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Rice Quality Analysis Using Image Processing Techniques

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ABSTRACT

The quality of food grains is becoming increasingly important as individuals become more educated and demand better quality food grains. There is always a chance of food grain adulteration by traders. Usually, the quality assessment is done by visual inspection, which is a manual method. In this study, we propose an image processing technique as an effort to objectively address the shortcomings of having a manual process. This paper reports the banana quality assessment of rice grains based on their size. The grains were categorized as grade 1, grade 2, and grade 3 according to size. We used different rice grain varieties, such as Basmati rice, Sona masuri, boiled rice, and egg rice, for testing. The system was developed based on an image data set, and the images were assigned to labels using a decision tree-based classification method. The outcomes have given us promising results.

KEYWORDS: food grain Grading, Extraction, Morphological Operations, quality analysis.

1. INTRODUCTION

The agricultural sector is the longest-standing and most extensive industry in the world. Historically, food product quality has been measured from physical and chemical composition by human sensory panel. The physical characteristics are grain size and shape, moisture content, chalkiness, whiteness, milling degree, and bulk density. Moisture content is simply water content within the grain. For storage purposes, moisture content should range between 12-14%. There are different methods for moisture analysis, like the standard moisture meter and hot air oven method. Chalkiness is a white spot in the rice endosperm. Chalky grains are when more than one-half of the grain is white-discolored and brittle. Due to their brittleness, chalky grains break during milling, so this affects the milling degree of the grain when produced. The classification of grains based on their chalkiness is white belly, white center, and white back. Chalky rice reduces the palatability of cooking products; therefore, levels of chalkiness above 20% are avoided in the world market. Examination of chalkiness can be done by a magnifying glass and a photographic enlarger. This paper is concentrated on analyzing grain size and shape using image processing methods. In this paper, we used a dial micrometer, a graphical method, and a grain shape tester for measuring grain shape and grain size.

2.LITERATURE SURVEY

1.This research investigates the image processing of rice grains for grading as a rapid and non-destructive approach in contrast to the human visual inspection or chemical methods. Utilizing machine vision to measure kernel size and analyze broken kernels provides high accuracy, reliability, and speed, reducing human error and variability. Grains were photographed on a black background using a high-resolution camera with 319 × 300 pixels. Images were processed using a combination of background subtraction, contrast enhancement, and binary conversion to complete the analysis. Image processing systems can successfully classify rice grain quality more accurately than human visual inspection could achieve. Future research can incorporate additional parameters, such as grain length, to improve grading precision.

2.The current article introduces an automated way to assess milled rice quality by means of identifying broken kernels through shape descriptor technology and geometric features. Kernels that are less than 75% of the length of a full grain kernel are identified as broken. Image segmentation, which includes morphological analysis of length, width, area, and perimeter classification, increases efficiency in this process. The features extracted from the image are saved to a data file for future analysis, where six varieties of rice would be represented by size, shape, and type. This article presents an efficient morphological methodology for the classification of broken rice grains. Future studies of broken rice may include even further classification based on chalkiness and possibly other grains altogether.

3. A rapid computer vision system was developed to analyze and classify three rice varieties originating from India based on their shape, size, and defects with an accuracy between 90 and 95 percent. Rice quality is based on various factors, including processing, texture, color, and broken kernels, among other characteristics, which lowers value. Before automating this process, quality inspection was based solely on human inspection, which is subjective and raises inefficiencies. The introduction of automated rice quality inspection using Machine Vision Systems (MVS) allows for rapid and objective measurement, but it is costly and sensitive to light. This study examined low-cost, robust flatbed scanning (FBS) to classify rice using a consumer-grade scanner and simple computer software (image analysis) for the three Indian rice varieties.

3. PROPOSED METHODOLOGY

NI LabVIEW software is utilized in image processing for rice quality analysis through the Vision and Motion toolbox. A color camera captures images and transfers them using USB for processing in LabVIEW. The algorithm to analyse the rice grains follows a series of main steps: capture an image of rice on a black background, filter and remove noise, segment the grains of rice using a shrinkage algorithm, edge detection through the contours, and then measure the length and breadth. Lastly, the rice grains are classified by size and shape. The automatic approach is more accurate and efficient than the manual inspection of the grading of rice.

