Grading of Rice using Image Processing (GRIP)

Aditya Ghag[1], Steephen Chacko[2], Nikhil Dedu[3], Meena Ugale[4]

[1, 2, 3, 4]Information Technology, Mumbai University, Mumbai, Maharashtra, India-400016

Email address: [1]adityaghag15@gmail.com

Abstract— AGMARK uses a manual system for grading quality of rice wherein the results may prove to be inaccurate. This can be overcome using Image Processing Technique. A digital inspection method to grade the quality of rice for the present AGMARK standards is proposed. Digital Image processing can classify the rice grain with speed and accuracy. Grading of Rice using Image Processing (GRIP) discusses the different parameters used for analysis of rice grains and how algorithm can be used to measure and compare them with accepted standards. MATLAB is used as a tool for Image processing and classification. Rice granules in the samples are classified based on the number of Full sized grains, Broken/Fragments, Foreign Matter present in the sample. Images are acquired for rice using camera. Image Pre-processing techniques, Adaptive thresholding, Feature extraction are the checks that are performed on the acquired image. This effort has been prepared to categorize the appropriate quality category for a specified rice sample based on its parameters which proves to be efficient.

Keywords— AGMARK; GRIP; image pre-processing; binarization; thresholding; feature extraction.

I. INTRODUCTION

Rice is grown in many regions across India. Being the second largest producer in the world, India is enforcing the use of rice grain standards to ensure that producers produce good quality grains and get paid maximum value for their grain according to the quality of the grain. The analysis of grain type, grading and their quality attributes is still performed manually by skilled personnel. This method is prone to many problems such as

1. It is influenced by human factors and working conditions
2. Human perception can result in inconsistent results

Digital Image processing is the method of using computer algorithms to perform image processing on digital images. AGMARK is an organization which is used in rating of the food products. There are different organizations which also involve in rating of quality of food grains like ISO, FDA etc. These organizations help the famers to provide certificates for the quality of grains they produce. There are AGMARK standards based on which the grains are categorized.

Problem Background

In Rice industry, the researchers have worked to provide a solution to the problem of rice industry and thus provide Machine Vision based Inspection using Digital Image Processing for quality analysis of rice grains which is fast, accurate, convenient, harmless, non-destructive and cost efficient technique in comparison with the traditional methods which can also achieve high degree of quality.

It can classify the rice grains with greater speed and accuracy than Human Vision Inspection. But still there is a problem of Non-Uniform Illumination i.e. dark and light areas in an image which show their effects in the process of extracting objects from the background and also cause segmentation errors due to an uneven illumination of the image. Work needs to be done at the rice industry to build some method for the proper extraction of objects from the background and to remove segmentation errors.

II. LITERATURE REVIEW

The authors have proposed Image Processing techniques for grading of rice based on their sizes (full, half or broken). Images are acquired using Flat Bed Scanning (FBS) Images were captured and stored in JPG format automatically. Through data cable these images has been transferred and then stored in disk. Images acquired are preprocessed for background subtraction and then converted to binary image. Pre-processed images are acquired, based on the following criteria the grains are extracted and mapped on to different images. The total grains in each image are counted after labeling the connected components in the image. It is then analyzed according to area acquired by each grain (full, half or broken). The grading formula & standards were applied and hence concluded with grading it [1].

The authors have proposed Digital Image Processing techniques for grading and checking the quality of the rice grains. They provide the solution to the problem of the rice industry for quality analysis. Grain samples are acquired with a color Digital Camera of Nikon D3200. Then the image is stored in hard disk and different parameters of rice were extracted from image for further analysis. Image of rice sample is acquired are then processed by Digital Image Processing techniques such as Scaling, Enhancement and Segmentation. Then morphological features are extracted using Matlab tool and histogram diagram for the extracted parameters. Quality of rice is defined from its physical and chemical characteristics [2].

