Rice Grain Grading Classification Based On Perimeter Using Moore-Neighbor Tracing Method

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***Abstract*— In this paper, we present improved rice detection for rice grading quality. Indeed, the agricultural industry sector, especially in rice production has a long-established history so far in Malaysia. Quality evaluation of grains is a major challenge previously. The main objective is to make the differentiation and classification of head and broken rice grains utilizing image processing technique. The classification of rice grain is implemented based on the size of the grain (head rice or broken). Moore-Neighbor Tracing method is used in order to locate or detect the rice around the image. Based on the result from analysis proved that perimeter is the main feature to be considered for rice grading since its give significant correlation compared to other properties. In conclusion, by using Moore-Neighbor Tracing techniques, we can identify the right quantity of rice grain up to 95.83 %.**

***Index Terms*— Broken Rice; Classification; Image processing; Moore-Neighbor Tracing.**

I. INTRODUCTION

Rice is developed in numerous districts crosswise over Malaysia. Malaysia is the major driving maker of rice in the whole world. In Southeast Asia, rice is staple nourishment for 80% of the population. As nations achieve independence in rice generation, the interest of the consumer for better quality rice has expanded [1]. The quality of rice is based upon numerous parameters, for example, shading, size, shape and no of broken bits. A rice quality investigation by people is neither goal nor proficient [2]. In perspective on this robotized rice quality investigation utilizing machine vision is attractive [3]. As of late, machine vision and image processing are broadly utilized as a part of an organic and rural examination with the change of computer innovation a noteworthy lessening of expense of equipment and programming of advanced imaging [4]. Numerous studies have connected image processing to grain quality examination [5]. There are numerous examines connected machine vision to gauge the rice appearance, quality review by using the image processing to distinguish grains based on the parameters, territory, length, width, border, shading and shape [6].

Rice classification is a procedure of expelling the broken rice from head rice and sorting them into all around characterized parts of diverse length [7]. Optical examination is the last quality control and improvement procedure in the rice factory. In order to accomplish a consistent and high quality in packs white rice, the different white rice parts are mixed as the business sector necessity. The attractive white rice is then stuffed and distributed to the clients either locally or outside [8].

Based on Padiberas Nasional Berhad (BERNAS) reviewed, rice is arranged into three evaluations, to be specific standard, premium and super. Standard alludes to rice with highly broken (more than 45%) and may contain 100% defect grain. Premium alludes to rice with highly broken (more than 45%) however, its harmed grain should not surpass 2%. Super is further partitioned into three distinctive evaluations in view of its broken content, to be specific Super Tempatan 15% (about 15% broken rice), Super Spesial Tempatan 10% (about 10% broken rice) and Super Spesial Tempatan 5% (about 5% broken rice)[9]. Composition of rice grain is one of the segments utilized for rice evaluation to differentiate between head rice and broken rice [10]. Head rice comprises of entire bit or possibly 8 portions of the kernel. Figure 1 demonstrates the graph of head and broken rice reviewed by BERNAS.

The rice grain refining system is an easy process or maybe a couple of steps, on the other hand a multi-stage process. For the one-stage processing procedure, husk and grain evacuation are done in one pass and processed or white rice is created straightly out of paddy. For two-stage procedure, eliminating husk and uprooting bran are done independently, and brown rice is created as a moderate product. In multi-stage processing, rice will be processed by various distinctive steps.

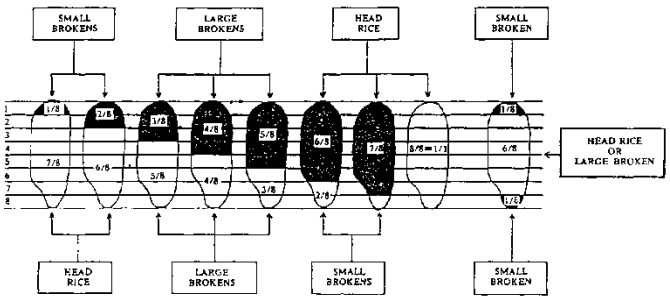

Figure 1: Classification of rice composition [15]

