Rice Leaf Blast Detection using on-Field Image of Western tract of Odisha based on Image Processing

Prabira Kumar Sethy, Soubhagya Lina Dash, Nalini Kanta Barpanda, Amiya Kumar Rath

Abstract-Rice covers about 69% of the cultivated area and is the major crop, covering about 63% of the total area under food grains. It is the staple food of almost the entire population of Odisha; therefore, the state economy is directly linked with improvements in production and productivity of rice in the state. The main barrier of production of rice in this region is the rice leaf blast (RLB). So monitoring of RLB is necessary time to time. This paper presents a novel segmentation method to detect RLB using on-field image, which is combination of channel extraction, thresholding and masking.

Keywords: Rice Leaf Blast Detection, Image Processing Technique, Image Segmentation.

I. Introduction

In Odisha, rice is grown under highly diverse ecosystems and a wide range of climatic conditions. Rice forms the major crop of all the agro-climatic zones of the state and is the staple food of almost the entire population of Odisha. Therefore, the state economy is directly linked to the improvement in production and productivity of rice in the state [1]. Once considered the rice bowl of the state, Bargarh district in western Odisha is now facing an agrarian crisis. A major part of western odisha rice cultivated field ruined by RLB. Disease can infect paddy at all growth stages and all aerial parts of plant (Leaf, neck and node).Among the three leaves infections are more severe. RLB is caused by *Magnaporthe grisea* a filamentous ascomycetes fungi [2]. Infection occurs on leaves during vegetative phase and on panicles and neck during reproductive phase of the crop resulting in significant loss in yield and grain quality [3].

Rice leaf blast first appears as pinhead-sized grayish dots that enlarge into spindle-shaped spots with brown margins and gray centers. When numerous spots occur on leaves, the results are leaf blight, drying of the leaves and plant, and death [4]. To avoid losses of rice crop due to RLB it is essential to monitor the rice field time to time. As physical verification of RLB is cumbersome an automatic methodology is the best scope for monitoring. Many researchers reported several techniques in the last decade to detect the Rice Blast based on image processing techniques. T. Gayathridevi et al. [5] reported an automated rice leaf disease detection method. The five rice leaf diseases with 1000 number of samples were considered for experimentation in the region of Thanjavur, Tamilnadu, India. Here three hybrid technique such as DWT, SIFT & GLCM were used for feature extraction. Then different classifier such as KNN, Naïve Bayes', ANN & SVM were used for identification of diseases. Finally it concluded that SVM is performing better than other classifier with accuracy of 98.63%. The affected area of brown spot & leaf scald diseased in rice leaf was determined using K-means clustering[6] and again by introduction of fuzzy logic with k-means segmentation the severity of disease is calculated & categorized in four classes [7]. T. Islam et al. [8] reported a faster rice disease detection technique. Green pixel masking and Naïve Bayes' classifier with accuracy of 89%, 90% & 90% respectively do the detection of bacterial blight, rice brown spot & rice blast. S. Phadikar and J.Goswami [9] proposed classification technique of two rice diseases namely brown spot & leaf blast. The vegetative index (VI) based segmentation used to isolate infected part from the rice leaf. Then LibSVM classify the two diseases by considering six texture features and achieved 84% of accuracy. An automated system was developed by Pugoy and Mariano [10] to identify leaf scald & brown spot diseases in rice crop based on image processing library. The algorithm converts RGB to HIS and then the pixel make grouping using K-means clustering. Then the test image compared & matches Color with the library image to predict the respective diseases. Qing Yao et al. [11] developed an application based on image processing and Support vector machine (SVM) to identify three rice diseases i.e. Rice bacterial leaf blight (RSLB), Rice sheath blight (RSB) & Rice blast (RB). The diseased leaf images are collected by using Nikon D80, 10.2 Megapixel cameras with 18-200 mm lens. The all captured image are maintained to a standard resolution of 800pixel ×600pixel. Then the standard RGB image are transformed into two channel y1 & y2 (y1=2g-r-b, y2=2r-g-b) and segmented using Otsu method. The support vector machine (SVM) classifier was used to identify the diseases by using 64 numbers of features (4 shape feature & 60 texture feature). The experiment was conducted by using 216 numbers of samples i.e. 108 numbers for training & 108 numbers for testing purposes and achieved 97.2% of accuracy. Fermi energy based segmentation was reported by S. Phadikar et al. [12] to separate the infected part from the entire leaf. For classification shape &color feature are considered. Then Rough set theory (RST) was used for feature selection and finally rule based classifier identify the four diseases i.e. leaf blast, brown spot, bacterial

Revised Manuscript Received on December 22, 2018.

