IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Issue-5, May 2019 E-ISSN: 2347-2693

Rice Panicle Blast Detection and Grading Based on Image Processing Techniques

Prabira Kumar Sethy[1*], Swaraj Kumar Sahu[2], Nalini Kanta Barpanda[3], Amiya Kumar Rath[4]

[1,2,3]Department of Electronics, Sambalpur University, Burla, India-768019
[4]Department of Computer Science and Engineering, VSSUT, Burla, India-768017

Corresponding Author: prabirsethy.05@gmail.com

DOI: https://doi.org/10.26438/ijcse/v7i5.165168 | Available online at: www.ijcseonline.org

Accepted: 12/May/2019, Published: 31/May/2019

Abstract- The disease in rice crop reduced the quality and quantity of production and mostly affect in leaf and panicle. The disease affect to the panicle is more severe than the other part of the paddy crop as it directly hampers the production. Detection and grading of rice panicle blast is required as prior condition for rice disease controlling. In this study, a novel detection and grading method for panicle blast based on imaging processing is proposed. The methodology contain some morphological operation like binary indexing, color conversion, channel extraction, Binarization and area calculation.

Keywords- *panicle blast; detection; grading; image processing.*

I. INTRODUCTION

Agriculture is the mainstay of the Indian economy. Agriculture and allied sectors contribute nearly 17.8 and 17.1 per cent of Gross Domestic Product (GDP of India) during 2007-08 and 2008-09 respectively. The agricultural output, however, mainly depends on monsoon, as nearly 55.7 percent of area sown is dependent on rainfall. An all-time record in production of food grains of 233.88 million tonnes is estimated in 2008-09 as per 4th Advance Estimates. The production of rice is estimated at 99.15 million tonnes [1]. Rice blast diseases caused production losses of US$55 million each year in South and Southeast Asia [2]. It is distributed in 85 countries. Damage is mainly influenced by environmental factors [3]. The rice blast disease is caused by the fungus Pyricularia grisea, which, in its sexual state, is known as Magnaporthe grisea. Some of the main type of rice blast diseases are Leaf blast, Collar Rot, Neck Rot and Panicle Blast, Node infection etc. Among all rice blast, panicle blast is dangerous because it affect in reproductive phase and hamper the quality & quantity of grain. Computer vision is a rapid, economic, consistent and objective inspection technique, which is non-destructive method of inspection, has found applications in the agricultural and food industry, including the inspection and grading of fruit and vegetable. Many researcher including our research team working on rice disease detection and identification based machine learning and image processing [4-9]. The ability to detect rice panicle blast early and quantify severity accurately is one of the prior requirements in the assessment and management of rice blast. So, that proper step can take to supress the disease. As per our study on panicle blast detection and grading, very limited researcher are working on this and they are use hyper spectral technique. Liu. Z. et al. [9] proposed a hyper spectral based method to classify the panicle according their level of infestation. The panicle are classified in to three distinct category according to configuration i.e. healthy panicle, empty panicle & infected panicle. The combination of principal component analysis (PCA) and support vector classifier (SVC) was used for classification purpose. The experiment was conducted by using 160 number of panicle samples with three hyper spectral condition such as raw reflectance, first-order spectral & second order reflectance spectra and achieved 96.55%,99.14% & 96.55% respectively. Huang. S. et al. [10] develop a model based on bags of of word(BoW) using hyper spectral data for grading the panicle blast. The total of 312 number of panicles with 50 varieties in yellow ripen stage were collected. Then the images of rice panicle were captured by use of Hypersis-VNIR-QE hyperspectral imaging system in the range of 370-980nm. Here the panicle is enclosed in a hyper cube, then form a dense regular grid to extract the local spectrum feature. Then the large collection of local spectrum vector was clustered by k-means algorithm to form spectrum dictionary. Quantization was used for two purposes: first to remove noise & interference, second it transforms each extracted local spectrum envelope into one spectrum word. After quantization, the collection of spectrum words distributed in spatial XY-plane. Further, each hyperspectral image is summarized as histogram of word occurrence, which counts the frequency of each spectrum word within the image. This representation is analogous to “bag of textons” and hence model was called bag of spectrum words.