The processing procedure begins with cleaning this to guarantee that base amount of contaminations and outside matters experience the framework. The second process is dehusking. At this stage, broken grain is measured, if

discovered higher than adequate points of confinement modification will be made with machines. The process of rice differentiation consists of isolating brown rice and paddy. Then, rice brightening and cleaning process. Born rice will then undergo a few brightening machines to create clean rice, grain and brewer. This is another procedure that makes a considerable measure of breakage. A further step is process of rice division in order to differentiate head rice and broken rice. Lastly is the process of mixing the rice in order to make an evaluation.

The targets of grading for rice guarantee just eatable rice achieves the customer needs by minimizing waste since it has been accounted by Department of Agriculture and Cooperation in India that around 9% of paddy is lost because of utilization of old strategies for drying and processing [11]. In this manner, the broken rice recognition can be utilized as a marker to guarantee the factory is composed by enhancing, preparing practices for better processing for business sector improving [12]. As we know, the broken rice is additionally impacted by the assortment of rice and inappropriate reaping time, in this manner checking the broken rice while processing stage can assist the agriculturists with improving agronomic practices which can improve ranch yields. They will pick rice assortment which is not inclined to splitting and just reap when it is developed. The process of harvesting of grain before maturity gives a low processing recuperation furthermore a higher extent of youthful seeds, high rate of broken rice, poor grain quality and more risks of ailment assault in capacity of grain. At long last, it shields customers from cost control since some industry mix a lot of broken rice. Today's image processing techniques has turned into a progressively prominent and intelligent strategy in rice evaluating [13].

Broken rice is delivered as an aftereffect of the processing procedure. Consumers toward as few broken rice as could reasonably be expected and this may be likewise one of the variable affecting the cost of rice. Subsequently, look into on broken rice recognizable proof with the guide of image processing is considerably more essential these days. In this paper, image processing techniques has been rice utilizing computerized system. Since the workers face many problems in order to finish their rice grading process. The main problem for the workers is the allocation of a long time to complete the work of separating rice. So, the main objective of this study is to aid the workers to differentiate between head rice grains and the broken rice grain easily compared to manually method. As a result, we can minimize the allocation of time in rice grading process.

II. METHODOLOGY

Rice grain samples were taken up for detecting and differentiating. Following is the basic steps for the process:

- Read the Image
- Threshold the Image
- Binarization
- Remove the Noise
- Determine the row and Column
- Detect The Boundary
- Coloring the rice
- Count and Differentiate the head and broken rice

A. Read the Image

To detect the boundaries of objects in a binary image using bwtraceboundary. Then, using bwboundaries, also can detect the boundaries of all objects in the image.

B. Threshold the Image

Use the *im2bw* function to convert the grayscale image into a binary image by using *thresholding*. The function *graythresh* automatically computes an appropriate threshold to use to convert the grayscale image to binary. Remove background noise with the *bwareaopen* function.

C. Binarization

Images need to be converted to binary image in advance. This is because *bwtraceboundary* and *bwboundaries* function only works on a binary image to design borders on the image. To detect the boundaries of rice grain in the image, *bwboundaries* function is used. Basically, *bwboundaries* get the border of all the objects in the image, including objects in other objects. In the binary image used in this example, some of the coins contain black areas where *bwboundaries* interpret as separate objects. To ensure *bwboundaries* only detect coins, use *imfill* to fill areas in each coin. *bwboundaries* which returns an array of cells, where each cell contains a row or column coordinates for an object in the image. Figure 2 below shows the image after binarization process.

Figure 2: Binary image of rice grain

D. Remove the Noise

Utilizing morphology functions eliminate pixels which do not belong to the objects of interest.

E. Determine the row and Column

Next, determine the row and column coordinates of the pixels on the border of the object we want detect.The function *bwboundary* use this point as a starting location for detecting the border.