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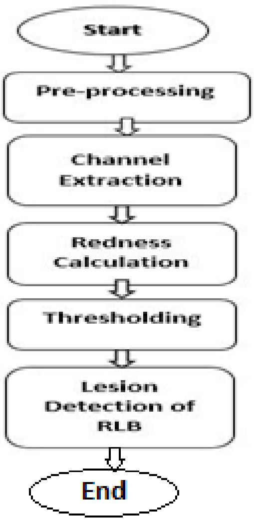
blight & stem rot. After studied above research paper we came to know that till date on-field images of rice crop were not used for experimentation. All images used for detection and identification are specially captured & covert to a particular format for analysis purpose. So here we used on-field image to detect RLB based on image processing techniques.

II. METHODOLOGY

The images are collected from different parts of Sambalpur & Bargarh, the major rice producing district of western odisha, India. The RLB has been detected using on-field images through execution of following steps and illustrated in flow chart 1.



Flow Chart 1. Steps of detecting lesion of RLB.

A. Image Collection

The images were captured using DSLR of Canon EOS 1300D with lens (55-250) mm from five different places of western tract of Odisha i.e. Attabira(longitude:83.7748,latitude:21.3717),Dhanakauda(longitude:84.1627,latitude:21.51532),Bhoitikira(longitude:85.745390,latitude:20.968730),Saranda(longitude:86.386612,latitude:22.266991),Attabira (longitude: 83.782660,latitude: 21.371950) and Bargarh (longitude:83.643300, latitude). The samples of RLB on-field images are shown in figure

Figure.1 Rice Leaf Blast on-field Images.

B. Pre-processing

A total of 250 numbers of images were collected from five places of western tract of odisha. Around 50 images of each place were collected on 31st September 2018 in between 9AM to 3PM. All images were transformed to a size of 640×480 pixel for further processing.

C. Channel Extraction

The RGB image was split in to 3 channel i.e. R channel, G channel & B channel. Here RGB color model is chosen, so, three channels such as red, green and blue channels are extracted separately, which one is the primary process of segmentation [13].

D. Redness Calculation

After extracting individual channel we only focus to calculate redness in the image. But the challenge is that a pixel having red component is necessarily red and it is only possible when other color component are low. To get the red pixel only, red component is high and other color component are low which only possible by executing equation 1 [14].

$$r = R - \max(G, B) \qquad (1)$$

The concept of getting red pixel only is simplifying by considering six number of pixels. Here in all the six pixels have red, green & blue component within 0 to 255. In pixel 4, high red component is present but also present the green & blue. Similarly in pixel 5 & 6 high red component is present but also high blue and high green component are present respectively. So by operation of equation (1), the pixels which consists of other non-zero component besides red component results negative or, zero value of red pixel. It implied green and blue color component have

non-effective after execution of equation (1) and only red pixels are present.

Pixel 1 (0,255,255) →	-255
Pixel 2 (0, 255, 0) →	-255
Pixel 3 (255, 0, 0) →	255
Pixel 4 (255,127,127) →	128
Pixel 5 (255, 0,255) →	0
Pixel 6 (255, 255, 0) →	0

E. Thresholding

After extracting the red pixels, thresholding is applied i.e. the intensity of red pixel should be less than 40-45. Thresholding is applied to differentiate the infected part of rice crop from other part. The threshold value is set in between 40- 45 so, that the mature grain and ripen rice leaf are not predicted as RLB.

