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Project Title: Extraction Rice Blast and Bacterial Blight using Digital Image Processing

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1.1 Abstract:

Rice is the most important food and cash crops in the world. Demand for rice as a major food item continues to increase and it is estimated that we will have to produce 50% more rice by the year 2025. Rice is often infected by some diseases caused by pathogens including fungi, bacteria and viruses. The symptoms of rice diseases, such as rice bacterial leaf blight, and rice blast, appear initially as spots around the infected areas. So, the detection of these diseases mainly relies on their spots. Some different diseases can cause similar spots and the same diseases can cause different spots because of different rice varieties and local conditions. It increases the complexity of identifying rice diseases. Misidentification usually leads to some incorrect control measurements, such as indiscriminate and untimely use of pesticides.

Although farmers can easily identify these diseases based on their early experience, most of the people are shifting to business and other sectors to earn money. Nobody wants to face the challenges of agriculture sector. As a result, the experience of farming will end and will not propagate to further generations. Consequently, detection of these deadly crop diseases is an essential research topic as it may prove useful in monitoring large fields of crops, and thus automatically detect the symptoms of diseases as soon as they appear on crop leaves. To classify these diseases from one another and from their own life cycle stages, Image processing techniques are used. So, the main idea of our project is to identify the disease symptoms of two deadly diseases which majorly occur in rice varieties, that is Rice Blast & Bacterial Blight using image processing methods and stores the data. The data is useful for the future farmers for easy identification and taking respective measures for controlling the disease.

When the RGB images were acquired, processed and compared with this stored data, one can easily identify the amount of infection occurred and can decide the amount of pesticide to be used for recovery of crop from corresponding disease.

1.2 Motivation:

Rice Blast is one of the deadliest diseases occur in rice. According to American Pathological Society Rice Blast is also called as: Pyricularia oryzae, Rice Blast fungus, Rice rotten neck, Blast of rice, Ryegrous Blast, Magnaporthe grisea. It is a significant problem in temperate regions and can be found in areas such as irrigated lowland and upland. Conditions conducive for rice blast include extended periods of free moisture where leaf wetness is required for infection and high humidity is common. Sporulation increases with high relative humidity and at 77-82 degrees, spore germination, lesion formation, and Sporulation are at optimum levels.

Research in agriculture is aimed towards increase of productivity and food quality at reduced expenditure and with increased profit, which has received importance in recent time. One of the vital components of crop management is accurate diagnosis and timely solution of the field problem. Diagnosis is a most challenging task to perform manually as it is a function of many parameters such as environment, nutrient, organism etc. With the recent advancement in image processing, it is possible to develop an autonomous system for disease classification of crops. Usage of various pesticides for controlling the diseases damages the rice field.

Furthermore, it is difficult to identify this disease using manual information. While giving information the person may be misguided by color and shape variations will leads to unwanted results. The research reported in this thesis an attempt to improve some of the existing algorithms and develop new techniques to facilitate accurate, fast and reliable computer based diagnosis of Rice Blast and Bacterial Blight diseases.

1.3 Objective:

The main aim of our project is to identify Rice blast and Bacterial Blight at its early stage so that we can increase production of rice. A computer-based system for identification of these diseases provides quantitative and objective evaluation of different lesions versus the subjective human assessment. It helps to extract the features of diseased part so that excessive usage of pesticides can be reduced. As a result, production will be increased.

2.1 Block diagram & Working:

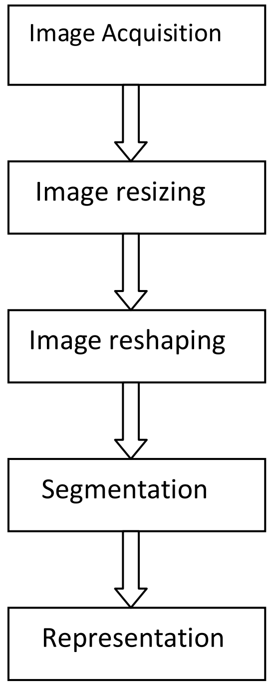


Figure 2.1: Block diagram of Otsu method

2.1.1 Image acquisition

The first stage of any vision system is the image acquisition stage. After the image has been obtained, various methods of processing can be applied to the image to perform many different vision tasks required today. However, if the image has not been acquired satisfactorily then the intended task may not be achievable, even with the aid of some form of image enhancement.

