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Quality Testing of Rice Grains Using Image Processing

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ABSTRACT
Rice is the most favorable and most consuming food for human being in all over the world and researchers are working to improve the quality of rice. Quality of grains is an important requirements. Seed purity is a crucial seed quality parameter in the Indian rice seed standard. The use of high quality cultivated rice seed, free of any foreign seeds, is the prerequisite to sustaining high yield in rice production. The presence of foreign seeds such as weedy rice in the cultivated rice seeds used by the farmers can adversely affect growth and yield as it competes for space and nutrients with the cultivated rice varieties in the field. The current cleaning processes that rely mostly on the difference in physical traits do not guarantee effective separation of weedy rice seeds from the lots. Seed bags found to contain more than 10 weed seeds upon inspection by the enforcing agency will not be approved for distribution to farmers. There are different type of techniques that use for testing the quality of rice grains. , like using machine vision and image processing. Image processing nowadays plays a vital role in automation in several domains like medical science, remote sensing, agriculture, environmental science, special science etc.
Keywords – Image Processing, Quality, Rice Grains.

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I. INTRODUCTION

The demand for quality of food products we consume is increasing day by day. India is second largest producer of rice grains first being China. Grain quality has probably been used as a criterion to select rice since humans first cultivated it. For the International Rice Research Institute, grain quality has had a key role in research from the institute's beginning. In the future, grain quality will be even more important once the very poor many of whom depend largely on rice for their staple food become better off and begin to demand higher quality rice. It is primarily due to his dedicated work in this important research area that IRRI scientists can routinely measure grain quality in pre breeding efforts serving national agricultural research systems. Grain quality evaluation of world rice is a much needed data base of selected grain quality characteristics of milled rice from all countries producing more than 0.1% of the world's rice. Quality characteristics and preferences are discussed by country based on information obtained from national programs.

Our present life situation in the world is very hurried as well as there is no time to take care of our health. In the recent survey most disease caused only because of the food habit. The Indian most famous proverb is food is the solution of the disease but now tablets and syrups are becomes food. This is only happens because of we don't know how to choose the food materials. Even though we care about our food but we don't know how to analyze it such that whether it contains the good quality as they promised. The one solution is that, each state government they have food quality analyze council, they randomly checking the food materials which are available in market but the checking also not frequent. So there are lot of chances for the duplicate products and low quality things. On the other side the only solution the branded name, because of the branded name we blindly go for the product. Because they have some quality certificates like ISO, ISI etc.

Rice is the most favorable and most consuming food for human being in all over the world and researchers are working to improve the quality of rice. The quality measurement of rice is also important because it is consumed as food as well as it is used for milling process in the national and international market. Many researchers have already worked on the quality of grain and proposed different techniques to characterize the quality of rice. Chalky is whiteness part in the rice grain and it is one of the most important parameter that is used to evaluate the quality of rice grain. There are different

methods are available for testing the quality of rice grains.

II. LITERATURE SURVEY

With Here different papers are studied based on the approaches used by different researchers and modification are made to provide more reliability in the proposed system.

N. Minni et al [1] presented a survey of grading the agricultural products using image processing. A model for the automatic grading of food products is suggested by analyzing their quality. Quality is checked and analyzed using the classification and clustering algorithms. Neural network and image processing algorithms are becoming prominent in the field of agriculture. So they proposed a model to detect the type of deficiencies in the food products with the help of image processing algorithms.

Dr. Prashant Kumbharkar et al [2] Introduced 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.

Manabu SUZUKI et al [4] presented that the quality of food plants has been performed by many inspection methods. To date, the evaluation of the grain of crops by photoacoustic spectroscopy in the infrared region has only been performed for corn. They had developed a method of applying a photoacoustic microscope (PAM) to pollen analysis. In therestudy, a PAM was used to evaluate the quality of crop grains, rice in there case, for the first time.