The authors have proposed Analysis of Rice Granules using Image Processing and Neural Network Pattern Recognition Tool. Images are acquired for rice using camera. Image Pre-processing techniques, Adaptive thresholding, Canny edge detection, Feature extraction are the checks that are performed on the acquired image using image processing method through Open source Computer Vision (Open CV) which is a library of functions that aids image processing in real time. The morphological features extracted from the image are given to Neural Network Pattern Recognition Tool.

This effort has been prepared to categorize the appropriate quality category for a specified rice sample based on its parameters. The performance of image processing condensed the time of action and enhanced the crop identification significantly [3].

The authors have proposed A New Technique of Quality Analysis for Rice Grading for Agmark Standards. The system proposes a digital method which can be used to evaluate the quality of rice for the present Agmark Standards. The proposed method is formulated with the help of digital image processing technique on MATLAB. The present rice quality inspection method is affected by various factors which degrade the rice quality such as adulteration, accuracy, security for food. The process is as follows rice sample image is taken on a black sheet with the help of a normal camera it is then converted into grayscale image. The binarization process converts the grayscale image into two values 0and 1. Values of various Morphological parameters of sample grain are extracted with the help of Region Props. These steps are repeated for different samples [4].

The authors have proposed Classification of Basmati Rice Grain Variety using Image Processing and Principal Component Analysis. Image is acquired using uniform lighting with a simple digital camera. The image is the pre-processed where, image distortion and noise is eliminated then further the image acquired is segmented using algorithm. Algorithms were developed in windows environment using MATLAB programming language to extract morphological features of individual basmati rice grains to calculate the axis, major& minor axis length, eccentricity & perimeter. [5].
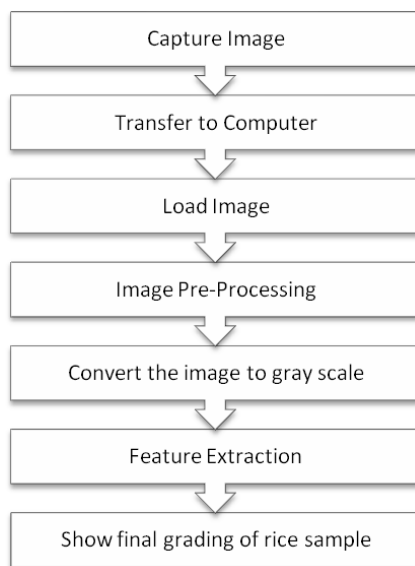
III. SYSTEM DESIGN

A. System Flow

Fig. 1. System flow.

a. Image acquisition

Image acquisition in image processing can be broadly defined as the action of retrieving an image from some source.

Take a high quality image of basmati rice sample with the help of high quality camera \ scanner. A black sheet was used which gives the black background to the image which helps in parameter extraction from the image. Input the image into the system. The interface between the Camera/scanner and PC is provided through USB Cable.

Fig. 2 Captured image of a sample.

b. Image Pre-processing and Smoothening.

The aim of pre-processing is an improvement of image data that suppresses unwanted distortion or enhances some image features for further processing. For human viewing, Image Enhancement improves the quality and clarity of images. Removing noise and blurriness, rising contrast and enlightening details from images are example of enhancement operation. Noise tends to attack images when picture are taken in low light setting. While capturing the image, sometime it has been distorted and hence image is to be enhanced by applying special median filtering to the image to remove noise. Here, Median filter is used for smoothening because it protect the edges of the image during noise removal and is mostly used in digital imaging and effective with salt and pepper noise and speckle noise. The noise in the input gray color image is detached using median filter. Now convert the High Quality Image into Grayscale Image. Image was pre-processed by removing the background and adjusting the contrast of the image. Most of these operations compute result based on weighted sum of a pixel value and its neighbours values.