III. RESULTS AND DISCUSSION

The performance of proposed methodology is experimented by eight different imaging condition. Fig. 2 show the image of healthy rice crop, its redness and results no lesion of RLB found. Fig. 3 is the image of healthy rice crop which also contain panicle and results no lesion of RLB. Fig. 4 is a blur image of rice crop, affected by RLB and the proposed methodology successfully detected the lesion of RLB. Fig. 5 is a dark image of rice crop affected by RLB and detect the lesion of RLB. Fig.6 is a dense rice crop image, affected by RLB and detect the lesion of RLB. Fig.7 is a high intensity image of rice crop, affected by RLB and detect the lesion of RLB.Fig.8 is a rice crop image which is very less affected by RLB and this case also the proposed methodology successfully detect the lesion of RLB. Fig. 9 is occluded rice crop image, affected by RLB and detect the lesion of RLB. So the proposed methodology have capability to detect the lesion of RLB in all condition of image

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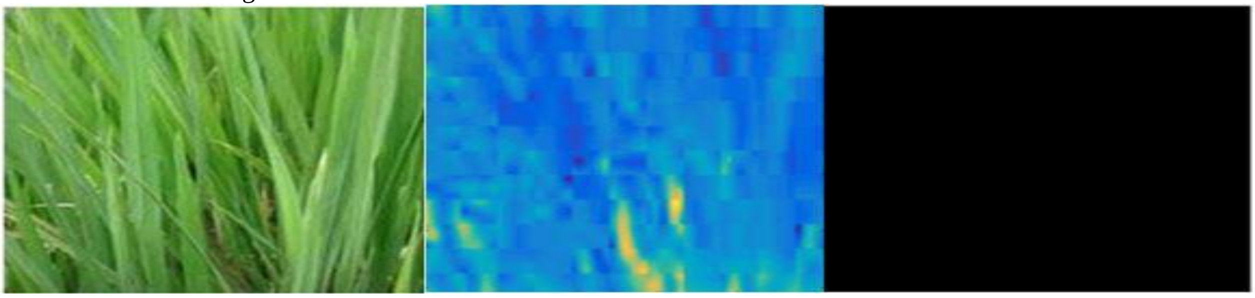
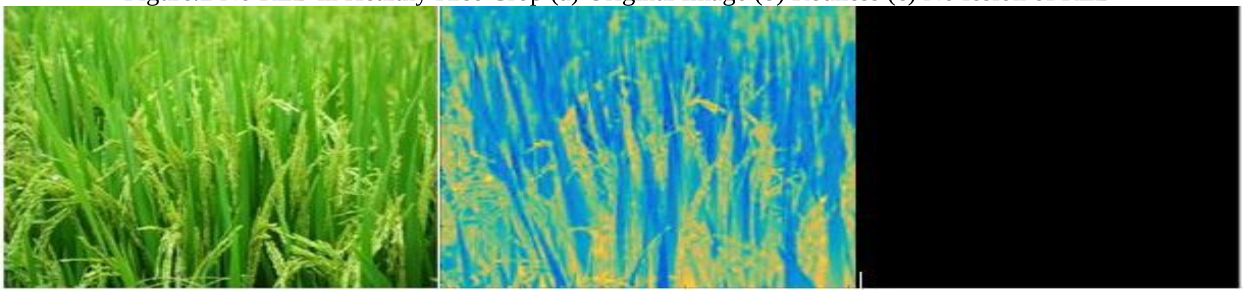
acquisition and degree of RLB affected.



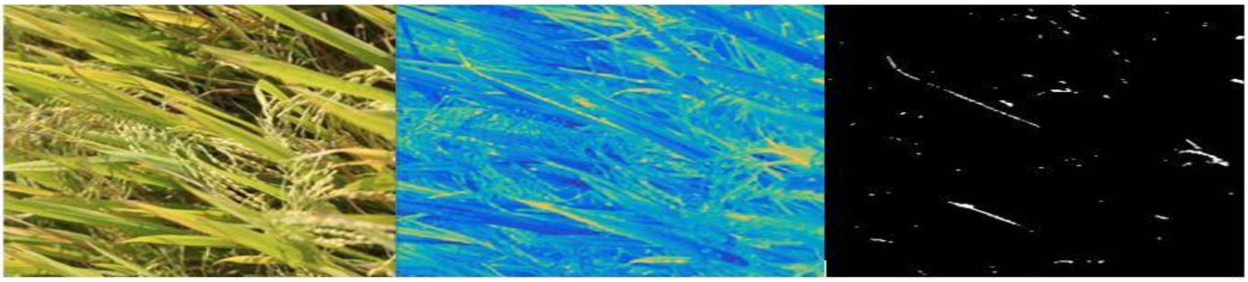
(a) (b) (c)

