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## Application for Rice Quality Assessment and Classification Using Image Processing Technique

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**ABSTRACT:** This paper introduces a solution of grading and evaluation of rice grains on the basis of grain size and shape using image processing techniques. Especially edge detection algorithm is used to find out the region of boundaries of each grain. The existing system of rice portal consists of following features: 1. Market report 2. Finance 3.USDA information 4.Features.In our paper there are little more advancement like: 1. Farmers will capture the image of the harvested rice and that image will be uploaded on our web portal. 2. With the help of this image, consumer can easily classify and judge the quality of rice. 3. This application will help the entire stake holders who are responsible of making almost 60% of the food grains business in India.

**KEYWORDS:** Grain quality, rice characteristics, imageacquisition, image processing and analysis, grain evaluation.

### I. INTRODUCTION

The agricultural industry is oldest and mostwidespread industry in the world. Rice is grown in many regions across India. 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. Rice is the most important grain with regard to human nutrition and calorie intake, providing more than one fifth of the calories consumed worldwide by the human species. Traditionally quality of food products is defined from its physical and chemical characteristics by human sensory panel. Physical parameter includes grain size and shape, moisture content, chalkiness, whiteness, milling degree and bulk density. Moisture content is nothing but the water content in the grain. For better storage purpose moisture content should be in between 12-14%. Different methods are used for moisture analysis like standard moisture meter and hot air oven method. Chalkiness is the white spot present in the rice endosperm. Chalky grain is defined as half of the grain is white in color and brittle in nature. Because of its brittle nature chalky grains break during milling so it affect on milling degree of rice. On the basis of chalkiness rice grains are classified as white belly, white center and whiteback. Chalky rice reduces the palatability of cooking products so presence of chalkiness more than 20% is avoided in world's market. Magnifying glass and photographic enlarger used for chalkiness detection.

The paper focused on grain size and shape analysis using image processing techniques. For the measurement of grain size and shape dial micrometer, graphical method and grain shape tester are used. But all these methods are time consuming and some of them are costly. To overcome this limitation image processing techniques is an alternative and best solution. The main objective of the proposed method is to provide an alternative solution for quality analysis which minimizes the required time and cost. Image processing is very important and advanced technological fields where significant developments have been made. Efforts are being geared to replace the traditional human sensory panel.

### II. RELATED WORK

Jagdeep Singh Aulakh, Dr. V.K. Banga, proposed image processing techniques for grading of rice samples based on their sizes [1]. The quality of food grains are rapidly assessed through visual inspection by human inspectors. The decision

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can be taken by external influence such as fatigue, bias etc. with the help of image processing technique we can overcome that. By using various procedures to obtain the percentage quality of rice grain. we referred Grading of rice grains by image processing technology.

Chetana V. et al proposed image processing technique for non destructive Quality Analysis of Indian Gujarat-17 Oryza Sativa SSP Indica(Rice)[2]. In this paper we give the solution of quality assessment through the computer vision, image analysis and processing we achieved high degree quality as compare to human inspection. This paper proposes a new method for counting the oryza sativa L.(rice seeds) with long and small seeds by using image processing with high degree quality and then quantify the rice seeds based on combined measurement. We referred machine vision, computer vision, quality, image processing, image analysis, oryza sativa L.(Rice seeds) ISEF edge detection, combined measurement.

R.Kirutika, S. Muruganand et al proposed matching of different rice grains using Digital Image Processing technique[3]. A digital image processing approach has been used to investigate different types of characteristics to identify the variety of rice. Two different variety of rice were used in test. These includes standards for rice length, area and aspect ratio and features of rice. It successfully shows the effectiveness of compactness as its features. The data base has been trained the data in number of time which recognize the rice. In these paper we referred technique of pre-processing, segmentation, blob analysis, feature matching.

S.Kanchana S. Lakshmi Bharati et al proposed checked quality of selected rice varieties physically. [4]. In this paper we selected three districts to procure rice varieties. The selected districts are Madhurai, Virudhunagar and Tirunelveli and 41 varieties of rices were selected for this study. In this paper we referred materials and methods of physical quality of selected rice varieties and procure rice varieties.