Fig. 3. Grayscale image of the sample.

c. Binarization of image

The binarization process converts the grayscale image into two values 0 and 1. The simplest method of image segmentation is called the thresholding method. The subsequent step is to segment an image which is one of the imperative stages in image analysis. By using threshold value, image binarization is performed. Threshold is used to separate the region in an image with respect to the object, which is to be analyzed and this is based on the variation of intensity between the object pixel and background pixel. In general, these values are zero and the maximum value in the image.

Fig. 3.4. Binarized Image of the sample.

d. Feature extraction

Extraction of quantitative information from segmented images is dealt with feature extraction. Object identification and classifications are performed based on diverse algorithms of morphological features. The features which were extracted from images of rice kernels are Perimeter, Area, Minor-axis Length and Major-axis Length etc.

Characteristics of rice:

1. Foreign Matter: It includes dust, stones, lumps of earth, chaff, stem or straw and any other impurity.

2. Broken: Broken shall include pieces of kernel, which are less than ¾ of a whole.

3. Full sized: This includes the full sized grains.

e. Final grading of rice

All samples are scanned or captured to create the image, to obtain all the required parameters. After getting these parameters, Rice grains are classified into different categories and proposed AGMARK standards were evaluated to get the results.

1. *Foreign matter*: It will be detected if the area of the grain will lie under the given the range. A>(1/3)Max.A, where A is the Area of object in the image and Max. A is the Maximum Area of the object in the image.

2. *Broken*: It will be detected if the Major Axis Length of the grain will lie under the given range. (1/3)Max.MA>MA>(3/4)Max.MA, where MA is the Major Axis Length of the object and Max.MA is the Maximum Major Axis Length of the object.

3. *Full Size Grain*: It will be detected if the Major Axis Length of the grain will lie under the given range.

MA>(3/4)Max.MA, where MA is the Major Axis Length of the object and Max.MA is the Maximum Major Axis Length of the object.

IV. RESULT ANALYSIS AND CONCLUSION

TABLE I. Test result of sample 1 [Kolam Rice].

Sample Number	Expected Broken Grains	Actual No. of Broken Grains	Full Sized Grain	Accuracy
1	3	4	32	75
2	2	2	39	100
3	3	3	37	100
4	2	2	41	100
5	2	3	32	66.66
Average				88.33

The above table shows the test results performed on Sample 1 (Kolam Rice). The results shows that 5 images of Kolam rice are given as input. As in sample no.1 the no. of broken rice grains when calculated manually came out to be 3 whereas when calculated by GRIP the output shown was 4 thereby giving an accuracy of 75%. The Average Accuracy of all the 5 samples of kolam rice was 88.33%.

TABLE II. Test result of sample 2 [Basmati Rice].

Sample Number	Expected Broken Grains	Actual No. of Broken Grains	Full Sized Grain	Accuracy
1	4	4	29	100
2	2	2	31	100
3	3	4	31	75
4	7	9	30	77.77
5	4	4	29	100
Average				90.55

The above table shows the test results performed on Sample 1 (Basmati rice). The results shows that 5 images of Basmati rice are given as input. As in sample no.1 the no. of broken rice grains when calculated manually came out to be 4 whereas when calculated by GRIP the output shown was 4 thereby giving an accuracy of 100%. The Average Accuracy of all the 5 samples of Basmati rice was 90.55%.

TABLE III. Test result of sample 3 [Masoori Rice].

Sample Number	Expected Broken Grains	Actual No. of Broken Grains	Full Sized Grain	Accuracy (%)
1	4	4	29	100
2	4	4	31	100
3	4	6	32	66.66
4	6	7	32	85.71
5	3	4	28	75
Average				85.47

The above table shows the test results performed on Sample 1 (Kolam rice). The results shows that 5 images of Kolam rice are given as input. As in sample no.1 the no. of broken rice grains when calculated manually came out to be 4 whereas when calculated by GRIP the output shown was 4

Aditya Ghag, Steephen Chacko, Nikhil Dedu, and Meena Ugale, "Grading of rice using image processing (GRIP)," *International Journal of Scientific and Technical Advancements*, Volume 2, Issue 1, pp. 213-216, 2016.

thereby giving an accuracy of 100%. The average accuracy of all the 5 samples of Masoori rice was 85..47%.

