TEST Engineering & Management

May-June 2020
ISSN: 0193-4120 Page No. 6633 - 6638

Recognition and Classification of Unhealthy Region of Rice Plant Leaves Using Hybrid Glcm-LBP

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Article Info
Volume 83
Page Number: 6633 - 6638
Publication Issue:
May-June 2020

Article History
Article Received: *19 November 2019*
Revised: *27 January 2020*
Accepted: *24 February 2020*
Publication: *18 May 2020*

Abstract:
Image processing techniques are used wide range in agricultural sciences. Rice is the world's most important economical crop. For the crop management it is essential to identify the various diseases of rice plant leaves. Diseases in rice plant causes economic losses and yield losses. So the identification of diseases in initial stages is required. This paper proposes an automatic detection system for the rice plant leaf diseases which includes the following steps, first step is to convert RGB to gray image, preprocessing and K – means segmentation. In the Second step, the hybrid GLCM-LBP is extracting the features from segmented and finally, the Artificial Neural Network is used to classify the diseases. The experimental results of proposed method achieves the classification accuracy of 93.27%

Keywords: *Preprocessing, K-means Clustering, Local Binary Patterns, GLCM, ANN.*

I. INTRODUCTION

In recent times the quality of food and huge production at lower expenditure is the consideration for the agricultural field. The most vital source of crop management is the exact detection and giving timely solution to the problem. Detection of a problem in manually is a very complex task against numerous parameters. The advancement of image processing techniques provides easier solution to these problems. The proposed method described these techniques.

Rice (Oryzae Sativa) is the main cropover 75% of the world. There are number of rice plant diseases occur in the rice growing fields like Bacterial blight, rice blast, sheath Blight, brown spot, bakanae, narrow brown spot, Bacterial leaf streak, Sheath rot, grassy stunt, false smut, etc., Out of these the proposed method takes into account of five diseases namely Bacterial Blight, Rice Blast, Brown Spot, Bacterial Leaf Streak and false smut.

Using the symptoms the disease can be easily identified [1], [3]. The Bacterial Leaf Blight disease is created by the *Xanthomonas oryzaepv. Oryzae. This is infected in the parts of silding wilt, starting at leaf tips and extended to width with a wavy margin During the infection of this disease it appears like a milky or opaque dewdrop on early lesions and the disease is in advance stage lesions turn from yellow to white.* Rice blast disease is produced by the Pricularia Grisea fungus. It causes severe damages in the seedling stage. It affects the distinct parts of the rice plant like leaf blade collar and stem [2].

The affected areas appear as grayish brown lesion and at the sever stage which turns to brown lesions. This destructs highly in rice temperate in lowland and subtropical part of Asia.Brown spot occurred by the Bipolaris Oryza fungus which is visible in the growing times. Brownspots become severe in the silicon-deficient soils. It causes blight of seedlings. Leaf spot is common. These spots are appearing in brown colour in the shape of round to oval looks like sesame seed. It occurs mostly in West Bengal. False smut disease is caused by *Ustilaginoidea virens.*

This infects in a panicle. The velvety spores are grown and enclose the floral parts [2]. And the spores are developed to result broken membrane. In the matured stage spores in orange colour turn into yellowish green or greenish black. **Leaf streak** *is caused by Xanthomonasoryzae* **pv.** *Oryzicola. This is initially small in size, dark green colour with water-soaked translucent streaks on the vein to booting from tillering stage. The lesions are change into brown and bacteria come out in the humid weather.*

G. Zhao and M. Pietikäinen (2007) presented dynamic texture detection and shape localization [4] using local binary patterns. Phadikar and Sil (2008) developed an automatic system for the detection of the infected areas of rice plants[5]. In which they captured the images using digital camera, were applied for various processing techniques to diagnose the infected areas of the plant. Then using neural network of the leaf disease hasbeen classified. Pugoy, R.A and Dr. Mariano, V (2011). Proposed a system to detect the deficiency nutrients and toxic and detection of diseases pin the rice plant leaf [6]. This is implemented using C++ programming language and ImageLab.

Mrunalini et al. [7] proposed the technique for identification and classification of distinct diseases using K means clustering segmentation. In [8] the author described the various image processing techniques and classification methods. Kulkarni et al. presented a neural network based plant diseases detection method [9]. Authors [10][11][12] presented an effective image processing techniques like K-mean clustering, histogram matching and colour analysis for the plant disease detection.

II. PROPOSED METHOD

The Fig. 1 describes the flow model of the proposed method.