Bhupinder Verma proposed grading and classification of rice by using image processing[5]. For grading and classification of rice they used image analysis (IA) method using flatbed scanning(FBS). A flatbed scanner also called as desktop scanner is used to obtain images of the rice kernels. FBS are available at a lower cost. They are the most versatile and commonly used scanners and these are available in almost all offices. In this paper they referred Image analysis, Binarization Morphological Operations, Computer /Machine vision, Neural Networks, basic steps in the classification and grading of rice.

Jagdeep Singh Aulakh, V.K. Banga, et. al percentage of hulled rice grain using image processing technique. In this paper they checked the purity of rice sample according to the size of grain(full, half or broken). The food grain types and their quality are rapidly assessed through visual inspection by human inspectors. The decision making capabilities of human inspector may subjected to external influence like fatigue, vengeance, bias etc. But with the help of image processing we can overcome that. By image processing we can also identify any broken grains mixed. Flat Bed Scanning (FBS) process uses the desktop scanner which is used in this paper.

Vidya Patil, V.S. Malemath et. al proposed image processing technique to automate the process which overcomes the drawback of manual process. They provide the concept of quality assessment of rice grain based on its size. It gives the number based on the size of grain like grade 1, grade 2, grade 3 etc. Here they considered different varieties of rice grains for testing like Basmati, sonamasuri, boiled rice, egg rice etc. The system is developed using 105 set of images and are classified using decision based classification tree. The result to be found was encouraging. They referred food grain grading, extraction, morphological operation, quality analysis.

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SheetalMahajan, Sukhvirkaret, et al proposed solution of quality analysis of Indian Basmati rice grain using Top Hat Transformation. In this paper the problem of Non uniform, illumination for quality assessment is defined which show their effects in the process of extracting object from the background and cause segmentation errors. This proposed method achieves high degree of accuracy in correcting the effects of non uniform illumination than computer vision inspection. This proposed method is based on Morphological features is developed for counting The number of Indian Basmati rice grain with Normal grains, Long grains and small grains.

Mrutyunjay M S, Lakshmikant T M, et al. proposed solution for quality evaluation and grading of rice grains using image processing techniques. According to the size of the grain (full, half or broken) the grading of rice is done. Quality of food grains are rapidly assessed through visual inspection by human inspectors. The decision making quality of human inspector are subjected to external influence such as fatigue, vengeance, bias etc. Through the help of image processing technique we can overcome that and which are also a non destructive and cost effective technique. The main procedures used in this paper are Input image, image preprocessing, grains extraction, counting of grains, analysis and grading.

Wan Putri N. W. M. Tahir, Norhaida Hussain et al. proposed about the method used for rice grading using image processing. Various approaches have been applied in the previous researchers to get rid of the difficulties for rice quality analysis. In most of the application machine vision has been used to differentiate rice grade based on special features such as shape, length, chalkiness, color and internal damage of rice. The ways which have been used to differentiate and analyze degree level of rice are RGB color model, histogram, edge detection etc. In this paper we are also discussing and suggesting another method in rice grading for Malaysia's type of rice using image processing method based on several features.

### III. PROPOSED SYSTEM APPROACH

Proposed work focused quality analysis on the basis of the measurement of physical parameter i.e. grain size and shape using image processing techniques. Basmati rice is used for quality analysis. Basmati rice is classified as extra long, long, medium and short. The image processing technique is used for counting the number of rice seeds and classifies them on the basis of length, breadth and length-breadth ratio. Length is the average length of rice grain while breadth is the average breadth of rice grain and length-breadth ratio is calculated as;

$$L/B = [(Avg. length of rice) / (Avg. breadth of rice)] * 100$$

Image is captured using a color camera. The image should be 640 X 380 pixels in size, which is shown in fig.1. The captured image stored in our web-portal database. After storing the image on web-portal database image processing algorithms are applied on it.