S.Durai et al[5]used image processing technique for grading of rice quality by chalky area analysis. By considering the chalky area of rice we can say all rice in the baggage is same variety or some mixed is there. In future we apply this technique to classify the rice as well as grading them**.** This proposed methodology is a simple and time efficient and we got 90 percentages of accuracy results when compared to the manual analysis of grain quality. For the taken samples they got the expected results when compared to other classical analysis methods.

SnehaS.Kausal et al[7]presented that the quality of grains is an important requirement to protect consumers from sub-standard products. Sensory pleasure, healthy eating, value and convenience the consumer trends are driving the food industry today. Rice delivers on all of these. There proposed system helps to identify the type of rice grain being provided. Fig.1: Block Diagram of the Proposed System

III. PROPOSED WORK

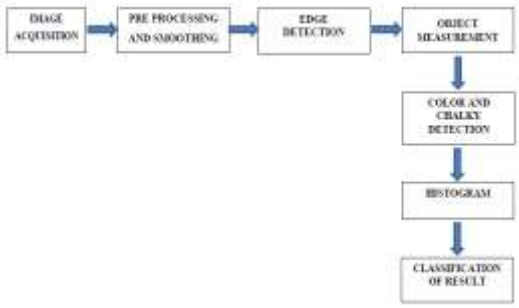

Fig.1: Block Diagram of the Proposed System

1)Image Acquisition

Image acquisition is the creation of digitally encoded representation of the visual characteristics of an object, such as physical scene or the interior structure of an object. We have acquired rice grain images from Inte IT-306 WC PC WEBCAM with black background under best illumination scenario. The saved images in Jpeg format are then used for image processing.

2) Image Preprocessing And Smoothing

The aim of image processing is an improvement of the image data that suppresses unwanted distortions or enhance some image features important for further processing. Smoothing is often used to reduce noise within an image. Preprocessing and smoothing means image is filtered from external factors (such as noise, dust etc.) Smoothing is often used to reduce noise within an image. Preprocessing and smoothing means image is filtered from external factors (such as noise, dust etc.) Capture image will be resize and enhance . In this we use Gaussian filter for removing noise. The mathematical equation of Gaussian filter is given in equation

$$G(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{x^2}{2\sigma^2}}$$

3)Edge detection

Edge detection includes a the variety of mathematical methods that aim at identifying points in a digital image at which the image brightness changes sharply or more formally, has discontinuities. The points at which image brightness changes sharply are typically organized into a set of curved line segments termed edges. The purpose of detecting sharp changes in image brightness is to capture important events and changes in properties of world. We used canny edge detector. The canny edge detector applied on gray scale images. It is a good approach for detecting the edges and has the ability to minimize the localization error. It can detect the weak edges as

well. The canny edge detector is a multistage edge detection algorithm. The steps are:

1. Preprocessing
2. Calculating gradients
3. Non maximum suppression
4. Thresholding with hysterysis

4)Object measurement

Object measurement are made on a per-object basis, with one set of measurements for each object detected in a field. These measurement are typically of morphological characteristics of the objects detected, and can include size, shape, position, intensity, color, count etc.

Following features were extracted from rice sample images:

i)Area: The total number of pixel covered by grain.

ii)Major axis Length (L**):** The longest line that can be drawn through an object is called major axis length.

iii)Minor axis Length (l**):** The longest line that can be drawn through an object, perpendicular to the major axis.

iv)Length (l**):** Rice grain is enclosed in rectangular bounding and the length of this rectangle bounding box gives the length.

v)Width (w**):** Width of rectangle bounding box is known as width

vi)Centroid

Center of mass of the region, returned as a 1-by-Q vector. The first element of Centroid is the horizontal coordinate (or x-coordinate) of the center of mass. The second element is the vertical coordinate (or y-coordinate). All other elements of Centroid are in order of dimension. This figure illustrates the centroid and bounding box for a discontiguous region. The region consists of the white pixels; the green box is the bounding box, and the red dot is the centroid.

