficiently using SVM classifier (82%) compared to the other classifiers .The future scope of this work is to improvise the segmentation process and to classify the disease using different classifier in order to carry out a comparative study.

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