DETERMINATION OF PHYSICAL QUALITY OF RICE USING IMAGE PROCESSING

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Abstract—Rice being one of the most useful crops needs Physical quality detection. Due to the limited capabilities of Human eye we propose a new technique using Image Processing for Physical Quality Detection. Here the aspect ratio is used as a parameter to determine the purity. This proposed method also helps to predict the cause of the quality deterioration.

Index Terms—Image Processing, Statistical Analysis, Rice Grain, Physical Quality

I. INTRODUCTION

The quality of the most staple food crop of world which is Rice is determined by shape, size aroma, nutritional value and the texture of the grain kernels. Broken rice grains appear during husking and adulteration, so there is always a need for the check for the quality of the rice.

The quality is tested either using digital Image vision or using Chemical method. Chemical Method is non-economical and time consuming. Whereas using Image Processing or computer Vision we can test the quality in a faster rate and non-destructively. A researcher (Zayas et al., 1986) has already used Computer Vision to study the wheat grains.

Rice grain Kernels are near about elliptical in shape and so possess an aspect ratio (i.e., the ratio of the major axis to its minor axis). Each rice variety has more or less the same aspect ratio to its grain kernels. With the variation of the rice variety and broken grains we observe a change in elliptical properties. Statistical Analysis on the grain properties makes the quality result using comparison with ideal variety results.

Image Processing is a useful tool in application of agriculture, metallurgy, biotechnology, etc. Image processing being a non-destructive, economical, fast and accurate has been beneficial tool for analysis. Digital image analysis has also been used to evaluate the effect of moisture content on cereal grains by studying its effect on the physical appearance and kernel morphology (Tahir et al., 2007).

II. RICE MORPHOLOGY

A) RICE GRAIN KERNEL

The rice grains are generally elliptical in shape. Major axis and minor axis may be determined as well as the aspect ratio may be calculated in accordance with the aspect ratio.

III. IMAGE CAPTURE

The images used in the program are obtained either using Digital Image Photography or Flat Bed Scanning. Both use a black background for its post-capturing works. For Flat Bed Scanning the rice were scattered in the glass panel of the flatbed scanner and a black background was used. For Digital Image Photography a fixed distance between the objects and the camera was used for capturing the image. The Images were converted into JPEG format for further processing.

Two Images are used. First image has the best finely selected rice grain which is used for reference and the second image is of the grain which is to be tested.

IV. METHODOLOGY

The following steps were carried out for processing.

- **i.** The captured images are converted to gray scale images.
- **ii.** Backgrounds of the Images are subtracted from the images.
- **iii.** The Images are further processed with contrast adjustment
- **iv.** Images are converted into binary Images for performing further filtering.

V. IMAGE SEGMENTATION

Owing to elliptical shape of the rice grain kernels, the major axis, minor axis and aspect ratio of each grain can be determined. The images obtained after processing are segmented to obtain the physical properties which is their major axis and minor axis of each grain. The value of Major axis and Minor axis obtained is used to calculate the aspect ratio (i.e., the ratio of the major axis to the minor axis) of each grain. This aspect ratio is used as a parametric value.

Two separate one dimensional arrays are used for storing the values. First array is used for storing the parameter values of each grain of the reference sample and may be nomenclature as reference parametric array. The Second array is used to store the parameter values of each grain of the sample parametric array. The reference parametric array and sample parametric array are used for further statistical analysis.

VI. ANALYSIS OF THE GRAIN PARAMETER

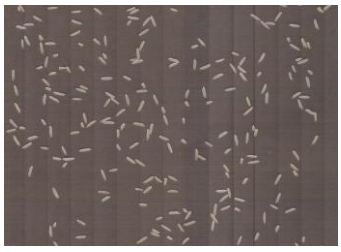
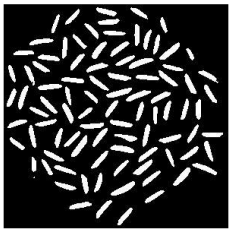
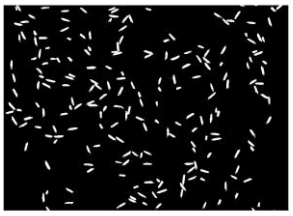
The further analyses of the Arrays are followed as follows:

- **i.** The Statistical mode of the elements of the reference parametric array values is calculated to determine the average size of the Rice kernel grains and may be termed as ideal rice index and referred as $\mathbf{R_I}$.
- **ii.** The grain index of each grain of the testing sample is calculated and is stored in another one dimensional array called Index Array with elements in the form of RIj where j indicates the index of the element of the sample parametric array.

  R_{Ij} = (Value of jth element of the sample parametric array) - R_I
- **iii.** The Statistical mode of the elements of the Index Array is determined which shows the mode value of the entire array determining the average change in the Grain aspect ratio of the sample with the referenced sample as is referred as Index Value of that sample.

VII. EXPERIMENTATION, OBSERVATION AND RESULT

The Experimentation was carried out as follows using the following images:

Image No	1	2	3
Preprocessed Image			
Binary Images After Applying Filters			
Image Purpose	Rice Grains with bigger Rice grains added. (Aspect ratio of average grain is greater than the reference grains)	Reference Image	Rice grains with broken grains (The aspect ratio of broken grains is less than the reference grain)
Index Values	**-0.5747**	**0**	**0.3325**
Cause	**The average grain aspect ration was greater than the reference image thus difference resulting in a negative value.**	**Identical Grains.**	**The broken grain aspect ratio is always less and thus the difference is positive.**

VIII. CONCLUSION

The above method proves to be a very efficient way to determine the quality by analyzing the index value of the sample to be tested. The value diverging from 0 on both the negative and positive indicate the quality deterioration. A negative value shows Adulteration by grains of larger aspect ratio or husk presence while a positive value shows presence of adulteration by grains of smaller aspect ratio or broken grains. MATLAB was used for programming the entire software for the experimentation. The setup used above is easily available. The method being more accurate than human eyes, fast and cost efficient and fit to be used for industries.

IX. REFERENCES

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