The coordinates for the region centre of mass. This is a row vector with one element per dimension, such as [x y z …].

5) Color and chalky detection

Chalky is basically the whiteness part in the rice grain. Chalky does not effect on the taste of food but it does effect on the milling process in the nation and international market.

Percentage of Chalky: Percentage of chalky is calculated using following formula.

$$percentage\ of\ chalky = \frac{Actual\ area\ of\ grain - area\ of\ chalky\ portion}{\text{Actual area of grain}}$$

i) Detection of Chalky in the Rice Grain

Chalky is the most important parameter for identifying the best quality in the rice grain. For quality parameter, ricegrain with minimum chalky is considered the best quality. In order to detect the chalky in the rice grain, we will be used extended maxima operator along with other morphological operators.

ii) Extended Maxima Operator

Extended maxima operator will be used in our image processing technique. By using this operator we can close all minimum values in the image and highlight the high values.

We will be separate the chalky portion in the grain images by applying this operator

iii) Algorithm for Chalky Calculation

The major steps that are involved in detection of the chalky in rice are described below:

a) Step1: Apply Morphology Opening:

Creates a square shaped structuring element with the specified length and width. Then perform the morphological opening operation on the image. Morphological opening is basically the dilation of erosion of set f by structuring element b.

b) Step 2: Apply Morphology Erosion and Reconstruction:

Erosion is one of the fundamental operation in morphological image processing.

c) Step 3: Apply Morphology Closing Operation:

In image processing closing is, combine with opening the basic concept of morphological noise removal. Opening removes small objects, while closing removes small holes. In mathematical morphology, the closing of a set (binary image) f by a structuring element b is the erosion of the dilation of that set.

d) Step 4: Apply Extended-Maxima-Transform:

The extended-maxima-transform is applied to identify the chalky in rice grain. This transform is the regional maximum of the H-maxima transform where H is a nonnegative scalar. The H-maxima transform suppresses all maxima in the intensity image whose height is less than H, where H is a scalar. In our work value of H is 15.The regional maxima are connected components of pixels with a constant intensity value, and whose external boundary pixels all have a lower value. By default, this operator used 8- connected neighborhoods for 2-D images. By using regional maxima operator we have separated the whiteness part from the rice grains in the image.

e) Step 5: Superimposed Regional Maxima on the Original Image

Next we superimposed the chalky on the original image.

f) Step 6: Compute the Area of Chalky:

After performing step 4, we extracted the chalky portion in the rice grain and calculated the area of

this chalky by the properties of region props .Finally we compared this value with the original area of rice.

6. Histogram

In image processing context, the histogram of an image normally refers to a histogram of the pixel intensity values. This histogram is a graph showing the number of pixels in an image at each different intensity value found in that image.

7.Classification of results

Classification is based on all standard, measured and calculated data from above procedure. In this we have considered percentage of normal rice grain parameters for grading purpose. And according to that we decide quality. In our case, we will classify the grading according to percentage of measurement factor that we have considered. If for particular sample testing of rice grain, we'll find max components parameters and average of all components, if that average value has 80 to 100 % of max components value then it will classify as grade 1, similarly if it is 60-80% then grade 2 and if its below 60 % then grade3.

Table 1: Classification

Percentage Factor	Grading Scale
80-100	Grade 1
60-80	Grade 2
0-60	Grade 3

IV. RESULTS

The proposed work is implemented on intel CORE processor i3, 4GB RAM Laptop configuration. MATLAB R2013a software was used to write the programming code. For standard illuminance and constant background, we have made cabinet in which Intex PC Web CAM is attached to capture the rice grain sample image, which is shown below.