The experimental result shows that the proposed algorithm works effectively for samples containing less number of rice grain for all variety of rice. The table shows the actual no. of broken grains and full size grains detected which are actually present in the sample. Thus the average accuracy of proposed algorithm came out to be 88.11%.

REFERENCES

[1] M. S. Mruntyunjaya, T. M. Lakshmikanth, T. K. Raghavendra, and P. P. Naik, "Quality analysis of rice grain using IP technique," *International Journal of Combined Research & Development (IJCRD)*, vol. 2, issue 3, 2014.

[2] S. Mahajan and S. Kaur, "Quality analysis of indian basmati rice grains using digital IP," *International Journal of Computer Science and Information Technologies*, vol. 5, issue 2, pp. 2358-2360, 2014.

[3] S. Abhirami, P. Neelanigam, and H. Kala, "Analysis of rice granules using IP and neural network pattern recognition tool," *International Journal of Computer Application*, vol. 96, no.7, 2014.

[4] P. Tanck and B. Kaushal , "A new technique for quality analysis for rice grading for AGMARK standards," *International Journal of Innovative Technology and Exploring Engineering (IJITEE)*, vol. 3, issue 12, pp. 83-85, 2014.

[5] R. Kambo and A. Verpude, "Classification of basmati rice grain variety using IP and principal component analysis," *IJCTT*, vol. 11, no. 2, 2014.

[6] V. Patil and V. S. Malemath, "Quality analysis and grading of rice grain images," vol. 3, issue 6, 2015.

[7] R. Kiruthika, S. Muruganand, and A. Periasamy, "Matching of different rice grains using digital image processing," *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering,* vol. 2, issue 7, 2013.

[8] B. B. Prajapati and S. Patel, "Algorithmic approach to quality analysis of indian basmati rice using digital image processing," *International Journal of Emerging Technology and Advanced Engineering*, vol. 3, issue 3, 2013.

[9] S. Patel and B. B. Prajapati, "Classification of Indian basmati rice using digital image processing as per Indian export rules," *International Research Journal of Computer Science Engineering and Application*, vol. 2, no. 1, pp. 234-237, 2013.

[10] S. Majumdar, and D.S. Jayas, "Classification of cereal grains using machine vision. IV. Combined morphology, color, and texture models. Transactions of the ASAE, 2000d.

[11] J. Singh Aulakh and V. K. Banga, "Grading of rice grains by image processing," *International Journal of Engineering Research & Technology (IJERT)*, vol. 1, issue 4, 2012.

[12] G. Kaur and B. Verma, "Measurement standards based grading of rice kernels by separating touching kernels for embedded imaging applications," *International Journal of Electronics, Communication & Instrumentation Engineering Research and Development (IJECIERD)*, vol. 3, issue 1, pp. 127-134, 2013.

[13] C. V. Maheshwari, "Q-curve approach for quality analysis of Indian oryza sativa ssp indica (Rice)," *International Journal of Advanced Technology in Engineering and Science*, vol. 01, issue 03, 2013.

[14] H. Kaur, B. Singh, ijsrp, Classification and grading of rice grains using multi-class SVM," *International Journal of Scientific and Research Publications*, vol. 3, issue 4, pp. 1-5, 2013.

[15] M. R. Siddagangappa and A. H. Kulkarni, "Classification and quality analysis of food grains," *IOSR Journal of Computer Engineering (IOSR-JCE)*, vol. 16, issue 4, Ver. III, pp. 01-10, 2014.

[16] C. V. Maheshwari, and K. R. Jain, "Parametric quality analysis of Indian Ponia Oryza Sativa SSP Indica (Rice)," *in International Journal for Scientific Research and Development (IJSRD)*, vol. 1, issue 2, pp. 112-116, 2013.