Finally, SVM classified the panicle into different grade by calculating chi-square kernel matrix of BoSW representation dictionary data with testing panicle. The model was successful in two-class & six-class-grading system with accuracy of 96.4% & 81.41% respectively.

Liu.Z. et al.[11] proposed a methodology for discriminating and classifying different fungal infection level in rice by applying neural network and PCA technique. In this method four infection of rice panicle were used. Rice panicle sample were placed in incubator with ice block to prevent water loss for hyper-spectral and relative water measurement. For hyper-spectral measurement, a spectrophotometer was used. Hyper-spectral data processing technique was used to calculate the 1st and 2nd derivative reflectance. They employed LVQ neural network to discriminate different level of fungal infection in rice panicles by combing with PCA The result indicate rice panicle and fungal infection level exhibited a higher reflectance in the visible region and lower reflectance in the NIR region.

II. METHODOLOGY

We take rice panicle sample, placed individually on a white paper, and then capture the image using smart phone camera of 12Megapixel resolution. The captured image is processed to calculate the healthy portion of panicle (golden color) and the total area of panicle. So ultimately, it deduct the infected portion or blast area of panicle. To level the grading of panicle blast, blast factor is calculated which is the ratio of healthy area and total area.

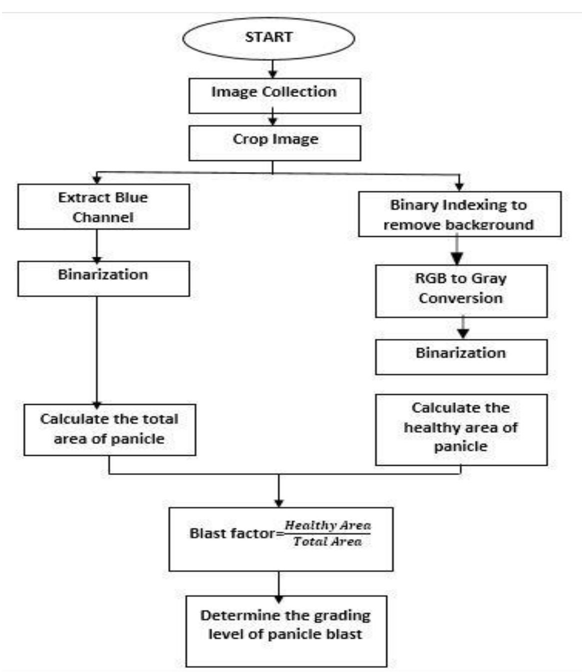

Fig.1 Flow Chart of Panicle Blast detection and Grading.

The total area of panicle is calculated as follows:

Step1: take the sample of panicle.
Step2: crop the image, which avoid the unwanted part of image.
Step3: Extract the blue channel because blue component have no large value difference between healthy part and infected part i.e. within the range of 52 to 60. However, in case of red and green channel the red value is in the range of (90 to 185) and the green value in the range of (73 to 138). So, red and green component have large difference of value between healthy and infected part of panicle. So we choose blue component as we calculate the total area of panicle.
Step4: apply Binarization operation and calculate the total area of panicle.

The healthy part of panicle is calculated as follows:
Step1: crop the image to avoid the unwanted part of image.
Step2: binary indexing to remove the background. The intensity value, which have less than 230, is assigned as zero. So only, the healthy part of panicle is observed in output.
Step3:RGB to Gray conversion and Binarization to calculate healthy area of panicle.

After calculating the healthy area and total area of panicle, the panicle blast is graded in to three category according to the value of blast factor. If blast factor is less than 0.01 it is treated as healthy or less infected panicle. If the blast factor is in the range of 0.1 & 0.3, it is average infected. Again, if blast factor is more than 0.3 it treated as high-infected panicle.