2.1.2 Image Resizing

Image Interpolation occurs when you resize or distort image from one-pixel grid to another. Image resizing is necessary when you need to increase or decrease the total number of pixels, whereas remapping can take place when you are correcting for lens distortion or rotating an image. Zooming refers to increasing the quantity of pixels, so that when you zoom an image you can see more detail.

2.1.3 Image Reshaping

A multi-spectral image is a collection of several monochrome images of same scene, each of them taken with a different sensor. Each image is referred to as band. A well-known multispectral is an RGB color image, consisting of a red, a green, a blue image, each of them taken with a sensor sensitive to a different wavelength. In image processing, multi-spectral images are most commonly used for remote sensing applications. Satellites usually take several images from frequency bands in the visual and non-visual range. Land sat 5, for example, produces 7 band images with the wavelength of the bands being between 450 to 1250nm. All the standard single-band image processing operators can also be applied to multi-spectral images by processing each band separately. For example, a multi-spectral image can be edge detected by finding the edges in each band and then combine the three-edge image together. However, we would obtain the more reliable edges, if we associate a pixel with an image based on its properties in all three bands and not only in one. To fully exploit the additional information contained in multiple bands, we should consider the image as one multi-spectral image rather than a set of monochrome gray level images. Special techniques exist to process multi-spectral images. For example, to classify a pixel belonging to one region, its intensities in the different bands are said to form a feature vector describing its location in the k-dimensional feature space.

The disadvantage of multi-spectral images is that, since we must process additional data, the required computation time and memory increases significantly. However, since the speed of hardware will increase, and the cost of memory will decrease in future, it can be expected that multi-spectral images will become more important in many fields of computer vision.

2.1.4 Segmentation

Thresholding is the process of classifying the pixels of a grayscale image into two classes, so that the image can be converted to binary by assigning each pixel either 0 or 1, depending on its gray-level.

2.1.5 OTSU Model

The thresholding procedure used in this paper is based on well-known OTSU's thresholding method.

Methodology of OTSUs Model

The basic premise of this method is the assumption that an image contains two clusters of pixels, e.g. foreground and background, which, in our case corresponds to the lesion and its surrounding leaf. Because the ease of implementation and the relative complexity, Otsu threshold is used in many applications from medical imaging to low level of computer vision, it is based on the threshold for portioning the pixels of an image into two classes. To identify these two clusters accurately, an algorithm is used to search for an optimal threshold level using discriminant analysis, where zeroth and first-order cumulative moments of histogram are calculated and used to define method of separability between two clusters. An optimal threshold level separating the two clusters is obtained by minimizing the within cluster variance (σ_ω^2), which is defined as the weighted sum of variances of the two clusters:

$$\sigma_\omega^2(t)=\omega_1(t)\sigma_1^2(t)+\omega_2(t)\sigma_2^2(t)$$

where weights ω_i are the probabilities of the two clusters separated by a threshold t and σi2 denotes the variance of the clusters. It can be shown that minimizing the within cluster variance (σω2) is equivalent to maximizing between cluster variance. The between cluster variance (σb2) is recalculated in Otsu method as following:

$$\sigma_b^2(t)=\sigma^2-\sigma_\omega^2(t)=\omega_1(t)+\omega_2(t)[\mu_1(t)-\mu_2(t)]^2$$

where μ_i is the mean values of the two clusters. Starting from an initial threshold value of t=1, ω_i and σ_i^2 are updated iteratively and in each iteration σ_b^2 (t) is calculated. The optimal threshold corresponds to the maximum value of σ_b^2 (t). The output binary image has values of 1 for all pixels in input image with luminance greater than the threshold level and 0 for the remaining pixels.