Figure.2 No RLB in Healthy Rice Crop (a) Original Image (b) Redness (c) No lesion of RLB



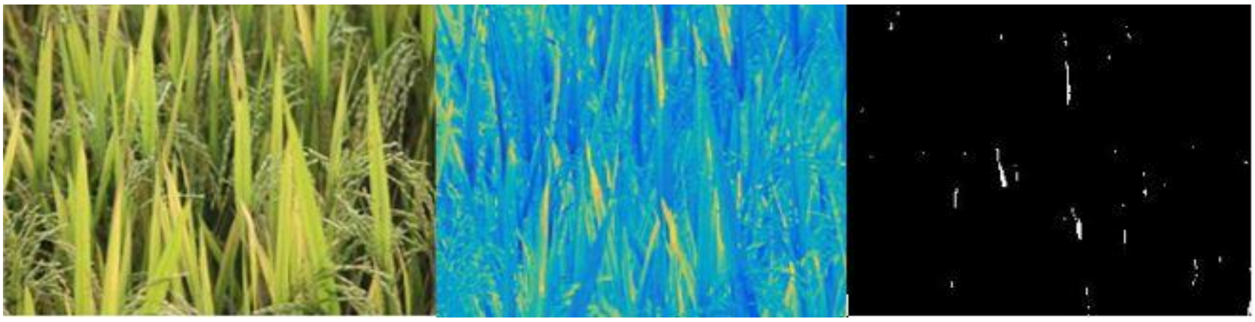
(a) (b) (c)

Figure.3 No RLB in Heathy Rice Crop with panicle (a) Original Image (b) Redness (c) No Lesion of RLB



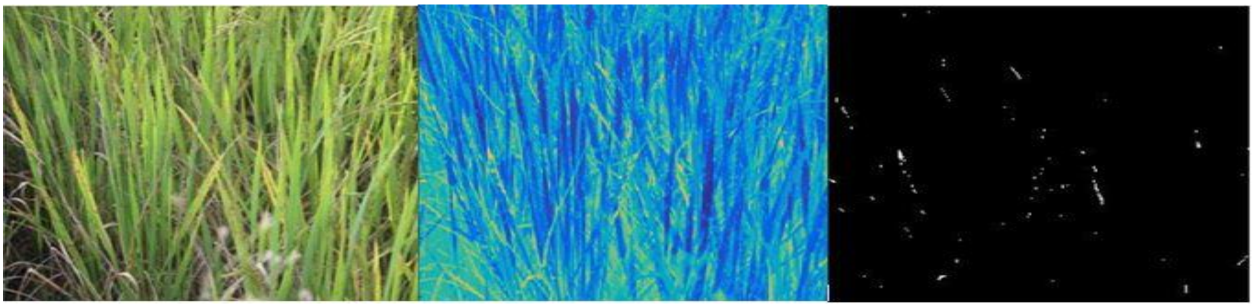
(a) (b) (c)

Figure.4 Blur Image of Rice Crop (a) Original Image (b) Redness (c) RLB lesion



(a) (b) (c)

Figure.5 Dark Image of Rice Crop (a) Original image (b) Redness (c) RLB Lesion found



(a) (b) (c)

Figure.6 Dense Rice Crop Image (a) Original Image (b) Redness (c) RLB Lesion Found