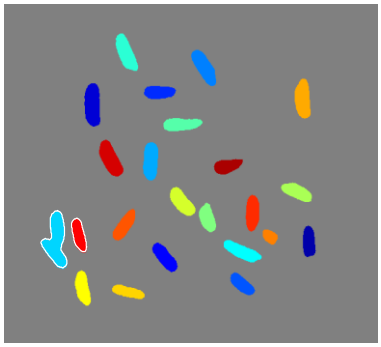

Figure 3: Detecting rice based on row

F. Detect the Boundary

The function of *bwtraceboundary* is used in order to detect the boundaries of the specified angle. As arguments are needed, we must determine the binary image, the row and column coordinates of the starting point, and the direction of the first step. Then, plot borders all of the rice in the original grayscale image using the coordinates returned by *bwboundaries*. The function of *bwtraceboundary* is used in order to detect the boundaries of the specified angle. As arguments are needed, we must determine the binary image, the row and column coordinates of the starting point, and the direction of the first step. Then, plot borders all of the rice in the original grayscale image using the coordinates returned by *bwboundaries*.

G. Colouring the rice grain

Moore Neighbor Tracing method and label2rgb function are used in order to detect and coloring the rice grain respectively. The fundamental of Moore Neighborhood concept is trace or detecting the object one by one based on the nearest object to the start point (first rice detected). The *label2rgb* function determines the color to assign to each object based on the number of objects in the label matrix and a range of colors in the *colormap*. The label2rgb function picks colors from the entire range.

H. Count and Differentiate

Start to count the area and perimeter of rice grain using the formula. Then differentiate the rice grading into 2 classes which is the head and broken rice.

III. RESULT AND DISCUSSION

A. Detection of rice grain

Figure 4 demonstrates the result of pixels that has been detected based on the coordinate since the starting pixel is on a thin part of rice grain as well as the initial step is set to north and south. From this image also we can see there are outlines of boundary that has been detected. When the rice grain in the image can be detected, further the amount of the rice grain in the image also can be calculated.

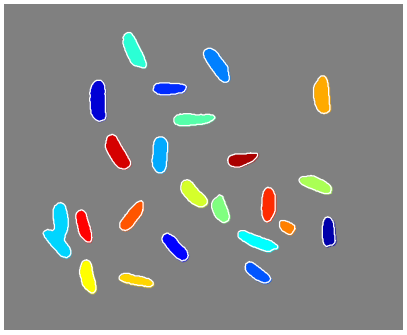

Figure 4: Detected rice grain

Figure 5 below shows the histogram of area-based for the rice grain. From the histogram, indicate that the distribution of the area of the rice grain.

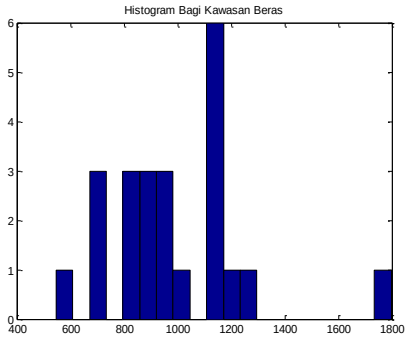

Figure 5: Histogram of area-based for rice grain

B. Count the rice grain and Classification

The result below show the amount of all entire objects which is rice grain that has been counted based on the original image. From the image, we can see that the system can only identify 23 rice grains. But the actual number of rice grain in the image is 24. So based on the Equation (1), the percentage of accuracy is 95.83%.

Field	Value	Min	Max
Connectivity	26	26	26
ImageSize	[517,633]	517	633
NumObjects	23	23	23
PixelIdxList	*1x23 cell*		

Figure 6: Number of rice grain

$$Accuracy(\%) = \frac{Number\ of\ rice\ count}{Actual\ number\ of\ rice} \times 100\% \qquad (1)$$

Table 1 shows the result of perimeter (in cm) for each rice grain.

