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Quality Analysis and Classification of Rice using Image processing

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Abstract: Grain quality analysis is a huge challenge in agricultural industries. Internal control is critical in the food industry because food products are characterized and rated into various categories after quality data has been collected. Grain quality assessment is performed by hand, but the results are subjective, lengthy, and pricey. To overcome the limitations and drawbacks of image processing techniques, different resolutions are used for grain quality analysis. Using image processing techniques, this paper proposes a method for grading and analyzing rice based on grain size and form. An edge detection algorithmic software is used in particular to determine the area of each grain's borders. we discover the endpoints of each grain using this technique, and we can then live the grain's endpoints using caliper.
Keywords: Grain quality, rice characteristics, image acquisition, image processing and analysis, grain evaluation, etc.

I. INTRODUCTION

Agricultural enterprise is the oldest and maximum huge enterprise withinside the world. Traditionally, the first-class of meals are described via way of means of a human sensory panel primarily based totally on its bodily and chemical properties. Physical parameters encompass grain length and form, moisture content material, chalk, whiteness, and freeness. For the top-of-line storage, the moisture content material needed to be among 12-14%. Various techniques are used for moisture evaluation.
The primary goal of the proposed method is to provide an alternative approach to quality analysis that requires less time and money. Image processing is an important and advanced technological subject that has seen significant progress. Attempts are being made to replace human manual detection. The document suggests a solution to agribusiness problems.

II. PROBLEM DEFINITION

Product quality analysis is critical in the agriculture sector. An experienced technician visually evaluates the quality of the grain seed. However, the outcome of such an assessment is comparative, varies in results, and takes a long time. The technician's attitude also has an impact on quality; as a result, a new and improved methodology, namely an image processing technique, is presented to address the flaws that have evolved as a result of old ways.

A. Quality and Classification

Grain quality assessment is a significant concern in agriculture. In the food sector, quality control is critical since food is categorized and divided into several classes based on quality factors after harvesting. Grain quality testing is manual, but it is subjective, time-consuming, and expensive. Using image processing techniques, the research provides a method for classifying and grading grains based on grain size and form. Specifically, edge detection to determine each grain's border. We may determine the endpoints of each grain using this technique, and then measure the length and width of the rice using vernier calipers. This process takes very little time and is very affordable.
The image processing technology is used to count the number of rice and classify them based on length, breadth, and length-breadth ratio. The length-width ratio is calculated as follows: length equals the average length of the rice grain, and breadth equals the average breadth of the rice grain.

L/B = [(average rice length) / (average rice breadth)] *100

B. Image Acquisition and Processing

A camera is used to capture the image. This is depicted in Figure 1. On the computer, the captured image is saved. Image processing methods are applied to the image after it has been saved.

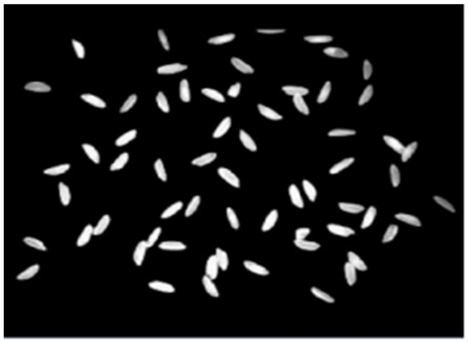

Fig.1 Original Image

III. METHODS

Fig. 2 depicts the flow of the image processing method, which consists of a few basic phases. For image acquisition, rice grains are scattered at random on a black background. The image is saved to be analyzed later. The first phase is pre-processing, which involves image registration and noise removal via a filter. The Shrinkage algorithm is used to segment the touching kernels in the second stage. We have a tendency to use edge detection in the third stage to find the boundary region. The rice grain measurement, as well as length, breadth, and length-breadth measurements, are completed in the fourth stage. Rice is categorized in the fifth stage of the algorithm based on its size and form.

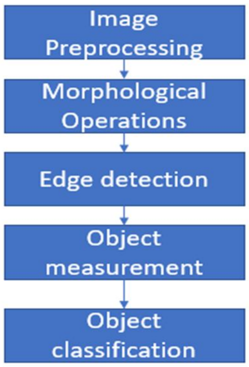

Fig.2 Flow Diagram for Image Processing Algorithm

A. Image Pre-processing

The image acquired with a camera is saved in the computer's 3-D RGB color space, as seen in fig 1. The filter is used to remove noise that happens during the image acquisition process. The image is also sharpened by the filter. The rice grains are segmented from the black background using a threshold technique, and the image is converted to a grey image as seen in fig 3.