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Fig.1. Original Image

The flow of image processing algorithm is shown in fig. 2 which consists of some basic steps. Rice seeds are randomly placed on a black background for image acquisition. The image is acquired and stored for further analysis. In the first pre-processing step, image registration takes place and noise is removed from the image by using a filter. In the second step, we perform a thresholding algorithm to find out the threshold value of rice. In the third step, we perform edge detection to find out the region of boundaries. In the fourth step, we perform a bounding box to find out the height and width of rice properly. In the fifth step, rice seed measurement is done and in the same step, length, breadth, and length-breadth is also measured. In the sixth step of the algorithm, rice is classified according to its size and shape.

## IV. METHODOLOGY

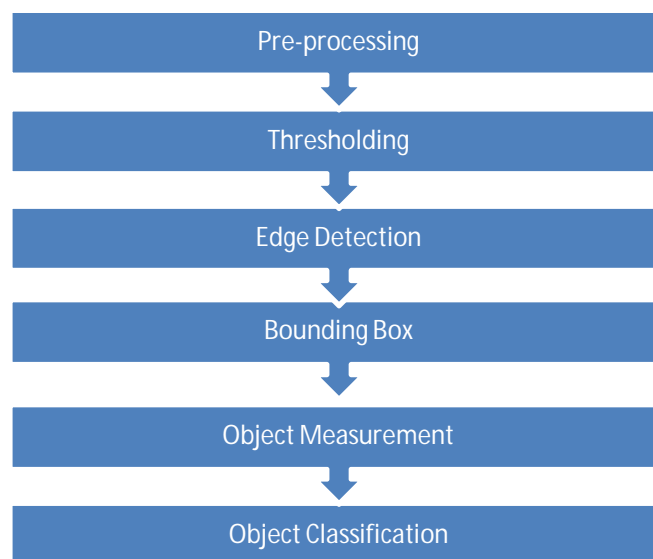


Fig.2. Flow Diagram for Image Processing Algorithm

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### Image pre-processing

Farmer capture image using color camera which is saved in the three dimensional RGB (red, green, blue) color space. The captured image stored in web-portal database which is shown in fig 3. Filter is applied to remove noise which occurs during the acquisition of image. Filter also sharpens the image. Threshold algorithm is used to segment the rice grains from the black background. Using color extractor color image get converted into gray image which is shown in fig 4.



Noise Removing



Gray Scale

### Edge detection

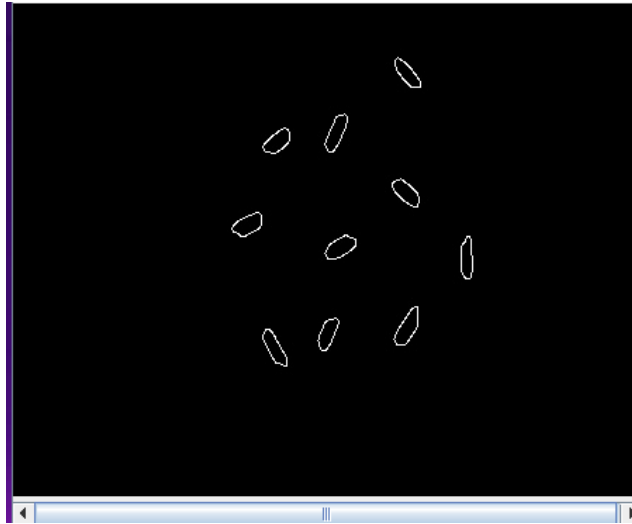
Edge detection helps to find out the region of boundaries of rice. There are six methods are available for edge detection in vision and motion toolbox like differentiation, gradient, canny, Roberts, sigma and sobel. The method specifies the type of edge detection filter to be used. We used canny method for edge detection in proposed methodology.