3.1 Block Diagram

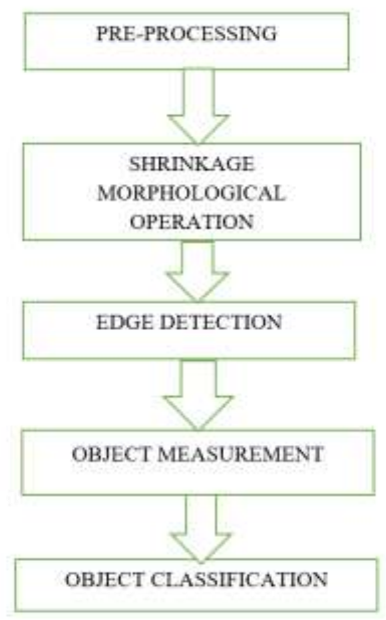

Figure 1: Block Diagram

A. Image pre-processing

Images are taken with a color camera, which is saved in a three-dimensional RGB (red, green, blue) color space. The taken image was acquired on a desktop using a USB connection, as shown in Fig 2. A filter was applied to remove noise during the image acquisition. The filter also sharpens the image. A threshold algorithm is used to threshold & segment rice grains from the black background. The color extractor is used to convert from color image to gray image, as shown in Fig. 3.

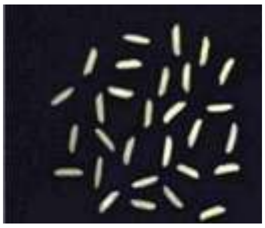

Fig.2 color image

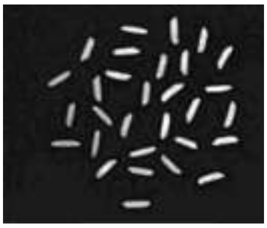

Fig.3 Gray scale image

B. Shrinkage morphological operation

On a black background, rice grains are laid out randomly. As depicted , none of the grains are oriented in one particular direction. On the subject of touching grains, we can apply morphological operations to classify them. Touching grains can be categorized into 2 specific types: point touching and line touching. Morphological operation is made up of dilation and erosion. Erosion is applied to separate the touching features of rice grains

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without losing the single-feature integrity and follows erosion in the dilation process. Dilation aims to grow the eroded features back to their original form without re-joining anything that was separated.

C. Edge detection

Edge detection helps find the characteristics of the edges of a rice grain (fig. 4). There are six edge detection methods available in the vision and motion toolbox, which are based on differentiation, gradient, Prewitt, Roberts, sigma, and Sobel. The choice of method gives the choice of which edge detection filter to use. We selected the Sobel method for edge detection in our study.

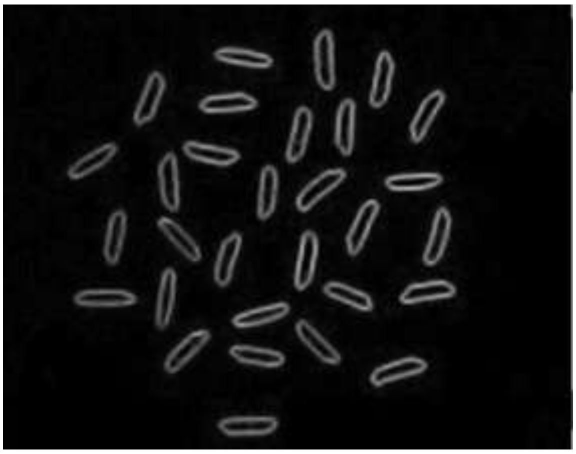

Fig.4 Edge Detection

D.OBJECT MEASUREMENT

For the measurement, we use the count of rice grains alluding to Fig. 5, which appears to show the total count of rice grains with the respective number shown in the red margin. After achieving the count of rice grains, we now can apply edge detection algorithms to the result in the image, and the end goal of applying the algorithm results in endpoint values of the grain. We then can take a caliper to connect the endpoints and take the value of the length and breadth of respective grains, and therefore, with the length and breadth ratio, we can calculate a length-breadth ratio.

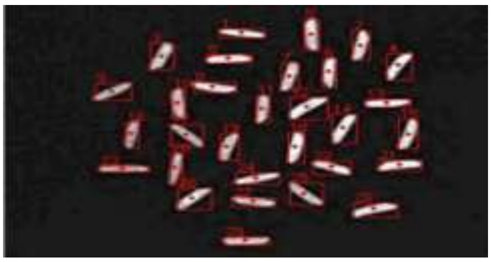

Fig.5 No. of Rice Grains

E.OBJECT CLASSIFICATION

Rice classification is based on standard, measured, and calculated data. The standard database is set for measuring rice size and shape. The Classification of rice grains according to the standard database involves grouping them side by side to classify and identify rice. The Classification of rice grains based on length and length-breadth ratio is important as it determines the size of the particular types of rice. The length-breadth ratio classification is used when the rice grains are classified as slender, medium, bold, or round. Classification of the rice grains itself represents a distinguishing of rice grain type.

