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Grading and Classification of Rice Grain Using PNN Technique in Digital Image Processing

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ABSTRACT
Rice is one amongst the most important cereal grain crops. The quality of rice has distinct effect on the yield of rice, so the proper inspection of rice quality is very important. During grain handling operations, information on grain type and grain quality is required at several stages before the next course of operation can be determined and performed. The varietals purity is one of the factors whose inspection is more difficult and more complicated than that of other factors. In the present grain-handling system, grain type and its quality are rapidly assessed by visual inspection. This evaluation process is, however, tedious and time consuming. The decision-making capabilities of a grain inspector can be seriously affected by his/her physical conditions such as fatigue and eyesight, mental state caused by biases and work pressure, and working conditions such as improper lighting, climate, etc. The farmers are affected by this manual activity. Hence, these tasks require automation and develop imaging systems that can be helpful to identify rice grain images, rectify it & then being analysed. The work finds application in grain handling operations at Agriculture Produce Market Committee (APMC), which is an important organization that deals with farmers produce, measures the quality of grains by its classification and finally values the produce.

Keywords: — Grading, Classification, Image Acquisition, Threshold, Image Segmentation, K-Nearest Neighbour Method, Probability Neural Network Method.

I. INTRODUCTION

Rice is grown in majority of states across India and for about 65% of the people living in India; rice is a staple food for them. Rice is essential food to life in India and it is grown on a majority of the rural farms. It determines the aspect ratio distribution which is very important for elongation. The rice has been used as a sample here which is examined from existing standards for rice Area, major axis, minor axis, aspect ratio, red mean, green mean, and blue mean. From the analysis, reference aspect ratios were assigned to classify the grains. It provides irrigate area, cropping pattern and rice productivity. In this observation, high resolution multi data from RNR Medium Jeera Rice, Old HMT Kedia Rice, Old Ganga Kaveri Sona Masuri Rice, Gagavati Broken Rice, Panna Kand Sona Masuri Rice data were selected for analysis. In this paper, a new approach for identification of rice's grain variety using logic algorithm was investigated. It was found that it is possible to know the undesired content within 70% accuracy. According to the author T.-Q. Yu, W. Jiang, T.-H. Ham, S.-H. Chu, P. Lestari, J.-H. Lee, M.-K. Kim, F.-r. Xu, L. Han, L.-Y. Dai and H.-J. Koh, [1] the identification and classification of rice varieties using neural network, they used a machine vision based on digital image processing which resulted to be much faster and hence a new approach for identification of rice seed varieties using Neural Network was used which is much better than compared to the other methods[1]. This research compared the eating quality trait between japonica rice cultivars from Yunnan province, China, and Korea which provided the information for effective approaches to improve eating quality of rice grains [1]. And according to the authors M. Allahgholipour, F. Alinia and J. Ali, [2], the relationship between rice grain amylose and pasting properties for breeding better quality rice varieties was investigated. The major trait in rice grain is that it exhibited distinct physio-chemical properties depending upon the variety and hence the quality of starch especially influenced cooking properties [2]. Therefore, the present study was undertaken to examine the relationship of Amylose Content with pasting properties for breeding better cooking quality rice varieties [2].

According to the author M. B. Shejul, D. B. Deosarkar, H. V. Kalpande, S. K. Chavan, V. D. Deshmukh, U. Dey, A. K. R. D. Bhandhavi and S. K. Arbad, the investigation attempted to estimate genetic variability for different grain quality characters in available genotypes of rice using probability neural network [3]. According to the author K. Futakuchi, J. Manful and T. Sakurai, presented an overview of definitions of rice grain quality and ways to improve rice grain quality ranging from the choice of the variety to management factors before and after harvest, In all steps along the value chain where the quality of locally produced rice was affected i.e., varietal selection, cultivation, harvesting and threshing, milling, storage, and parboiling were some issues to be addressed in this approach [4]. Therefore better access of

value chain actors to price information was an important prerequisite for rice quality classification [4].

II. PROPOSED METHODOLOGY

The block diagram illustrating the procedure for Grading and Classification of rice grains using PNN techniques is shown in Fig 1. And methodology is given Algorithm 1.

Algorithm 1: Grading and Classification of variety of rice grains.

Input: Original 24-bit Colour Image

Output: Classified food grains

Start

Step1: Acquire the food grain images.

Step2: Pre-processing of an image.