Fig.2: Input Image

Fig.2 : Crop Input Image

Fig.3: Gray Image

Fig.4: Contrast Image

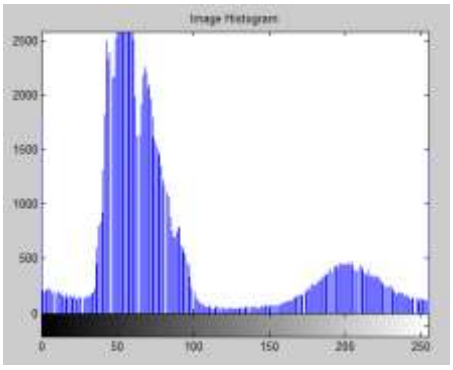

Fig.5: Image Histogram

Fig.6: Binary Image

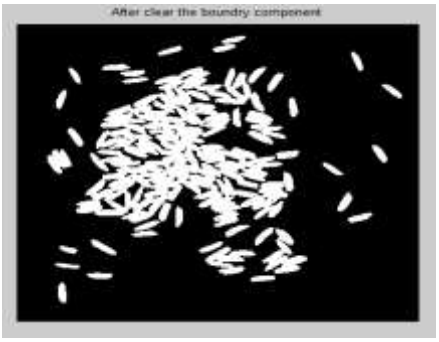

Fig.7: After clear the boundary component

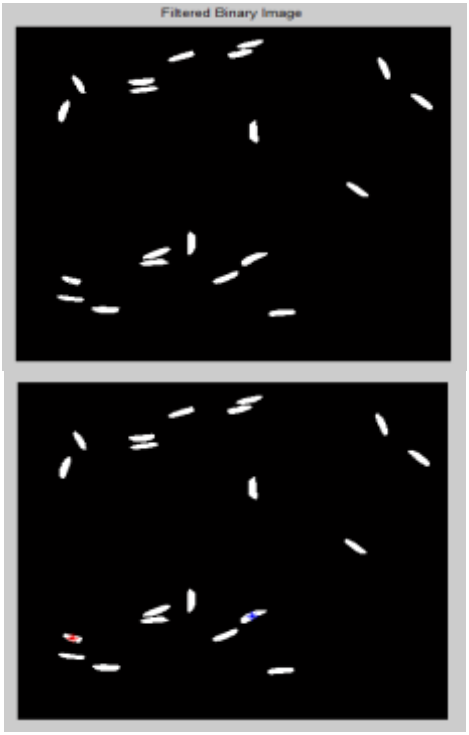

Fig.8: Filtered Binary Images

Table 2: Average values of area,length,width and chalky of each sample

Sample No.	Rice Type	Mean Area	Mean Length	Mean Width	% of chalky
Sample 1	Dilnoor Basmati Gold	138.9	25.15	7.27	95
Sample 2	JokarKolam	90.25	19.62	6.05	95
Sample 3	Chinnor Kalimo-och	114.9	22.26	6.80	78
Sample 4	HMT Grade 1	113.7	19.86	7.53	96
Sample 5	Parimal Control	139.2	20.30	8.98	0.94

Table 3: Grading on the Basis of Area

Samples	**Grade**
Sample 1	Grade 1
Sample 2	Grade 1
Sample 3	Grade 1
Sample 4	Grade 1
Sample 5	Grade 2

Table 4: Grading on the Basis of Width

Samples	**Grade**
Sample 1	Grade 1
Sample 2	Grade 1
Sample 3	Grade 1
Sample 4	Grade 1
Sample 5	Grade 1

Table 5: Grading on the Basis of Length

Samples	**Grade**
Sample 1	Grade 1
Sample 2	Grade 1
Sample 3	Grade 1
Sample 4	Grade 1
Sample 5	Grade 1

Table 6: Grading on the Basis of Chalky

Samples	**Grade**
Sample 1	Grade 1
Sample 2	Grade 1
Sample 3	Grade 2
Sample 4	Grade 1
Sample 5	Grade 1

V. CONCLUSION

The quality of grain is an important requirement. There are different methods are use for quality testing of rice grains. It concluded that the image processing algorithms will develop to segment and identify rice grains. It will be shows that the use of image processing algorithm is an efficient method to analyze grains quality by its size.

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