CLASSIFICATION OF PADDY VARITIES USING IMAGE PROCESSING

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ABSTRACT
This paper presents the classification method of various paddy varieties as per the rice processing requirement. In first phase four morphological features of the individual as well as group's average features of paddy were extracted using image processing. Out of these four features only two features (minor axis and area) are providing sufficient information to classify the paddy as per the requirement of rice dryer and processing plant. In the second stage a feed forward neural network was applied to classify the extracted data. These data were classified in to large, medium and small samples. Another 10 sets of samples were tested using NN and it is found that all these samples are classified properly.

Keywords
Grain samples, Machine vision, Neural network, Paddy varieties, Classification.

1. INTRODUCTION
Rice is one of the most important cereal grain crop .The quality of rice seed has distinct effect on the milling operation and head rice yield. The proper inspection and classification of rice seed quality is very important. The variety, quality of paddy and purity inspection is more difficult and complicated, than other operational factors which are playing important role in milling operation. In the present grain handling and milling system, types of grain and quality are assessed by visual inspection .This evaluation process is tedious and not fully reliable. According to B.S.Anami [1], the decision making capabilities of a grain inspector can be seriously affected by his /her physical condition such as fatigue, eyesight, work pressure and working conditions. Morphological feature detection and Identification of paddy seed varieties as for as parboiling and milling conditions are concern is the main focus of this study.

In India and particularly in central India, have so many rice mills and parboiling plants. Drying of paddy is one of the important processes during parboiling. Convection drying [2], [3], is most popular in grain drying. In this process the drying air is heated to a considerable extend depends on types and size of grain .The bulk grain in the dryer is treated as porous volume, the heated air comes in the contact of most of the surface area and penetrate from all directions off the grain . For heat conduction purpose paddy shape can be treated as cylindrical body. The dimensions are the important factor of the body (paddy) to be studied for the quantitative analysis of the heat penetration. There is large variation in the dimensions of the paddy varieties, which cannot be distinguished by open eyes. Machine vision system provides an alternative to manual inspection of paddy samples. Neural network application can be used to minimize the operational parameters. This effort of machine vision leads towards the automation of various processes in the paddy parboiling and milling industries. In the recent years efforts to develop Machine vision system (MVS) for industrial application has been increased considerably owing to Availability of the low cost electronic instruments and processing hardware.

Liu –yen et. al. [4], classified the six paddy varieties using digital image analysis based on colour and morphological features. They obtained the images in the steady illumination by mounting the stable supported camera with flexible vertical movement. After image acquisition seven colour and fourteen morphological features were used to discriminate the paddy varieties. An algorithm was developed in window environment using MATLAB programming language to extract the colour feature and morphological features such as Area, major axis length, minor axis length and roundness. I. Zayas et. al. [5], used the image analysis to discriminate the wheat seed and non wheat seed .They discriminate the seeds using size. A sample shape descriptors were used to create a wheat pattern structured prototype that could be compared by matching against a stored structured prototype. The number of objects in the field of view was determined by size of the object and optical setting .Object was oriented along their longest axis parallel to the bottom line of the screen. A detection threshold for the overlaid binary image was set for each field. Morphological derivative parameters of the basic parameters such as area, perimeter, length, width, and feret's diameters were combined to create a wheat pattern prototype.

B. S. Anami et. al.[1] worked on classification of foreign bodies mixed food grains image and textural features. The considered food grain image features mixed with foreign body features are stored in the form of knowledge base to train the ANN for classification. N. S. Visen et. al.[6], classified the six grain samples (barley, Canadian western wheat , Canadian western red spring wheat, oats and rye). A data base of colour and textural feature was created for each category and the classification study was carried out using five different features. I. Y. Zayas et. al. [7], studied and developed the methodology for wheat classes and verity identification by combination of image analysis with hardness of kernels. The wheat kernel observations were split into two data sets i.e. training and test. The training data sets observation was taken out from the whole data set for each variety using SAS provision for random sampling. The remaining observations comprised the test data, to complete the discriminant function for the group classification of hard verses soft kernels. The correct classification rates for the training and test data were about 80% for hard wheat and 93% for the soft wheat. The classification rate was worse when only image features were considered. P. H. Gramitto et. al. [8], conducted the study on automatic identification of weed seeds by colour image processing. They took the features such as principal axis, size of minimal rectangular box containing seed and ratio of its area to the seed area (compactness). Ali Douik et. al. [9], presented hybrid method for cereal grain identification. The

method combines a statistical pattern recognition using morphological and colour features based on fuzzy logic decision making and achieved the reasonable accuracy. In this paper, the authors have focused on morphological feature detection and Identification of paddy seed varieties as for as parboiling and milling conditions are concern.

2. MATERIAL AND METHOD

A Nicon colour camera was used to record the images of the paddy of the different size. The camera was mounted on a stand which provided easy vertical movement and stable support. When the camera was fixed the distance between the lens and the sample table with uniform background, was 40 cm. The back ground was a sky blue. The uniform intensity of lighting on the sample table was provided .The sample seeds were collected from Balaji rice processing plant Gondia. The seeds were arranged in the random orientation and position inside the field of view. The images of the 100 individual rice seed of mixed varieties and 9 bulk images of different varieties were taken for analysis.

2.1 MORPHOLOGICAL FEATURE EXTRACTION

Algorithm was developed in Window environment using MATLAB programming to extract the morphological features. Rice seeds are detected based on its colour information, then the area, perimeter, major and minor axes were determined using the centroid [10], of detected rice seeds, with a .83 cm (.33") gutter. The block diagram of the process is shown in Fig 1.