III. RESULT AND DISCUSSION

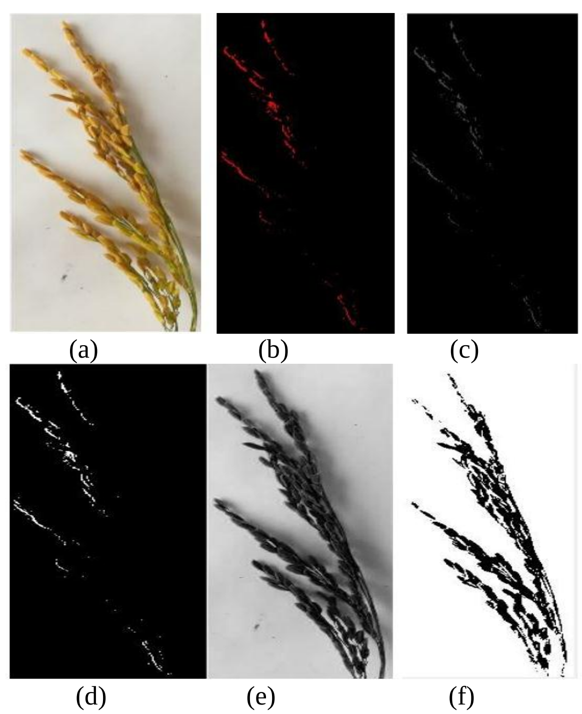

Fig.2 Healthy Panicle and Processed output.

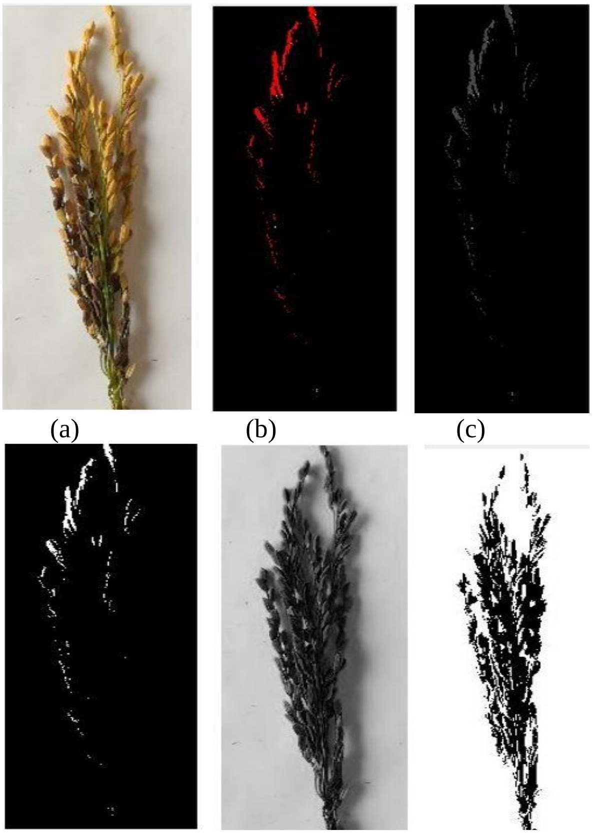

Fig.3 Average Panicle Blast and its processed output.

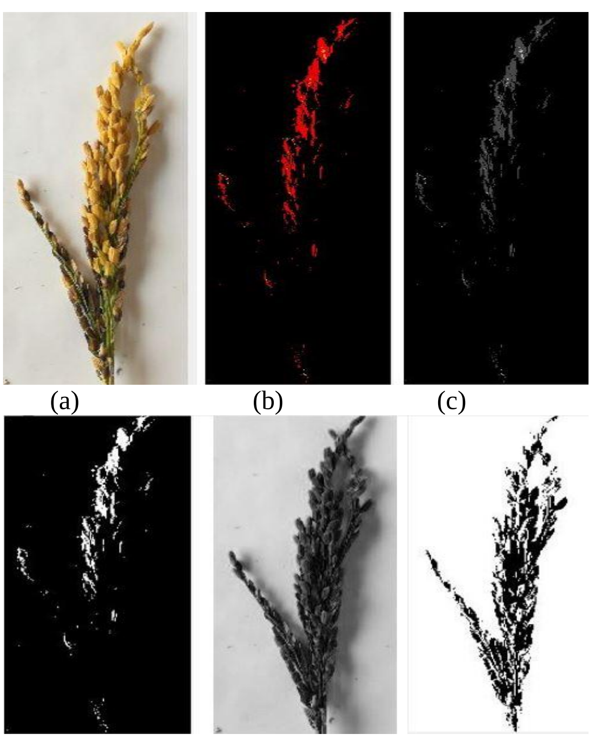

Fig.4 High Panicle Blast and its Processed Output.