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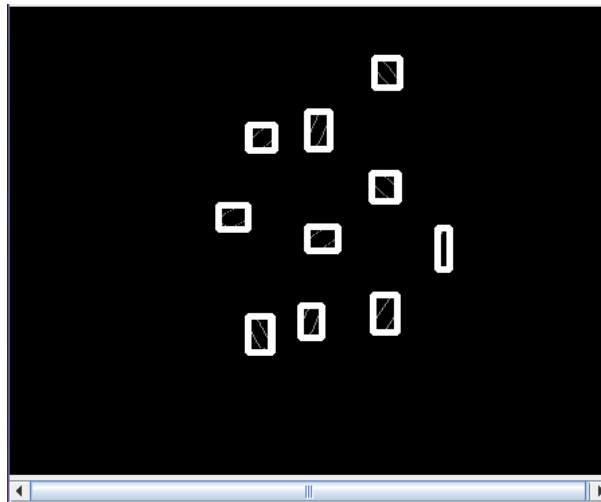
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Edge Detection

### Bounding Box

Bounding Box helps to find out the height and width of the rice.



Bounding Box

### Object measurement

Measurement indicates the count of rice grains which is shown in fig. , which shows the counting of each grain with number indicated in red margin. After getting the count of rice grains, edge detection algorithms applied on the image and outcome of the applied algorithm is we get endpoint values of each grain. We use caliper to join the endpoints and measure the value of length and breadth of each grain. After getting the value of length and breadth we can calculate length-breadth ratio.

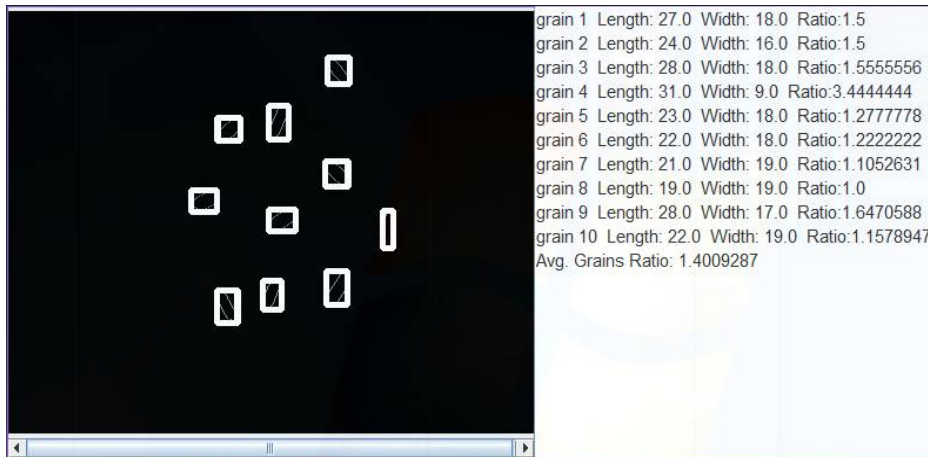


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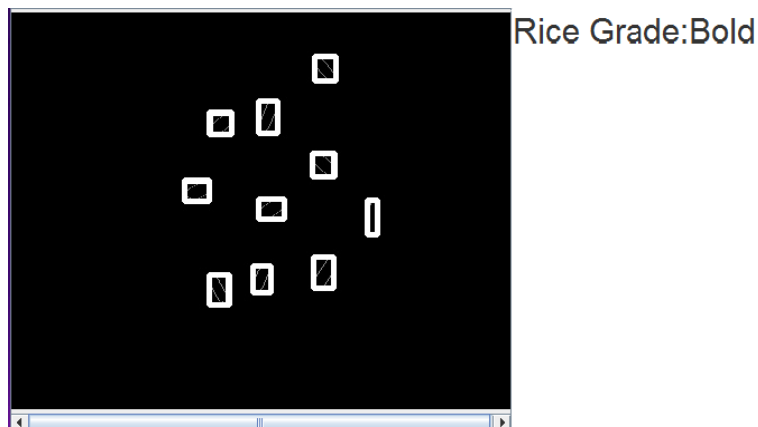
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Object Measurement

### Object classification

Classification requires all standard, measured and calculated results. The standard database for rice size and shape measurement is referred from laboratory manual on rice grain quality, Directorate of Rice Research Rajendranagar, Hyderabad.