Step3: Enhance image to remove noise and blurring by filtering an image.

Step4: Do the image segmentation.

Step5: Count the number of grains.

Step6: Extract Area, major axis, minor axis, aspect ratio, red mean, green mean, blue mean features.

Step7: Use these features to match and grade the rice grain image samples using Probability Neural Network.

Stop

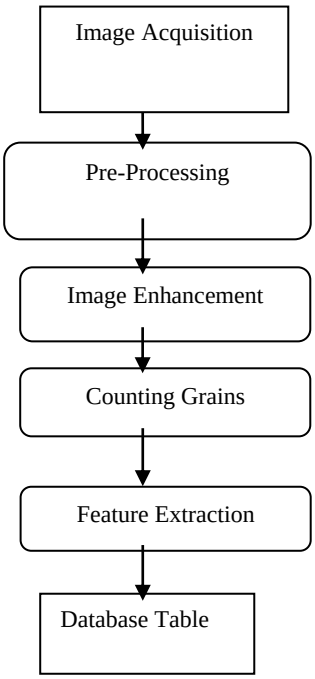

Fig. 1 Flowchart of the system design

A. IMAGE ACQUISITION

A total of around 300 food grain images are acquired under standardized lighting conditions. The images are acquired with a Digital Camera that is used to capture images of rice grain samples keeping fixed distance of approximately 800 mm. Orientation 0 degree on focal length 3.7mm To collect data a camera has been placed at a location situated with a plane normal to the object's path. The black and green background is used. The environment was controlled to improve the data collection with simple plain background. The images acquired were 3264 x 2448 pixels in size. Images were captured and stored in JPEG format automatically. Through data cable these images has been transferred and then stored in disk managing proper sequence. The varieties of rice grains which we have collected are from Agricultural Produce Market Committee (APMC), Belgaum district of Karnataka state, India for the growing year 2017-2018.

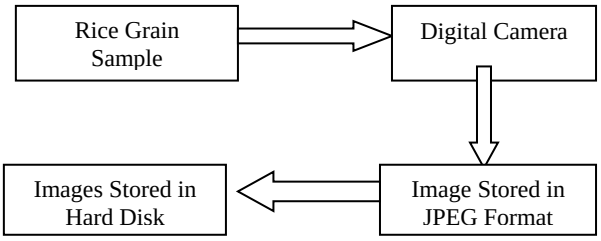

Fig. 2. Block Diagram for Image Capturing

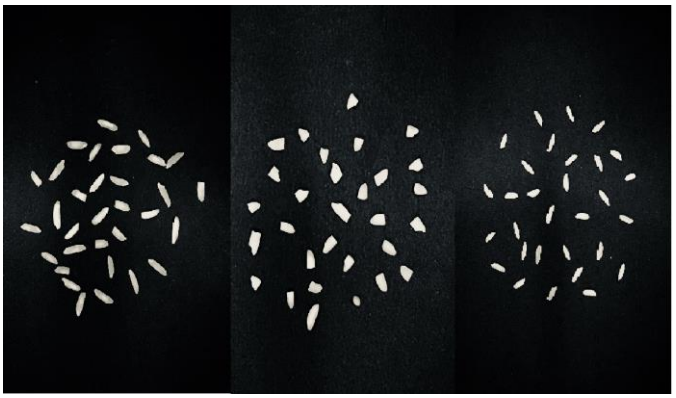

Fig 3: Input Images of Rice

The proposed system determines the aspect ratio distribution which is very important for elongation. The rice has been used as a sample. The samples examined were from existing standards for rice area, major axis, minor axis, aspect ratio, red mean, green mean, and blue mean, entropy of red, entropy of green and entropy of blue. From the analysis, reference aspect ratios were assigned to classify the grains. In this observation, high resolution multi data from Basmati Rice, Broken Rice, Delhi Basmati rice, Old Ganga Kaveri and Old HMT Kedia Sona Masuri Rice, RNR Jeera Rice data were selected for analysis. This Technique is used to analyse the rice grains machine vision system using Probability neural network algorithm was investigated. Our system gives us computerized results to classify and determine the quality of rice grains, whose accuracy pertains to be high.