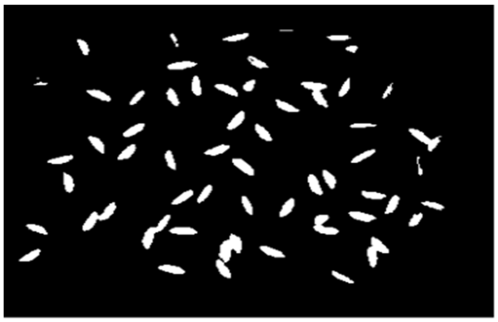

Fig3. Grayscale image

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B. Shrinkage Morphological Operation

Rice grains are scattered randomly across a black background. The grains in Figure 1 are not oriented in any way. When contacting grains occur, morphological operations can be used to categorize them. Grain touching can be separated into two types: point and line touching. The combination of dilatation and erosion is a morphological surgery. Erosion is a technique for separating adjacent parts of a grain of rice without compromising its integrity. The erosion process is followed by the dilation process. The purpose of dilatation is to restore the original shape of degraded features without re-joining the divided elements.

In the vision and motion toolbox, there are different types of morphological operations are available such as;

1) Auto M **-** Auto median,
2) Close **-** Dilation followed by an erosion,
3) Dilate **-** Dilation (opposite of erosion),
4) Erode **-** Erosion which removes isolated background pixels,
5) Open **-** Erosion followed by dilation,
6) P close **-** A succession of seven closings and openings,
7) P open **-** A succession of seven openings and closings.

Fig4. Erosion form of image

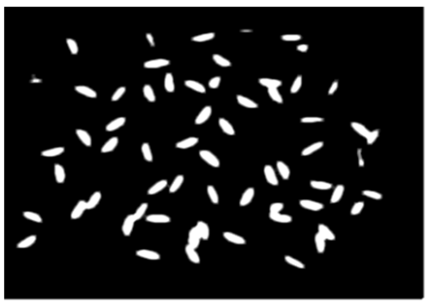

Fig5. Dilation form of image

C. Edge Detection

As illustrated in Fig.6, edge detection aids in locating the region of rice grain boundaries. Gaussian, Gradient, Prewitt, Canny, Fuzzy, and Sobel are six edge detection algorithms offered in Vision and Motion Toolbox. In the proposed methodology, we use the Sobel method to find edges.

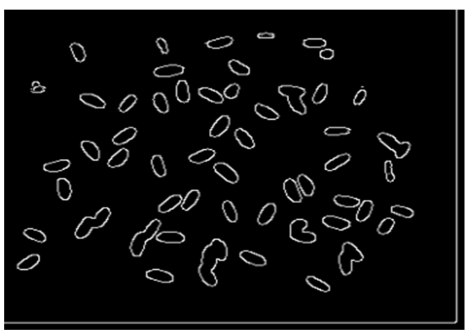

Fig6. Erosion form if the image

D. Object Measurement

The number of grains of rice in the image represents the number of individual grains in the evaluation. After counting the number of grains of rice, edge detection techniques are implemented to the image, and endpoint values for each grain are obtained as a result of the algorithm's application. We use a caliper to connect the endpoints and evaluate the length and breadth of every grain. Once we have the length and breadth values, we can calculate the length to breadth ratio.

E. Object Classification

All outcomes must be standard, measured, and calculated to be classified. The laboratory manual on rice grain quality, Board of Rice analysis, Rajendranagar, Hyderabad, provides the standard information for measuring the size and form of rice.

The table below shows how rice grains are classified based on the length and length-to-breadth ratio:

SLENDER	Aspect ratio>=3 and aspect ratio<3.5
MEDIUM	Aspect ratio>=2.1 and aspect ratio<3
BOLD	Aspect ratio>=1.1 and aspect ratio<2.1
ROUND	Aspect ratio>=0.9 and aspect ratio<1
DUST	Aspect ratio>3.5

Table1. Classification Based ON The L/B Ratio

IV. RESULT AND DISCUSSION

Table 4 shows the results obtained from putting image processing algorithms into action. The length-breadth ratio of each grain in the input image is shown in the result.