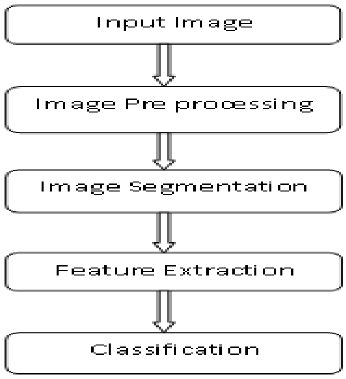

Fig.1. Flow chart of proposed System

A. *Image Acquisition*

The initial step in image processing technique is acquiring of images. The images are collected from the agricultural lands and IRRI website. The different types of input patterns are shown in Fig.1.

Fig. 2. Input Patterns of Diseased Leaf

B. Image Preprocessing

The major goal of image pre-processing is to enhance and improve the image features for succeeding process by eliminating the distortions in the input image. Pre-processing involves the different methods like image resize, filtering, conversion of image, and contrast enhancement. In this method we used the resizing of image, enhance contrast and conversion of RGB to grayscale. This is shown in Fig. 3

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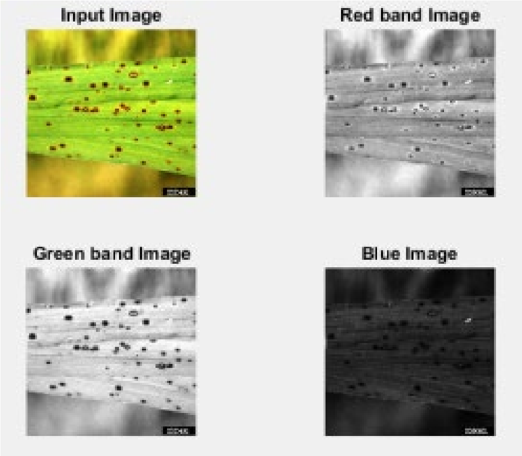

Fig.3: Image Preprocessing

Image Segmentation

This proposed method uses K-means clustering technique for segmentation. In K means clustering algorithm, images are divided into four clusters out of four one has the dominant level of infected areas of the image.

C. K- means clustering Algorithm

K means clustering technique used for segmentation partitions the images into K number of clusters depends on their features. The classification is performed using Euclidean distance is given below.

$$(E.d)^2 = \min\,(\mu_1 - \mu_k)\sum_{i=1}^{i=n}\sum_{j=1}^{j=n}|X(i,j) - \mu^2| \quad (1)$$

$$\mu_k = \frac{\sum_{i=1}^{i=n} P(i)+i}{\sum_{i=1}^{i=n} P(i)} \quad (2)$$

First step in K means clustering algorithm is getting input image. Then RGB image is converted into L*a*b* colour space. After that colours are classified using *a*bcolour space. Using the output of K means, labeling of each pixel is done.. Image is segmented based on colour. Then the infected part of the image is selected. The Fig. (4), (5) and (6) represents the Image segmentation results.

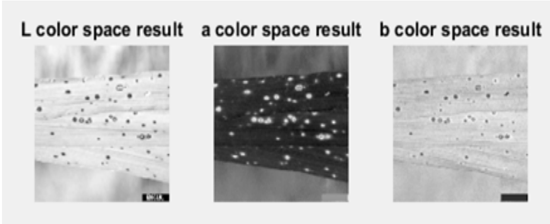

Fig. 4. RGB to LAB Space

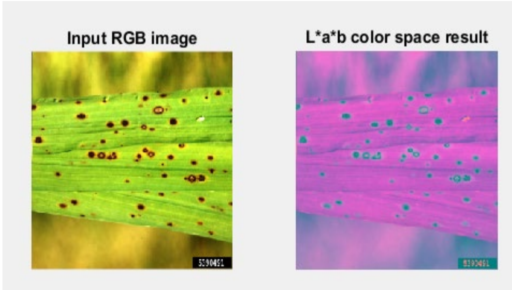

Fig. 5. Images of LAB

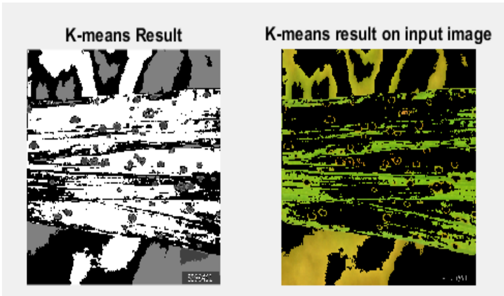

Fig. 6. K Means Result

D Feature Extraction

In the proposed method feature extraction is carried out on using colourand texture patterns. The classification is performed using colour Histogram, Local Binary patterns and GLCM techniques.

i) Colour Histogram

Colour histogram is used to extract the information from the image.Histogram is used to represent the probability of a pixel colour. The distinct number of colour is reduced using uniform normalization and equalization. This is shown in figure 7.