The methodology is examined with three variety of panicle i.e. healthy panicle (Fig.2), average affected panicle (Fig.3) and severely affected panicle (Fig.3). In figure 2 is a sample of healthy panicle. Fig.2 (a), (b), (c), (d) & (e) depict the panicle sample, binary indexed image which extract the heathy part of panicle, gray scale conversion, Binarized image of healthy portion, blue channel of panicle which show the total part of panicle and Binarized output of total panicle respectively. Then calculate the area of healthy part & total panicle area and the ratio of both i.e. blast factor is determined and resulted that fig.2 sample is a healthy or less infected panicle. Similarly Fig.3 (a) to (e) depict the panicle sample, binary indexed image which extract the heathy part of panicle, gray scale conversion, Binarized image of healthy portion, blue channel of panicle which show the total part of panicle and Binarized output of total panicle respectively. Then calculate the area of healthy part & total panicle area and the ratio of both i.e. blast factor is determined and resulted that fig.3 sample is an average infected panicle. Again, Fig.4 (a) to (e) depict the panicle sample, binary indexed image which extract the heathy part of panicle, gray scale conversion, Binarized image of healthy portion, blue channel of panicle which show the total part of panicle and Binarized output of total panicle respectively. Then calculate the area of healthy part & total panicle area and the ratio of both i.e. blast factor is determined and resulted that fig.4 sample is severely infected panicle.

IV. CONCLUSION

This proposed methodology successfully detect and grade the panicle blast of rice crop, which is very useful to implement to make the automation machine for precision farming.

REFERENCES

[1] INDIA 2010, A REFERENCE ANNUAL, Ministry of Information and Broadcasting, Government of India, India, 54, 2010, 4, pp. 61.

[2] Devlin Kuyek, "Blast, biotech and big business," Jointly published by Biothai (Thailand),GRAIN, KMP (Philippines), MASIPAG (Philippines), PAN Indonesia, Philippine Greens and UBINIG (Bangladesh) Research Inc., 2000.

[3] Hajime Kato, "Rice Blast Control," in Proc. of Journal The Royal Society of Chemistry, Japan,2001.

[4] Prabira Kumar Sethy, Baishalee Negi and Nilamani Bhoi. Detection of Healthy and Defected Diseased Leaf of Rice Crop using K-Means Clustering Technique. *International Journal of Computer Applications* 157(1):24-27, January 2017.

[5] Sethy P.K., Negi B., Barpanda N.K., Behera S.K., Rath A.K. (2018) Measurement of Disease Severity of Rice Crop Using Machine Learning and Computational Intelligence. In: Cognitive Science and Artificial Intelligence. SpringerBriefs in Applied Sciences and Technology. Springer, Singapore.

[6] S. Phadikar and J. Sil, "Rice disease identification using pattern recognition techniques," 2008 11th International Conference on

Computer and Information Technology, Khulna, 2008, pp. 420-423.doi: 10.1109/ICCITECHN.2008.4803079.
[7] Phadikar, S., Sil, J., & Das, A. K. (2013). Rice diseases classification using feature selection and rule generation techniques. Computers and Electronics in Agriculture, 90, 76–85. doi:10.1016/j.compag.2012.11.001.
[8] Sethy, P. K. (2017). Identification of Mineral Deficiency in Rice Crop based on SVM in Approach of K-Means & Fuzzy C-Means Clustering. Helix, 7(5), 1970-1983. Retrieved from:http://helix.dnares.in/2018/03/14.
[9] Liu, Z. Y., Shi, J. J., Zhang, L. W., & Huang, J. F. (2010). Discrimination of rice panicles by hyperspectral reflectance data based on principal component analysis and support vector classification. Journal of Zhejiang University. Science. B, 11(1), 71-8. doi: 10.1631/jzus.B0900193.
[10] Huang, S., Qi, L., Ma, X., Xue, K., Wang, W., & Zhu, X. (2015). Hyperspectral image analysis based on BoSW model for rice panicle blast grading. Computers and Electronics in Agriculture, 118, 167–178. doi:10.1016/j.compag.2015.08.031.
[11] Liu, Z.-Y., Wu, H.-F., & Huang, J.-F. (2010). Application of neural networks to discriminate fungal infection levels in rice panicles using hyperspectral reflectance and principal components analysis. Computers and Electronics in Agriculture, 72(2), 99–106. doi:10.1016/j.compag.2010.03.003.