S.no	Grain Number	L/B ratio	Label
1	Grain 1	1.29	Bold
2	Grain 2	2	Bold
3	Grain 3	1.29	Bold
4	Grain 4	1.62	Bold
5	Grain 5	1.78	Bold
6	Grain 6	2.14	Medium
7	Grain 7	1.5	Bold
8	Grain 8	1	Round
9	Grain 9	1.23	Bold
10	Grain 10	1.25	Bold
11	Grain 11	1.92	Bold
12	Grain 12	1.11	Bold
13	Grain 13	1.73	Bold
14	Grain 14	1.54	Bold
15	Grain 15	2	Bold
16	Grain 16	1.25	Bold
17	Grain 17	1.52	Bold
18	Grain 18	2.2	Medium
19	Grain 19	1.13	Bold
20	Grain 20	1	Round
21	Grain 21	3.33	Slender
22	Grain 22	1.91	Bold

23	Grain 23	2.1	Medium
24	Grain 24	1.33	Bold
25	Grain 25	1.62	Bold
26	Grain 26	1.06	Bold
27	Grain 27	1.36	Bold
28	Grain 28	1.08	Bold
29	Grain 29	3.67	Dust
30	Grain 30	1.27	Bold
31	Grain 31	1.2	Bold
32	Grain 32	1.33	Bold
33	Grain 33	1.43	Bold
34	Grain 34	1.23	Bold
35	Grain 35	1.43	Bold
36	Grain 36	1.58	Bold
37	Grain 37	1.36	Bold
38	Grain 38	1.7	Bold
39	Grain 39	1.23	Bold
40	Grain 40	1.18	Bold
41	Grain 41	2	Bold
42	Grain 42	1.33	Bold
43	Grain 43	2.33	Medium
44	Grain 44	2.4	Medium
45	Grain 45	1.29	Bold
46	Grain 46	1.22	Bold
47	Grain 47	1.55	Bold
48	Grain 48	2.86	Medium
49	Grain 49	2.1	Medium
50	Grain 50	1.88	Bold
51	Grain 51	4	Dust
52	Grain 52	1.2	Bold

Table2. Results for L/B Ratio

Images in which rice grains are randomly arranged and dispersed in a layer are subjected to image analysis techniques. When a fault occurs, such as touching kernels, the shrinking process effectively separates the connecting section from the points where the kernels are touching. Edge detection is used to determine the range of each grain's boundaries and endpoints, after which the length and width can be measured with a caliper. The length-breadth ratio is calculated when the length and breadth values have been determined. A dash app is created to see the results of the Average aspect Ratio Vs Classification chart and a pie chart for Quality analysis of the input image.

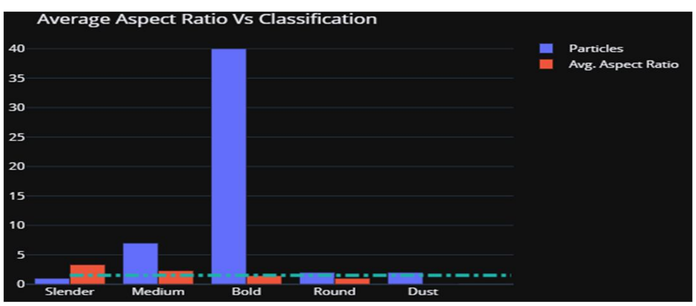

Fig7. Grouped Bar chart - Avg. Aspect Ratio VS Classification

Grouped Bar chart – Used for Classification purposes
- Blue Bar indicates the Number of Rice grains.
- Red Bar indicates Average Aspect Ratio.

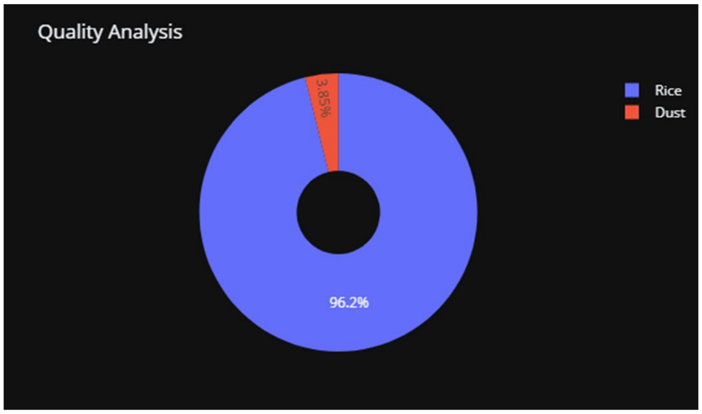

fig8. Pie chart – Quality Analysis

Pie chart – Used for Quality Analysis purposes
- Blue Section indicates the percentage of Rice grains in the given sample.
- Red Section indicates the percentage of Dust in the given sample.