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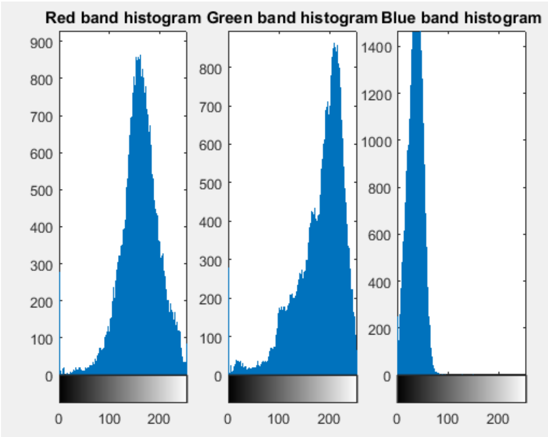

Fig. 7: Colour Histogram output

ii) Local Binary Patterns

A local binary pattern (LBP) isan image classification methods in computer vision. LBP is the powerful texture feature classification. After the LBP code histogram is formed to improve the texture feature detection.Local Binary patterns (LBP) of the input image is computed by the formula

$$LBP = \sum_{x=0}^{n-1} s(V_n - V_c), 2^n s(x) = \begin{cases} 1, x \geq 0 \\ 0, \ x < 0 \end{cases}$$

Where, V_c is the central pixel value, V_n is the neighbors value, After computing LBP foreach pixel, a histogram is produced to denote the texture image

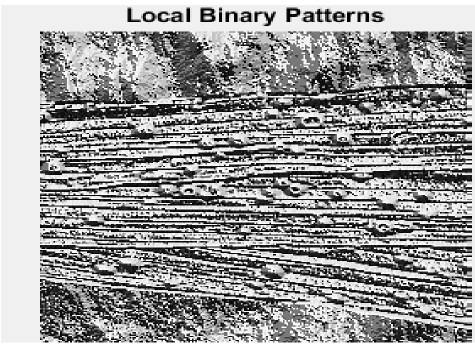

Fig.8: Local Binary Patterns

iii) Gray-level co-occurrence matrix (GLCM)

Gray-level co-occurrence matrix (GLCM) is a texture method of testing the pixel relationship. The statistical features oftexture are described using GLCM. The extracted texture features are mean, standard Deviation, Kurtosis, Skewness, contrast, correlation entropy, energy, homogeneity, variance and RMS.

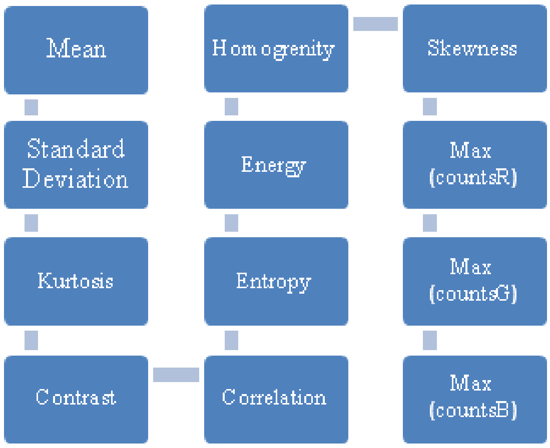

Fig.9. GLCM Features

E. Classification

Classification of diseases is performed using artificial neural network. The classifier consists of three layers. They are input layer, hidden layer and output layer. For that first we train the network with available data. Then the predicted results are compared with known value.The weights of the layers are adjusted according to the predicted result. The figure 10 shows the predicted result of a proposed method.

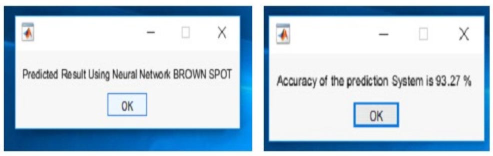

Fig.10. Predicted Result

III. RESULTS AND DISCUSSIONS

The rice plant images with diseases were collected from agricultural gardens and IRRI centreAduthurai, Tamilnadu. 50 images were collected per disease. Using Computer visionmethods these images were analyzed and identified leaf is infected by which type of disease. These plants were also inspected manually checked by the IRRI experts and compared with program output.