Table 1
Perimeter of rice grain

No. rice grain	Perimeter (cm)
1	4.05
2	4.27
3	4.00
4	6.22
5	3.39
6	3.48
7	3.42
8	3.48
9	3.51
10	3.78
11	4.01
12	3.32
13	3.97
14	3.51
15	3.19
16	3.09
17	3.08
18	4.14
19	3.51
20	2.02
21	3.12
22	3.49
23	3.92

Figure 7 below shows the illustration of perimeter for each of rice that has been detected. By using image processing techniques, the perimeter of rice can be measured easily and quickly. With this, it can help the manually process in getting the measurement of the size of the rice to be graded.
Next,the rice will be classified according to the size of the perimeter that had been set as the default standard. With this, the rice can be detected and differentiate easily and then can be graded for improving and maintaining the quality of the rice in order to improve the technology in the agriculture sector in Malaysia.

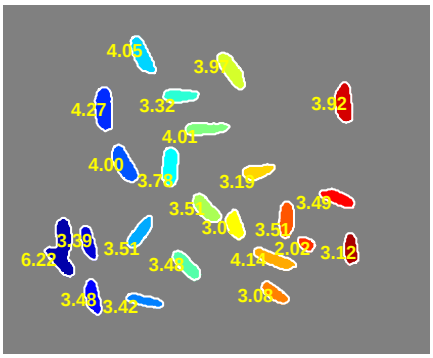

Figure 7: Perimeter all of rice grain

Figure 8 below shows that the head rice has been detected. The results can be seen from the illustration is the classification of two categories which is head and broken rice. The perimeter of head rice must exceed 6/8 of perfect size of a rice grain. In that scenario, the size of rice under 5/8 levels will be regarded as broken rice. Head rice that has been identified is highlighted by the small circle indicator in order to distinguish the head rice and broken rice. Based on the illustration below, we can see that 22 head rice that has been classified.

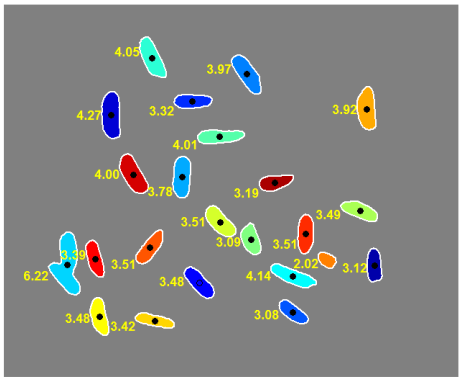

Figure 8: Head rice highlighted

Figure 9 below shows the broken rice that has been detected. Broken rice is the rice perimeter less than 5/8 of perfect rice. In this situation, the size of the rice defect over 5/8 or less will be regarded as broken rice. Based on the illustration below, there is only 1 that is classified as broken rice since their size is lower than 2.7 cm.

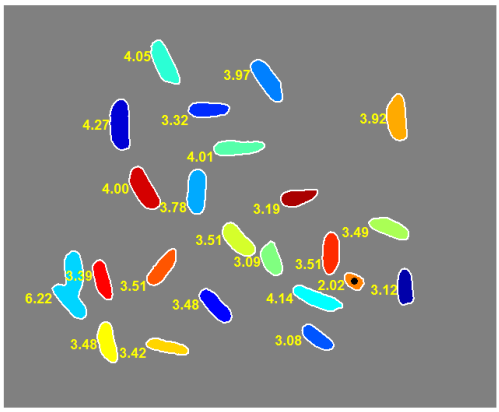

Figure 9: Broken rice Highlighted

IV. CONCLUSION

Based on the study were made, proved that by using image processing can help to improve the classification of rice grain grading quality since the time allocation and accuracy for rice detection is better compared to manually method. As a result, the accuracy for rice grain detection reaches 95.83%. As we know, decision making abilities of human-reviewers are influenced by a few factors such as weakness, bias and inaccurate when using huge sample. As a nutshell, the results will inspire for further study in detecting techniques and grading for the rice grain by using different scope and method.

ACKNOWLEDGMENT

This work was supported by research grants RAGS/2013/FTMK/ICT02/01/B00039 under the Ministry of Higher Education of Malaysia for financial support.

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