TABLE 1

CLASSIFICATION OF RICE GRAINS [9]

LONG SLENDER	Length 6mm & above, L/B ratio and above
MEDIUM SLENDER	Length less than 6mm, L/B ratio and above
SHORT SLENDER	Length 6mm & above, L/B ratio and 2.5-3.0
LONG BOLD	Length 6mm & above, L/B ratio less than 3
SHORT BOLD	Length less than 6mm, L/B ratio less than 2.5

TABLE 2

CLASSIFICATION ON THE BASIS OF LENGTH

GRAIN SIZE	LENGTH(mm)
Extra-long	>7.5
Long	6.61-7.7
Medium	5.51-6.6
Short	5.5 or less

TABLE 3

CLASSIFICTATION 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

4. RESULTS

The algorithms for image analysis are run on a generated image of rice grains that's randomly distributed and flattened in one layer. The image analysis algorithms have proven to be very effective in separating the connecting part of the point touching kernels, should the error occur where there are touching kernels. Edge detection is performed to find the area of boundaries and endpoints of each grain, from which the caliper length and breadth can be measured. After obtaining the length and breadth values, a length-breadth ratio calculation is performed.

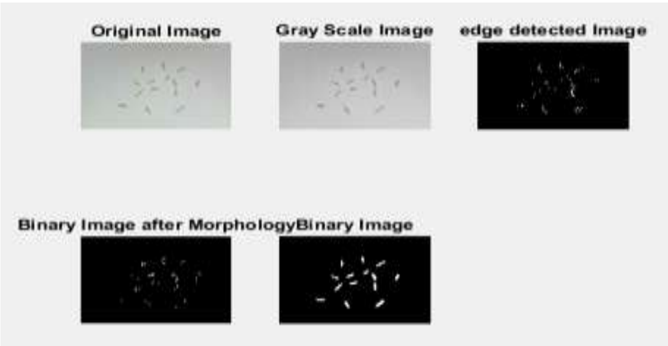

Fig .6 Shows Result

S.NO	GRAIN NUMBER	L/B RATIO	TYPE OF RICE GRAIN
1	RICE GRAIN 1	3.44	SLENDER
2	RICE GRAIN 2	3.55	SLENDER
3	RICE GRAIN 3	4.52	SLENDER
4	RICE GRAIN 4	3.31	SLENDER
5	RICE GRAIN 5	3.58	SLENDER
6	RICE GRAIN 6	2.89	MEDIUM
7	RICE GRAIN 7	2.67	MEDIUM
8	RICE GRAIN 8	3.59	SLENDER
9	RICE GRAIN 9	2.77	MEDIUM
10	RICE GRAIN 10	3.17	SLENDER
11	RICE GRAIN 11	3.49	SLENDER
12	RICE GRAIN 12	4.06	SLENDER
13	RICE GRAIN 13	4.11	SLENDER
14	RICE GRAIN 14	3.36	SLENDER

TABLE 4

5. CONCLUSION

A quick computer vision system was designed and implemented to explore the analysis and classification of three varieties of rice from India based on features of shape, size, and defects and to obtain an accuracy between 90 and 95 percent. Rice quality is based on several factors, including but not limited to processing, texture, color, and physical defects (broken kernels) that can impact value. Before automation, the inspection of rice quality was performed manually through direct inspection and was subjective and inefficient. Automated quality inspection has been created using Machine Vision Systems (MVS) for general and rapid objective measurements at some cost and, in some situations, light sensitive. In this study, low-cost, robust flatbed scanning (FBS) was investigated to classify rice of the three Indian varieties, using a consumer-level scanner in combination with simple computer software (image analysis).6.

6.FUTURE SCOPE

For quality analysis, the maximum number of parameters can be detected via image processing methods. Future work can expand on their work with the eventual goal of designing a system that can classify rice grains on each of the parameters that can be used to improve rice quality.

The design of such a system needs to have low costs and short time requirements for quality analysis as well.

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