2.1.6 K-Means clustering

K-Means is the simplest unsupervised learning algorithm is to solve a well-known clustering problem. The procedure follows as simple and easy to classify a given data set through a certain number of clusters. The main idea is to partition into k clusters.

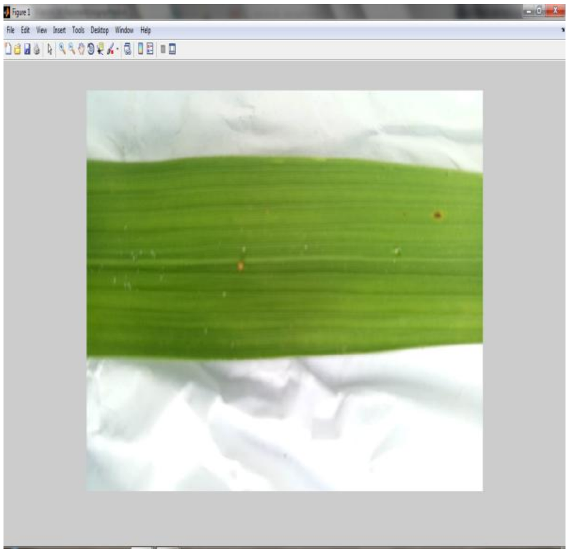
2.1.7 Representation

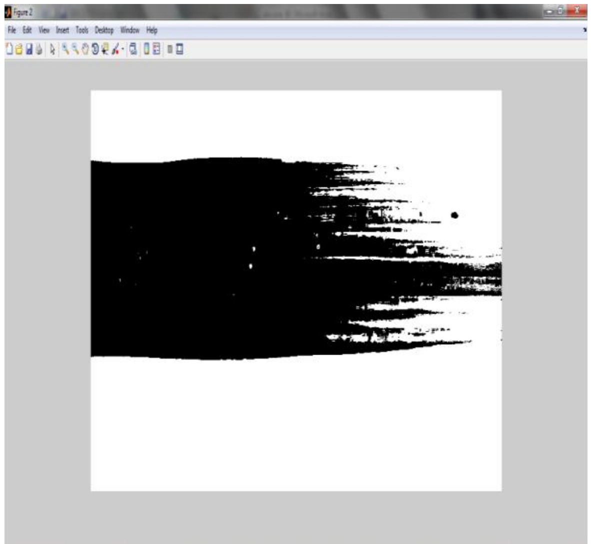
The segmented image is represented as binary image in OTSU thresholding whereas in K-Means clustering the segmented image clusters are represented in colors for clear understanding of disease effected regions.

2.2 Technical Specifications

- MATLAB 2013a
- Computer with minimum configuration of 1GB RAM, Pentium Processor, 16GB Hard Disk with Windows XP (Service Pack3)

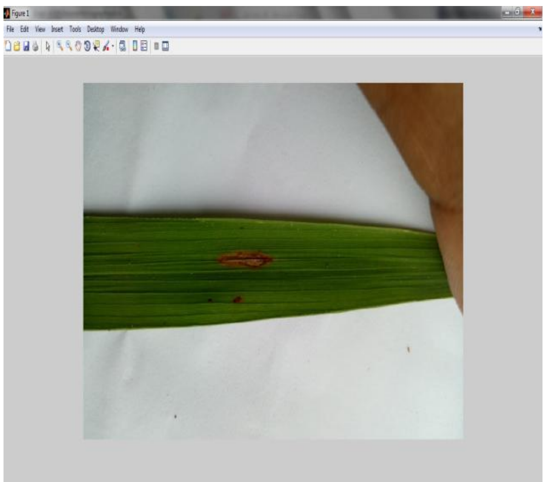
2.3 Results & Analysis:

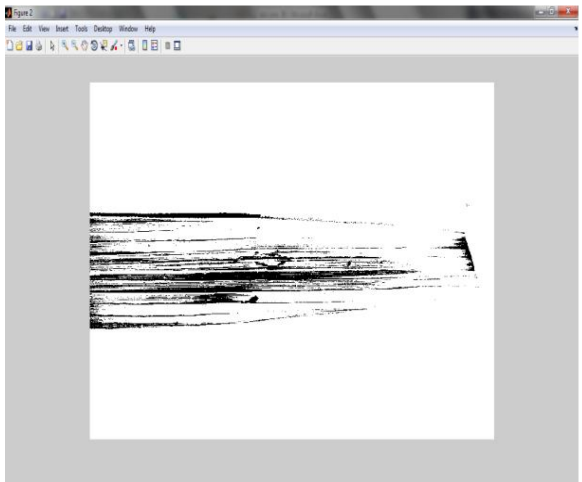




(a) (b)

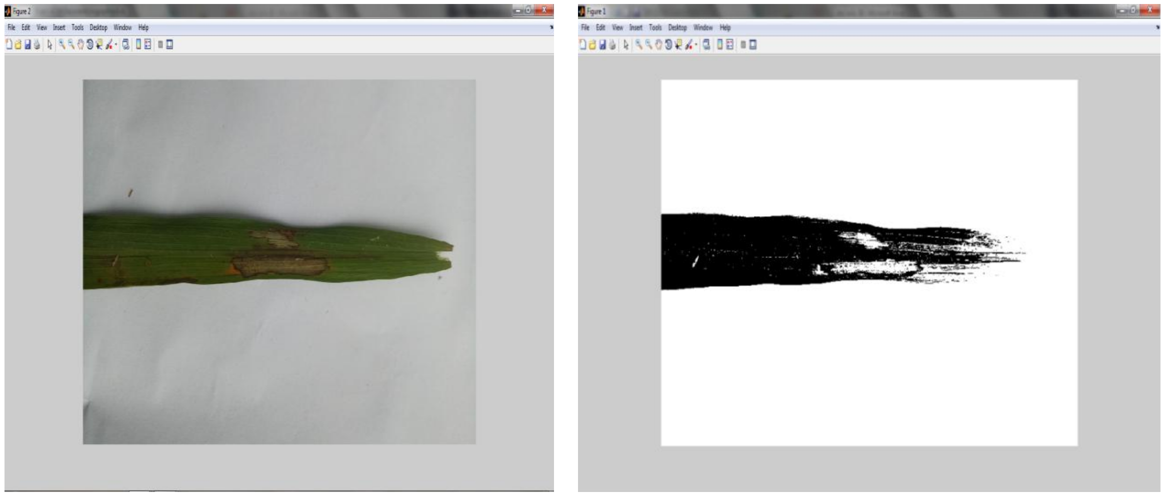
Figure 2.2 (a) Disease infected leaf in first stage (b) Segmentad image of input image in first stage (tval = 0.5273[for 20])





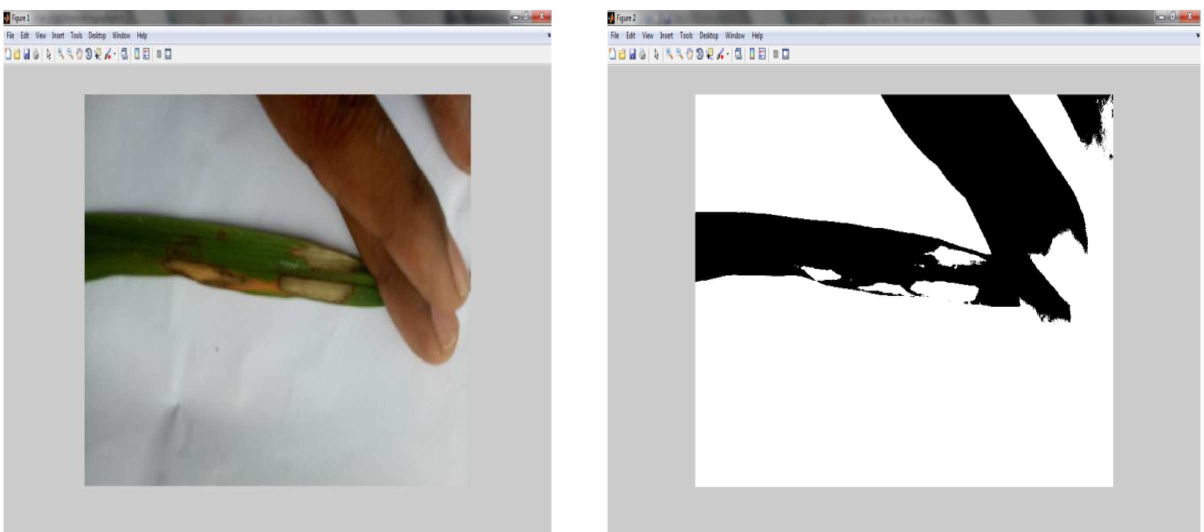
(a) (b)