B. PRE PROCESSING

Multichannel colour information processing has assumed great importance of late due to the evolution of the fields of remote sensing, GIS, biomedical imaging, multispectral data management, etc. Retrieval and analysis of object specific features from such a diverse range of channel information are essentially complex tasks primarily due to the complexity of underlying data. Colour image pre-processing and segmentation are classical examples of multichannel information processing. Pre-processing, this is a data preparation step for filtering, contrast enhancement, and noise reduction. Amongst the existing image enhancement procedures, filtering techniques have become very popular over the years for addressing the problem of noise removal and edge enhancement.

1) ***Gray Scale Image:*** Gray scale image is an image where every pixel of rice grain holds a single sample, the rice intensity information, also known as black-and-white image. After pre-processing the Gray scale level for image, it has only black and- white pixel in it. It varies from black at the weakest intensity 0 to white at the strongest 1.

2) ***RGB to Gray:*** In this case every pixel in an image is specified by three values that is red, green and blue. The array of class single, or double whose pixel values specify intensity values. So it converts into RGB to Gray scale conversion. For single or double arrays, values range from [0, 1]. For uint8, values range from [0, 255]. For uint16, values range from [0, 65535]. In this work, the image used is RGB colour image which is in in jpeg format. it has much of pixel rate, due to which pixel error occurs and that's the reason RGB image is converted into grey scale image . It is only a two dimensional as pixel rate also reduce easily get real image.

3) ***Binary Image:*** In this stage the grey scale image is converted to a binary image. The output image replaces all pixels in the input image with luminance greater than level with the value 1 (white) and replaces all other pixels with the value 0 (black).It specifies the level in the range [0,1], regardless of the class of the input image. The function grey thresh can be used to compute the level argument automatically in order to separate an object in the image from the background. The colour of the object (usually white) is referred to as the foreground colour. The rest (usually black) is referred to as the background colour.

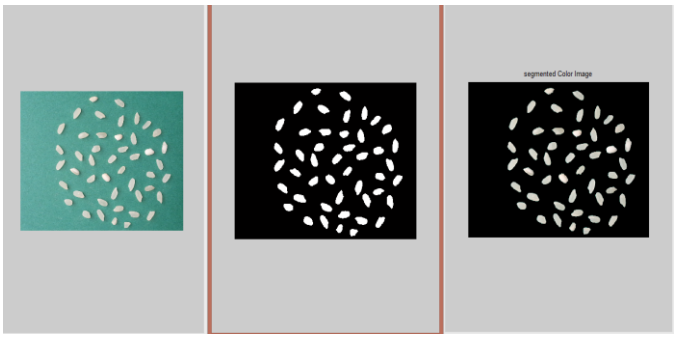

Fig 4: Pre-Processed Image

C. IMAGE ENHANCEMENT

Image enhancement is one amongst the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail the hidden detail, or simply to highlight certain features of interest in an image. It is important to keep in mind that enhancement is a very subjective area of image processing. Improvement in quality of these degraded images can be achieved by using application of enhancement techniques. Texture feature used out of the five senses sight, hearing, touch, taste and smell which humans use to perceive their environment, sight is the most powerful. Receiving and analysing images forms a large part of the routine cerebral activity of human beings throughout their waking lives. In fact, more than 99% of the activity of the human brain is involved in processing images from the visual cortex [5]. A visual image is rich in information. Confucius said, "A picture is worth a thousand words." Image Enhancement is simple and most appealing area among all the digital image processing techniques. The major purpose of image enhancement is to bring out detail that is hidden in an image or to increase contrast in a low contrast image. In image Retrieval various enhancement schemes are used for enhancing an image which includes grey scale manipulation, filtering and Histogram Equalization. Histogram equalization is one of the well known image enhancement technique. The basic idea of histogram equalization method is to re-map the grey levels of an image. Many image enhancement schemes like Contrast limited Adaptive Histogram Equalization (CLAHE), Equal area dualistic sub-image histogram equalization (DSIHE), Dynamic Histogram equalization (DHE) Algorithm, etc has been implemented and compared. The Performance of all these Methods has been analysed and a number of Practical experiments of real time images have been presented. From the experimental results, it is found that all the three techniques yields Different aspects for different parameters. In

future, for the enhancement purpose more images can be taken from the different application fields so that it becomes clearer that for which application which particular technique is better both for Gray Scale Images and colour Images.