V. CONCLUSION

In this project, we classify the taken rice grain sample into different categories and also analyze its quality based on the aspect ratio, so comparison with other works is not possible. Existing work only detects the rice grains or calculates the number of rice grains in the given sample, but our work helps analyze the quality of the rice sample and place it into a specific category. The quality of the grains in the samples is nearly 100% accurate and capable of efficiently classifying high-value grains, which is otherwise very time-consuming in manual analysis. This function can save a lot of time and manpower.

VI. FUTURE WORK

The majority of quality analysis factors must be measured using image processing techniques. This research could be expanded to develop a method for identifying granules based on any attribute that can be used to improve rice quality. The cost of such a system should be low, as should the time spent on quality analysis.

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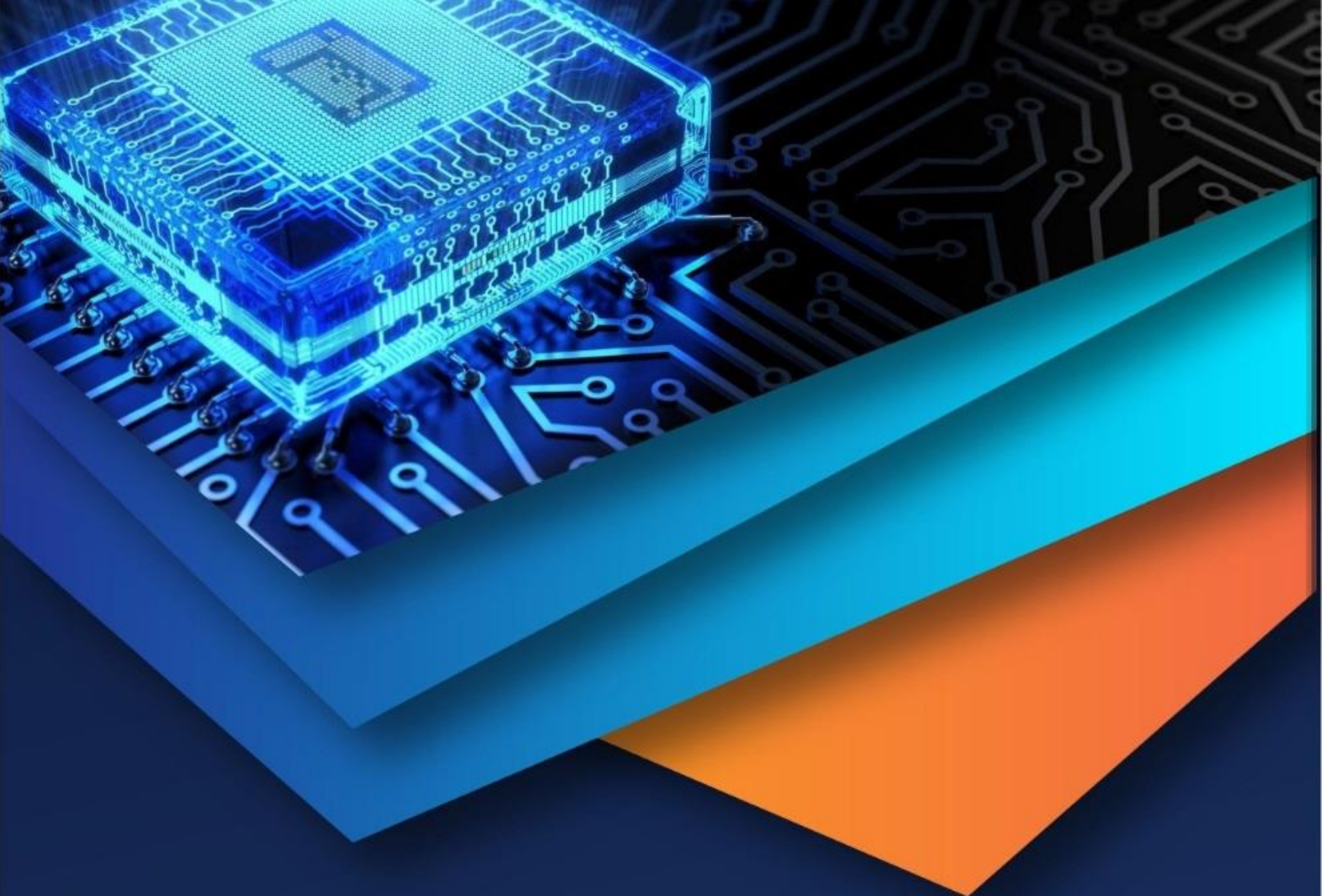

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