The training simulation identification is observed using the figure 1 and this figure shows the epoch 1 with a value of gradient of 0.28781 validation performance. The Figure 12 shows the Confusion Matrix for the given input image.

The Table 1 gives the GLCM feature outputs for the different diseases.

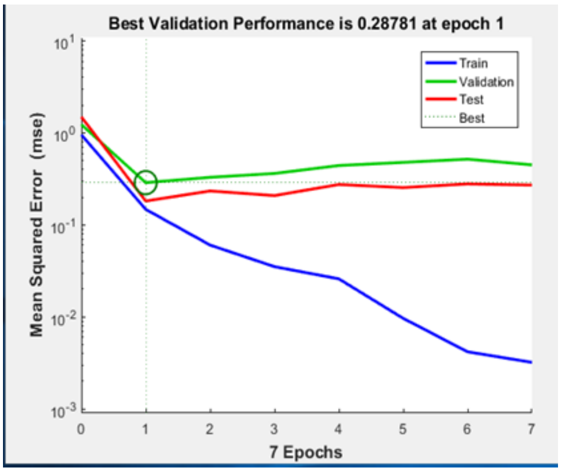

Fig. 11. Validation Result

TABLE1. GLCM feature outputs for Different diseases

Features	Leaf Blast	Brown Spot	Leaf Blight	Leaf Streak	False Smut
Mean	11.6304	38.615	27.6364	69.7613	19.3023
S.D	38.7114	66.27	60.5568	79.4848	52.3012
Entropy	1.45204	3.11612	2.6753	4.08688	1.7012
RMS	5.09746	8.69728	6.77867	9.78723	5.59953
Variance	1442.42	4214.19	2930.13	4714.99	2473.04
Smoothness	1	1	1	1	1
Kurtosis	16.1384	3.7898	7.01916	1.37749	9.36275
Skewness	3.64079	1.4657	2.24697	0.39236	2.72706
IDM	255	255	255	255	255
Contrast	0.331924	1.34741	0.742693	0.824877	0.882368
Correlation	0.865687	0.827008	0.872075	0.910687	0.812269
Energy	0.751517	0.457568	0.586456	0.337912	0.692773
Homogeneity	0.964914	0.929448	0.911421	0.942442	0.94

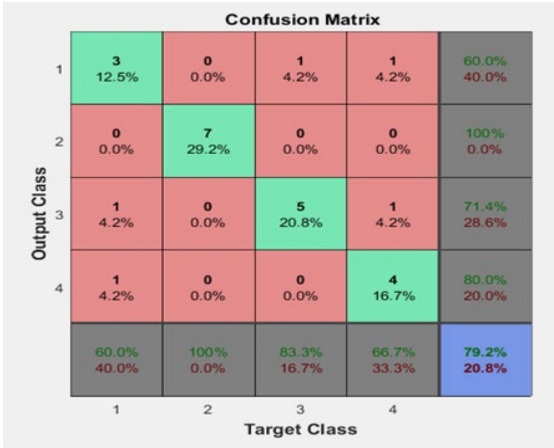

Fig.12. Confusion Matrix

The accuracy of the proposed method is defined as,

$$Accuracy = \frac{Number\ of\ images\ Classified\ correctly}{Total\ number\ of\ tested\ images}$$

The Fig.13 shows the accuracy result of different diseases.

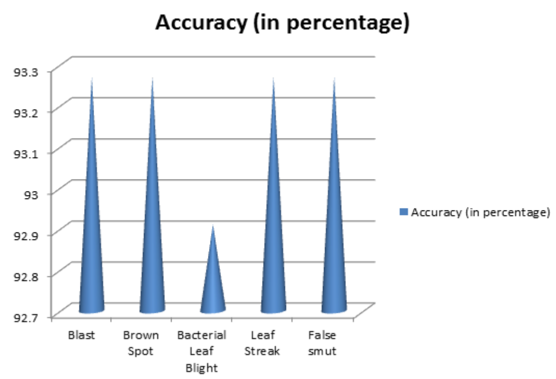

Fig.13: Accuracy Result

IV. Conclusion

The accurate disease identification and classification of the rice plant is the most important for the rice cultivation and this is accomplished using image processing techniques. The proposed method, the diseases present in the rice plant leaf image were easily identified and classified using artificial neural network. The infected parts of the leaves were identified with an accuracy rate of 93.27%.

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