D. COUNTING GRAINS

Numerous methods have been used till now to count the number of grains. This fall into three major categories: counting with the human eye, electronic or laser-based particle counters, and image processing algorithms. Counting visually does not require specialized tools other than microscopes but is very time-consuming. One can also count sub-samples and then estimate the total amount of rice's. Image processing automates grain counting from various forms of pollen grain images. This method requires use of computer software to scan images for objects or rice grains here and then count each separate object as a unit or rice grain. The purpose of the present study was therefore to develop a fast, user-friendly, low-cost and non expensive image processing method of counting grains of known identity. An automated process is necessary to reduce the time and labour required for such analysis. The method described here for counting grains from digital images is not only user-friendly, but also efficient, a Although the multiple image analysis can very occasionally fail to detect grains correctly, multiple image analysis counts were more consistent than single image analysis counts accurate and consistent. Understanding the source of counting error by the software is crucial to minimizing error occurrence, such as the erroneous count by multiple image processing samples.

Fig 5: Segmented and cropped rice grains

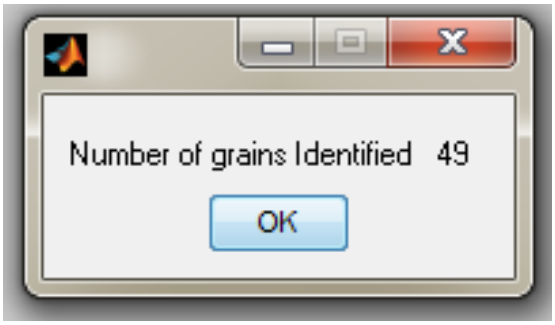

Fig 6: Grain Count Image

E. FEATURE EXTRACTION

Algorithms were developed in Windows environment using MATLAB 08 programming language to extract morphological features of individual rice grains for its further classifications. The following morphological and colour features are extracted from images of individual rice grains:

Area (mm2): The algorithm calculated the number of pixels inside the image including the grain boundary, and multiplied by the calibration factor (mm2/pixel).

Major axis length (mm): It is the distance between the end points of the longest line that could be drawn through the grain. The major axis endpoints were found by computing the pixel distance between every combination of border pixels in the grain boundary and finding the pair with the maximum length.

Minor axis length (mm): It is the distance between the end points of the longest line that could be drawn through the grain while maintaining perpendicularis with the major axis.

Aspect ratio: Major axis length/Minor axis length.

Red Mean: Average or mean value of red colour rice grain image is been calculated.

Green Mean: Average or mean value of green colour rice grain image is been calculated.

Blue Mean: Average or mean value of blue colour rice grain image is been calculated.

F. DATABASE TABLE

A database table as depicted below is an organized set of data elements or values obtained using a model of vertical columns which are identified by their name and horizontal rows, the cell being the unit where a row and column intersect. The data in a table does not have to be physically stored in the database as it is generated automatically. In non-relational systems, hierarchical databases, the distant counterpart of a table is a structured file, representing the rows of a table in each record of the file and each column in a record. Data in the table is stored in sequence of records which are equivalent to table

term of a relational database with each record having equivalent rows.

:- 5.Sona Masuri Jeera.jpg

Area	Majaxis	Minaxis	Aspratio	Rmean	Gmean	Bmean	Entropy_r	Entropy_g	Entropy_b
0.08964	55	22	0.25	0.1344	0.1318	0.1361	0.4203	0.419	0.4134
0.08976	50	29	0.1724	0.1104	0.1073	0.111	0.3961	0.3981	0.3934
0.07435	45	29	0.1552	0.1074	0.1027	0.1038	0.3839	0.3822	0.3748
0.09862	42	41	0.1024	0.1014	0.09722	0.1008	0.3465	0.3399	0.3402
0.102	56	30	0.1867	0.1059	0.1009	0.1032	0.3713	0.3699	0.3735
0.1104	52	36	0.1444	0.1035	0.09862	0.1009	0.3712	0.3641	0.3598
0.09168	45	37	0.1216	0.09941	0.09512	0.09769	0.3528	0.3525	0.3502
0.09735	50	28	0.1786	0.1223	0.1173	0.1205	0.4299	0.4169	0.419
0.09996	57	20	0.285	0.1562	0.1474	0.1501	0.4845	0.4886	0.4916
0.08238	45	34	0.1324	0.09705	0.09376	0.09615	0.3488	0.3485	0.3483
0.09545	57	19	0.3	0.1499	0.1432	0.1459	0.4875	0.4769	0.4748
0.1015	57	20	0.285	0.155	0.1473	0.1508	0.5213	0.5168	0.5136
0.1065	60	19	0.3158	0.1629	0.1536	0.1577	0.5025	0.5058	0.5065
0.07916	48	21	0.2286	0.1396	0.1335	0.135	0.4611	0.4638	0.4665
0.1014	56	22	0.2545	0.1435	0.1355	0.1377	0.4666	0.4621	0.4625
0.1069	48	41	0.1171	0.08741	0.08284	0.08454	0.3428	0.336	0.3408
0.08148	46	34	0.1353	0.0945	0.08961	0.09125	0.3381	0.3399	0.3409
0.1006	56	24	0.2333	0.1319	0.124	0.126	0.4484	0.4476	0.4482
0.09169	53	20	0.265	0.1526	0.1468	0.1494	0.4796	0.4813	0.4815