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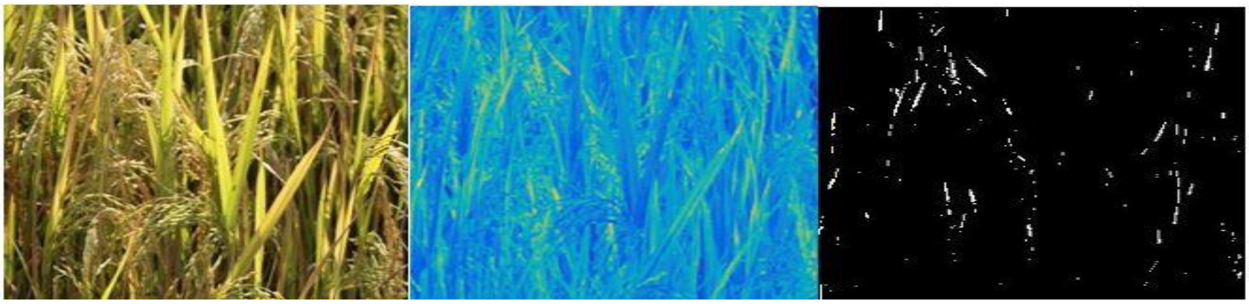
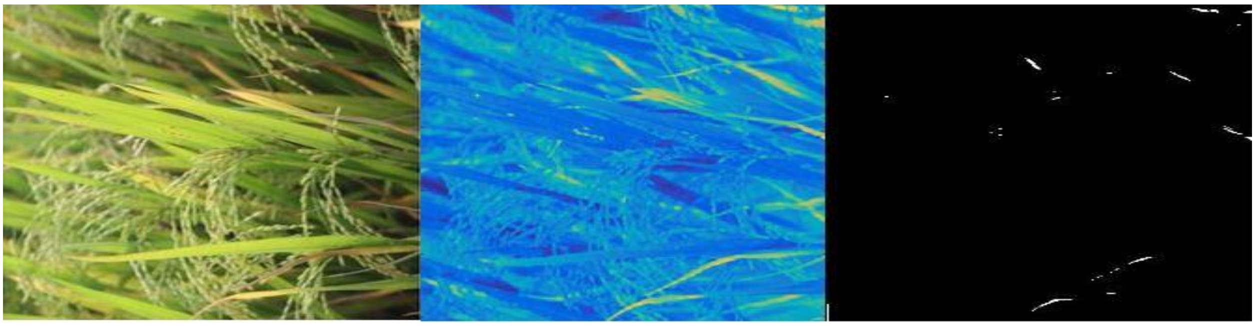


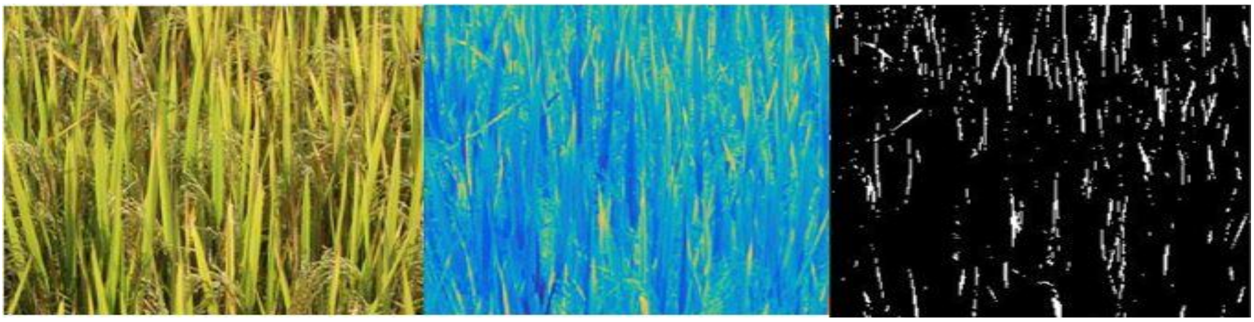
(a) (b) (c)

Figure.7 High Intensity Rice Crop Image (a) Original Image (b) Redness (c) RLB Lesion found



(a) (b) (c)

Figure.8 Very Less RLB affected Rice Crop Image (a) Original Image (b) Redness (c) RLB Lesion found



(a) (b) (c)

Figure.9 Occluded Rice Crop Image (a) Original Image (b) Redness (c) RLB Lesion foundIV.

IV. CONCLUSION AND FUTURE SCOPE

Segmentation techniques used in image segmentation especially on color image using RGB model have been represented in this paper. The methodology is successfully detected RLB lesion using on-field image with all condition of image acquisition and degree of RLB affected. The supremacy of proposed methodology, the RLB is detected using on-field images. This work can further extended for identification and severity measurement of different diseases of rice crop using on-field images by take account the shape of lesion.

ACKNOWLEDGEMENT

The authors are thankful to Yogesh Bhitiria, Bhabya Swarup and Debashis Palai the BTech student of Sambalpur University Institute of Information Technology (SUIIT) for their kind cooperation for collecting the sample images.

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