Figure 2.3: (a) Disease infected leaf in Second stage (b) Segmentad image of input image in secondstage (tval = 0.1758[for 75])



(a) (b)

Figure 2.4: (a) Disease infected leaf in third stage (b) Segmentad image of input image (tval = 0.2461[for 50])



(a) (b)

Figure 2.5: (a) Disease infected leaf in final stage (b) Segmentad image of input image in final stage (tval = 0.3281[for 40])

Results of Clustering Algorithm

Rice Blast

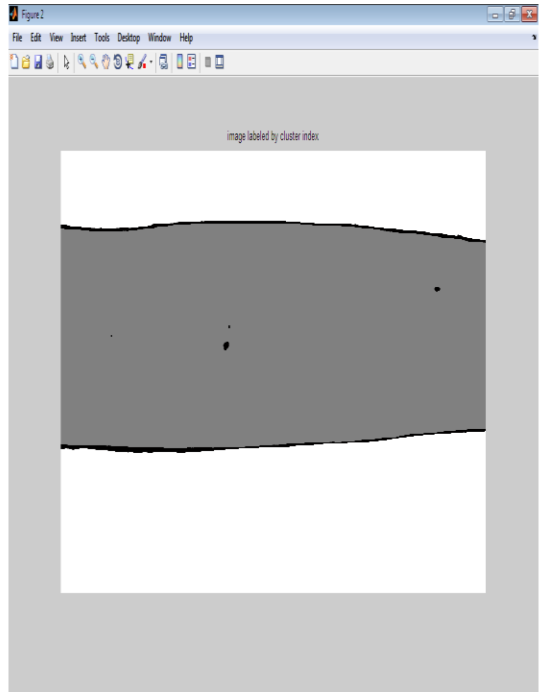


Figure 2.6 : Disease infected image of first stage

Figure 2.7: Cluster indexed image

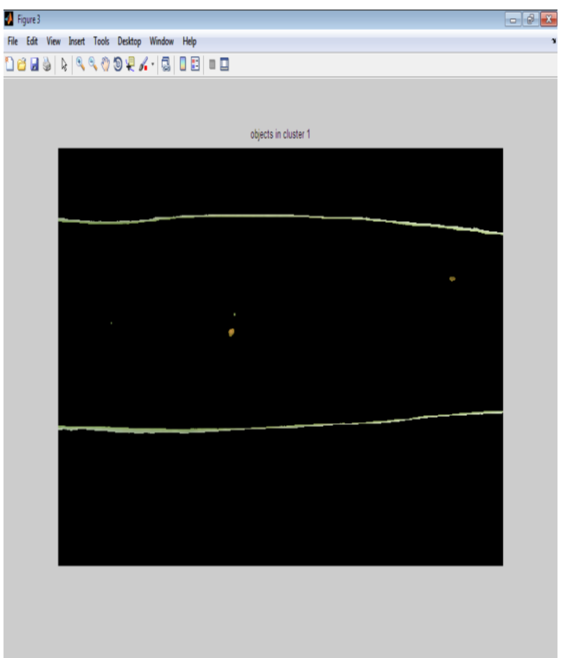