Fig 7: Rice grain trained values in .txt file

2	0.0892	0.58	0.25	0.232	0.1221	0.1254	0.1218
2	0.0971	0.6	0.33	0.1818	0.09953	0.1012	0.09868
2	0.0873	0.53	0.34	0.1559	0.09751	0.09958	0.09709
2	0.0826	0.44	0.43	0.1023	0.08849	0.09	0.08718
2	0.0761	0.51	0.31	0.1645	0.09294	0.09555	0.09089
2	0.0832	0.53	0.23	0.2304	0.1448	0.1471	0.145
2	0.101	0.61	0.28	0.2179	0.1231	0.125	0.1223
2	0.0714	0.45	0.36	0.125	0.0854	0.08808	0.08364
2	0.0881	0.58	0.29	0.2	0.1065	0.1089	0.1044
2	0.0663	0.39	0.3	0.13	0.1185	0.1206	0.1184
2	0.0386	0.28	0.23	0.1217	0.1214	0.1253	0.1221
2	0.055	0.33	0.33	0.1	0.099	0.1026	0.09884

Fig 8: Database Table

III. CONCLUSION

In the present work a digital imaging approach has been devised in order to investigate different types of characteristics to identify and classify the rice varieties. Here two different common rice varieties were used in tests for defining. These include existing standards for rice length, area and aspect ratio features of rice and colour features of rice grains. It successfully shows the effectiveness of compactness as its features. When the data base of this work can recognize the rice grains, which has been trained the data in number of times; and hence it has been identified. With proper selection of software tools, we can design a low cost tool for quality analysis of rice grains which provides all relevant parameters about rice grains by image analysis that is required for its classification which can be done using probability neural network method. Hence we aim for the accurate classification of micro calcification of different types of rice varieties for using in the testing and producing the accurate result. The proposed system determines the aspect ratio distribution which is very important for elongation. The rice has been used as a sample. The samples examined were from existing standards for rice geometrical features such as area, major axis, minor axis, aspect ratio features and colour features such as red mean, green mean and blue mean colour features and also entropy for red, entropy for green and entropy go blue colour features. From the analysis, reference aspect ratios were assigned to classify and match the rice grains using probability neural network.

REFERENCES

[1]. T.-Q. Yu, W. Jiang, T.-H. Ham, S.-H. Chu, P. Lestari, J.-H. Lee, M.-K. Kim, F.-r. Xu, L. Han, L.-Y. Dai and H.-J. Koh, "Comparision of Grain Quality Traits between Japonica Rice Cultivars from Korea and Yunnan Province of China," *Journal of Crop Science and Biotechnology*, vol. 2, p. 6, 12 June 2008.

[2]. M. Allahgholipour, F. Alinia and J. Ali, "Relationship between Rice Grain Amylose and Pasting Properties for Breeding Better Quality Rice Varieties," *Plant Breeding 125*, p. 6, 5 January 2006.

[3]. M. B. Shejul, D. B. Deosarkar, H. V. Kalpande, S. K. Chavan, V. D. Deshmukh, U. Dey, A. K. R. D. Bhandhavi and S. K. Arbad, "Variability Studies for Grain Quality Characters in Upland Rice (Oryza Sativa L.)," *African Journal of Agriculture Research*, vol. 8, no. 38, p. 4, 3 October 2013.

[4]. K. Futakuchi, J. Manful and T. Sakurai, "Improving Grain Quality of Locally Produced Rice in Africa," *CAB International 2013*, p. 15, 2013.