Fig 1: block diagram of the feature extraction and classification process

The ranges of the extracted features (area, perimeter, major and minor axis) for the large, medium and small size paddy are shown in Table 1.

Quality	Area(A)	Perimeter (R)	Major axis (a)	Minor axis (b)
Large	260-336	63.45-85.84	25.98-38.15	13.23-11.24
medium	259-216	62.0-72.04	24.62-32.25	9.7-10.94
small	120-200	51.69-68.18	21.53-31.59	6.29-8.9

Table 1:-Ranges of the extracted feature

2.2 NEURAL NETWORK

The two layer feed forward neural network model as shown in figure 2 with 5 neuron in each layer is employed for classification.

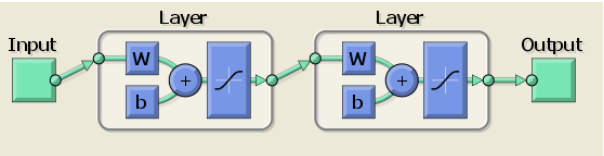

Fig 2: Two Layer Neural Network

The training function levenberg marquardt back propagation (TRAINLM), gradient descent with momentum weight and bias as learning function (LEARNGDM), and mean squared normalized error (MSE) as a performance function was used to train the NN. The training of the NN was performed using 100 samples and then it is tested using random seeds of different quality in bulk with average features. For training and validating the NN, images were divided in to three training sets i.e. large quality, Medium quality and Small quality by considering the area and minor axis limit shown in table 2.

Table 2:- Classification Ranges

Quality	Area(A)	Minor Axis(b)
Large	A >=260	b > 11
Medium	259> A> 201	11>b>9
Small	A<200	b < 9

3. RESULTS AND CONCLUSION

(1) The ranges of the feature extracted are shown in table 1
(2) The minor axis and area are in different ranges for different paddy varieties.
(3) The perimeter and major axis do not differ much for different varieties of the paddy as shown in table 1.
To classify the paddy in to large, medium and small category from the extracted features a feed forward Neural Network is used. The NN was trained by the data extracted from images. The target matrix was assigned value 1 for the large paddy, 2 for the medium paddy, and 3 for the small size paddy. A MATLAB programming was developed to display the Large when outcome of the class is 1, Medium when outcome 2 and Small when outcome is 3. Fig 3 shows the images of three bulk samples of each quality. It is seen that every sample was assigned the correct values and classified in to the appropriate class.

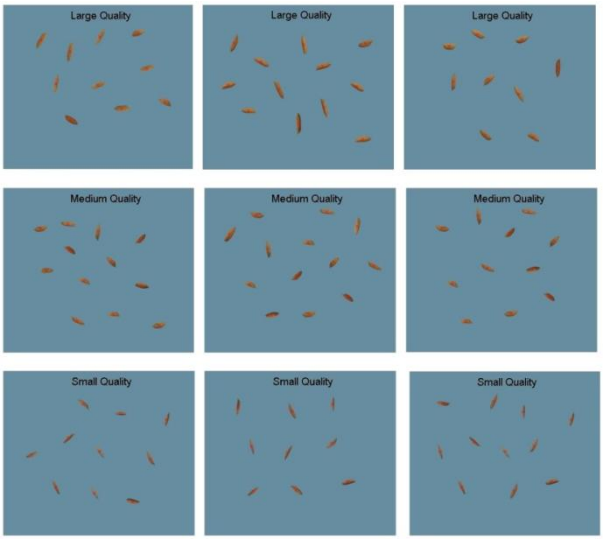

Fig 3: Classified results of randomly selected bulk samples of paddy

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5. REFERENCES

[1] B. S. Anami ,D.G.Savakar: 2009 Improved method for identification and classification of foreign bodies mixed food grains image samples,ICGST-AIML Journal,vol.9,isssue1.

[2] E. Barati,J. A. Esfahani:- 2011 Mathematical modelling of convective drying :Lumped temperature and spatially distributed moisture in slab, Elsevier Energy 36(2011),2294-2301.

[3] Somkiat Prachayawarakorn et. al.:2005 Journal of stored products research, 41(2005), 333-351.

[4] Liu –yen, Cheng Fang, Ying Yi –bin, and Rao Xin-qin: 2005 Identification of rice seed varieties using neural network,Journal of Zhejiang uni.Science, 6b(11):1095-1100.

[5] I.Zayas ,Y.Pomeranz ,and F.S.Lai: Discrimination of Wheat seed and nonwheat components in Grain samples by image analysis, vol.66,No. 3,1989 .

[6] N.S. Visen ,J.Paliwal ,D.S.Jayas and N.D.G.White: 2004 Image analysis of bulk grain samples using neural networks,canadian biosystem engg.vol.46.

[7] I. Y. Zayas ,C.R.Martine, J.L.Steele,A.Ketsevich: 1996 Wheat classification using image analysis and crush force parameters ,American society of Agricultural Engineers 1996,vol.39(6):2199-2204.

[8] P.H.Gramitto ,H.D.Navone,P.F.Verdes ,and H.A.Caccatto : Automatic identification of weed seeds by colour image processing

[9] Ali Douik and Mehrez Abdellaoui : 2008 Cereal varieties classification using wavelet techniques combined to multi-layer neural networks,16th Mediterranean conference on control and automation, Congress centre Ajaccio France, June 25-27

[10] Jitendra N. Chourasia and Preeti Bajaj:- 2011 Centroid Based Detection Algorithm for Hybrid Traffic Sign Recognition System, proceedings of ICETET pg. 96

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