Figure 2.8: Image of 1st cluster

Figure 2.9: Image of 2nd cluster

Figure 2.10 Image of 3rd cluster

Figure 2.11: Second stage

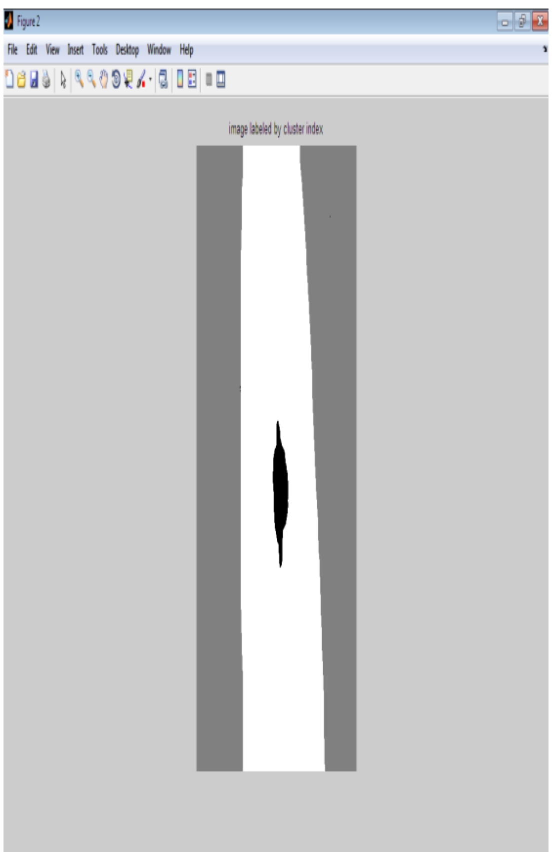


Figure 2.12: clustered index image

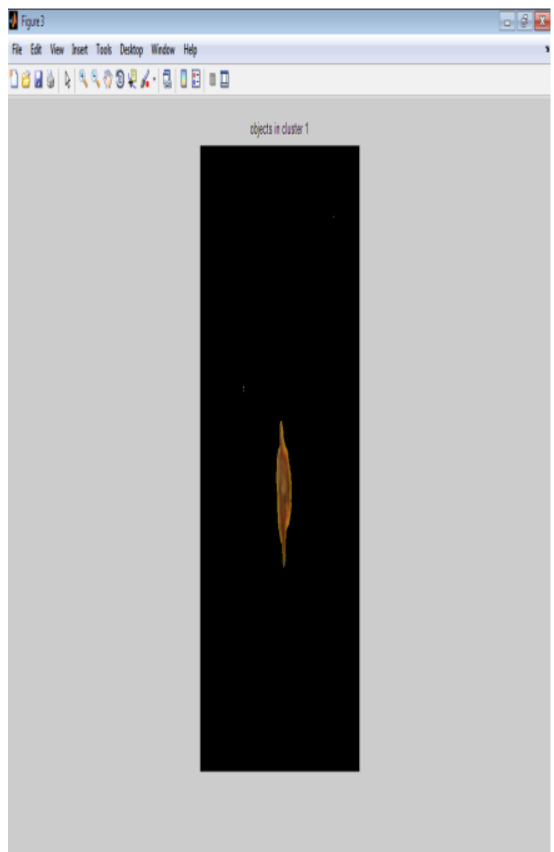


Figure 2.13: Image of 1st cluster

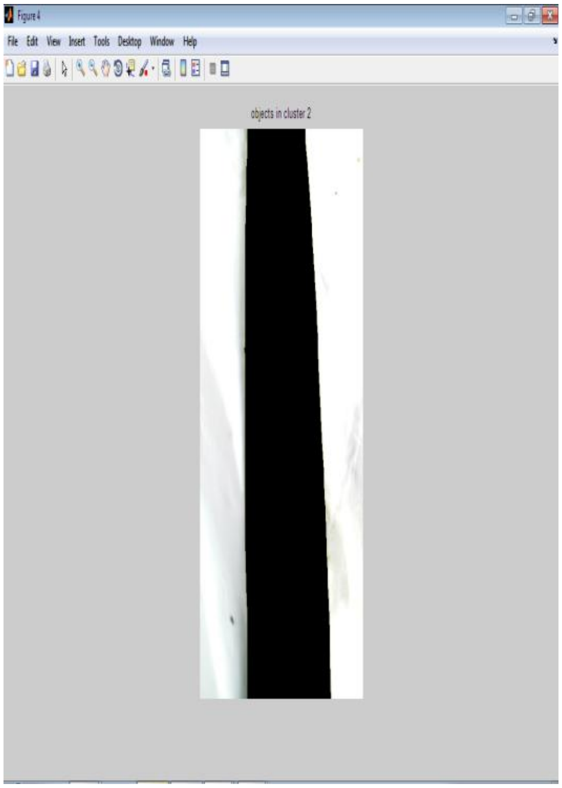


Figure 2.14: Image of 2nd cluster

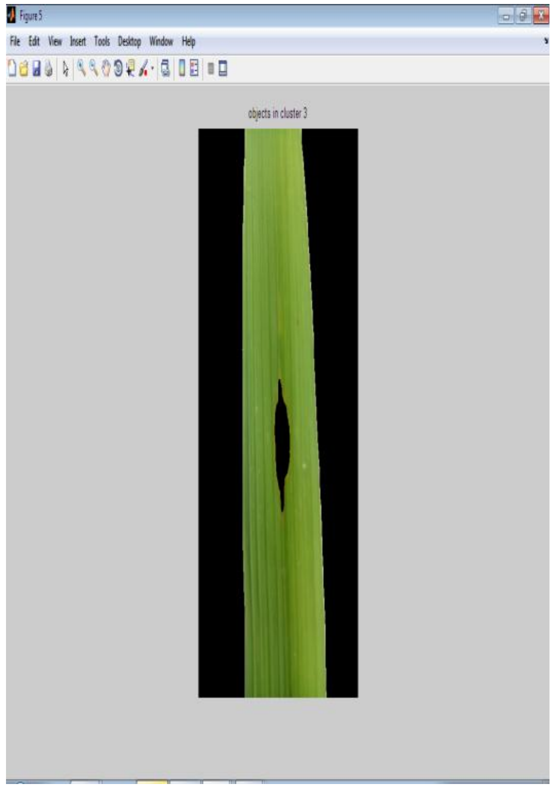


Figure 2.15: Image of 3rd cluster

Figure 2.16: Third stage

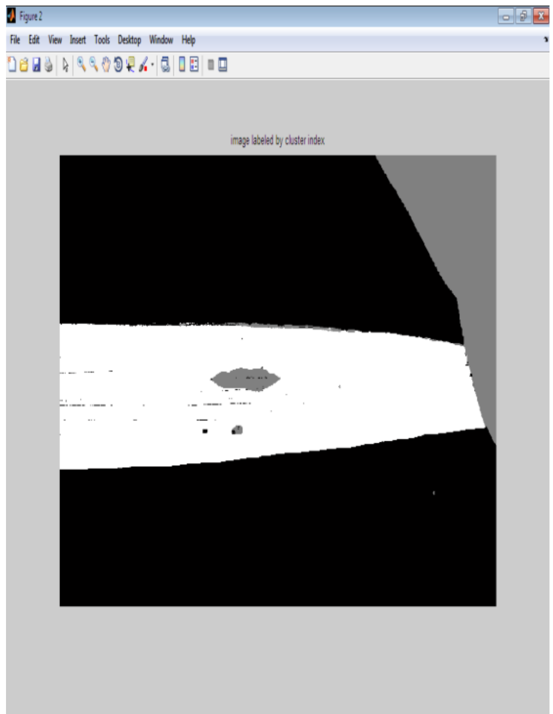


Figure 2.17: clustered index image

Figure 2.18: Fifth stage

Figure 2.19 : Clustered index image

3.1 CONCLUSION:

Hence image-based computer aide diagnosis systems have significant potential for screening and early detection of Rice blast and Bacterial Blight. We review the state of the4 art in these systems and the art in these systems and examine current practices, problems, and prospects of image acquisition, preprocessing, segmentation of the rice diseases.

Hence the results obtained by the proposed method segmentation of Rice Blast and Bacterial Blight using K-Means clustering algorithm which is the computer based diagnosis of these deadly diseases provides better and accurate results than the OTSU multilevel thresholding method.