Object Classification

The classification of rice grain as per the standard database is shown in following tables. Table 1 indicates classification of rice grains on the basis of length and length-breadth ratio. Table 2 shows classification of grains on the basis of length, which decides size of the specific grain. Table 3 gives classification on the basis of length-breadth ratio, depending on grains are classified as extra-long, long, medium, small; which decides shape of that grain. The given tables are used for classifying the rice grains into different types.

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TABLE 1  
CLASSIFICATION OF RICE GRAINS

Long Slender(LS)	Length 6 mm and above, L/B ratio 3 and above
Short Slender(SS)	Length less than 6mm,L/B ratio 3 and above
Medium Slender(MS)	Length less than 6 mm, L/B ratio 2.5 to 3.0
Long Bold(LB)	Length 6 mm and above, L/B ratio less than 3
Short Bold(SB)	Length less than 6 mm, L/B ratio less than 2.5

TABLE 2  
CLASSIFICATION ON THE BASIS OF LENGTH

Extra-Long	>7.5
Long	6.61-7.5
Medium	5.51-6.6
Small	5.5 or less

TABLE 3  
CLASSIFICATION ON THE BASIS OF L/B RATIO

Grain Shape	L/B ratio
Slender	Over 3
Medium	2.1-3
Bold	1.1-2
Round	1 or less

### V.ADVANTAGES OF PROPOSED SYSTEM

1. It provides the strong quality assessment of rice grains based on its size.
2. Based on the size the grains are graded easily.
3. It gives better and accurate result.
4. Time require to analyze rice quality is minimum as compared to traditional and manual method.



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## VI. ALGORITHM

**Input:**

Rice sample input image.

**Output:**

Classified grain quality grade.

**Steps of algorithm:**

- Step1:** Pre-process the images of rice to remove background noise
- Step2:** Convert the pre processed image to binary image using threshold algorithm.
- Step3:** Region label the binary image.
- Step4:** Segment/crop the individual grains present in the image.
- Step5:** Extract the geometric features major axis, minor axis and area of all the individual grains
- Step6:** Perform analysis on the quality using the average values of the features extracted
- Step7:** Classify the sample for the Type and grade based on the analysis
- Stop.**

## VII. RESULT AND DISCUSSION

The results which occurred by implementing image processing algorithms are shown in table 4. The results indicate length-breadth ratio of each grain.

TABLE 4  
RESULTS FOR L/B RATIO

Sr. no.	Number of grain	L/B ratio	Sr. No.	Number of grain	L/B Ratio
1	Grain 0	2.04	16	Grain 15	3.02
2	Grain 1	3.45	17	Grain 16	3.10
3	Grain 2	3.12	18	Grain 17	2.70
4	Grain 3	1.99	19	Grain 18	1.84
5	Grain 4	2.89	20	Grain 19	2.99
6	Grain 5	2.75	21	Grain 20	2.00
7	Grain 6	2.50	22	Grain 21	1.88
8	Grain 7	3.25	23	Grain 22	2.60
9	Grain 8	3.90	24	Grain 23	2.85
10	Grain 9	1.12	25	Grain 24	1.44
11	Grain 10	2.90	26	Grain 25	2.88
12	Grain 11	2.72	27	Grain 26	3.05
13	Grain 12	2.45	28	Grain 27	1.21
14	Grain 13	3	29	Grain 28	2.66
15	Grain 14	2.86	30	Grain 29	1.46

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## VIII. CONCLUSION

The image processing algorithms are developed to segment and identify rice grains. From the obtained results, it can be concluded that the use of image processing algorithm is an efficient method to analyze grains quality by its size. The main benefit of proposed method is it requires minimum time; cost is less and gives better results compared with manual results or traditional methods.

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