Reliable Quality Analysis of Indian Basmati Rice Using Image Processing

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***Abstract*— Image processing techniques have been applied increasingly for food quality evaluation in recent years. The basic problem of rice industry for quality assessment is defined which is traditionally done manually by human inspector. Hence a solution for quality evaluation and grading of rice industry using computer vision and image processing is proposed. Machine vision provides one alternative for an automated, reliable and cost-effective technique. Thresholding-based and classification-based methods for image segmentation; size, shape, color, and texture features for object measurement; and k-means technique is used for classification. The promise of image processing techniques for food quality evaluation is demonstrated for counting the number of basmati rice seeds with long as well as small seeds. A Knowledge-based classifier is used to identify the unknown grain types. The shape, size, textural features are presented to the knowledge based classifier decision purposes. The knowledge is then used to identify the unknown grain types (foreign elements).**

Keywords—: Machine Vision, Computer Vision, Quality, Image Processing, Image Analysis, ISEF Edge Detection Combined Measurements.

I. INTRODUCTION

Basmati Rice is one of the most important and popular cereal grain crops of India the ever increasing population losses the quality of basmati rice and has distinct effect on the yield of rice, so the proper inspection of basmati rice quality is very important [1]. During grain handling operations, information on grain type and grain quality is required at several stages before the next course of operation can be determined and performed. The varietals purity is one of the factors whose inspection is more difficult and more complicated than that of other factors. In the present grain handling system, grain type and quality are rapidly assessed by visual inspection. This evaluation process is, however, tedious and time consuming. The decision-making capabilities of a grain inspector can be seriously affected by his/her physical condition such as fatigue and eyesight, mental state caused by biases and work pressure, and working conditions such as improper lighting, climate, etc. The farmers are affected by this manual activity. Hence, these tasks require automation and develop imaging systems that can be helpful to identify rice grain images, rectify it & then being analyzed.

The agricultural industry is probably too oldest and most widespread industry in the world. In this hi-tech uprising, an agricultural industry has become more intellectual and automatic machinery has replaced the human effort. In India to overcome the need of ever-increasing population it is necessary to make advancement in agricultural industry. Due to automation need of high quality and safety standards achieved with accurate, fast and cost effective quality determination of agricultural products. Quality control is of major importance in the food industry because after harvesting, based on quality parameter a food product has been sorted and graded in different grades. Traditionally quality of food product is defined from its physical and chemical properties by human sensory panel which is time consuming, may be varying results and costly.

Machine vision is one of the important advanced technological field where significant developments have been made. Machine vision attempts to impersonate sensory perception of human beings viz. vision, touch, smell, taste, hearing etc. Efforts are being geared towards the replacement of traditional human sensory panel with automated systems, as human operations are inconsistent and less efficient.

Scientists have successfully endowed computers with machine vision by digital cameras and machines. Extreme research is in progress all over the country on application of electronic eye and nose in food, beverage and agricultural industry. Many industries have come up with the same but its quite costly.

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The main goal of our project is counting the number of seeds with long seed, small seed, normal seed and the foreign elements using image processing with a high degree of quality and then quantify the same for the rice seeds based on combined measurements

This paper presents a solution to the problem faced by Indian Rice industry, Section 2 discusses the Particular problem of

quality evaluation of Basmati Rice seed . Section 3 talks about the materials and methods proposed for calculating parameters for the quality of rice seeds .The proposed system and proposed algorithm for computing Rice seed with long seed as well as small seed being present in the sample is also discussed in the same section. Section 4 discusses the quantification for the quality of rice seeds based on image processing and analysis. Section 5 discusses results based on quality analysis. Section 6 provides the conclusion of the proposed process.

II. PROBLEM DEFINITION

In agricultural industry quality assessment of product is main problem. Nowadays, the quality of grain seed has been determined manually through a visual inspection by experienced technicians. So it requires high degree of accuracy to satisfy customer need of high level quality as well as correctness for a reliable quality evaluation method which is proposed based on image processing.

Figure1: Basmati Rice Seeds

Figure 2: Basmati Rice seed with Foreign elements

Basmati rice seed contains long as well as small seed as shown in Figure 1. These seeds are having very much importance in quantifying quality.At the time of processing these seeds are removed. Proper removal of this seed is Necessary if it is not so then it creates degradation in quality of rice seed. This paper proposes a new method for counting the number of Basmati rice seeds with these foreign elements as shown in Figure 2 contains foreign elements with the presence of other grains based on combined measurements.

III MATERIALS AND METHODS

It is a methodology in which the image of few basmati rice samples may be acquired by creating a flat layer of grain. The sample grain images have been rectified by being scaled, enhanced and then segmented. We use area, major axis length, minor axis length and eccentricity of rice seed for counting the number of basmati rice seeds with long seed, small seed and normal seed.

i) System Description and Operating Procedure:

In our proposed system there is a camera, which is mounted on the top of the box at point The camera is having 12-mega pixels quality with 8X optical zoom. After capturing images of rice seed by camera is stored for further processing.

Steps

1. Spread the samples of tobacco uniformly on the tray to avoid overlapping of samples.
2. Capture the image with the help of digital camera (Sony-DSC W210).
3. Pre-processing the Image in computer.
4. Display number of foreign elements on screen based on measured parameters.
5. Repeat the steps 1 to 4 for 10 to 12 samples.

: ii) Proposed algorithm to detect rice seeds with long and small seeds:

According to our proposed algorithm first capture image of sample spread on the black or butter paper using camera.

Proposed Algorithm

STEPS

1. Acquire the image
2. Convert the RGB image to gray image
3. Apply the edge detection operation
4. Calculate the Geometric parameters.
5. Based on these parameters classify rice seed into three parts namely normal, long, small rice seeds and foreign elements.
6. Display the count of normal, long and small rice seeds on screen

ii) ISEF Edge Detection:

The edge can be detected by any of template based edge detector but Shen-Castan Infinite symmetric exponential filter based edge detector is an optimal edge detector like canny edge detector which gives optimal filtered image[18]. First the whole image will be filtered by the recursive ISEF filter in X direction and in Y direction. Then the Laplacian image can be approximated by subtracting the filtered image from the original image. For thinning purpose apply non maxima suppression as it is used in canny for false zero crossing. The gradient at the edge pixel is either a maximum or a minimum. Now gradient applied image has been thinned, and the problem of Streaking can be eliminated by thresholding with Hysteresis. Finally thinning is applied to make edge of single pixel.

Step1: Apply ISEF Filter in X and Y direction
Step2: Apply Binary Laplacian and Non Maxima Suppression Technique
Step3: Find the Gradient
Step4: Apply hysteresis Thresholding
Step5: Thinning

iv) Parameter calculation

Here we are extracting five parameters area, major axis length, minor axis length, eccentricity and circularity for differentiating normal rice seed from long seed as well as small seed and the foreign elements "The area A of any object in an image is defined by total number of pixels enclosed by boundary of the object"
"The major axis length N of an image is defined as the length (in pixels) of the major axis of the ellipse that has the same normalized second central moments as the region" "The minor axis length M of an image is defined as the length (in pixels) of the minor axis of the ellipse that has the same normalized second central moments as the region". "The eccentricity is the ratio of the distance between the foci of the ellipse and its major axis length. The value is between 0 and 1

MAJOR AXIS

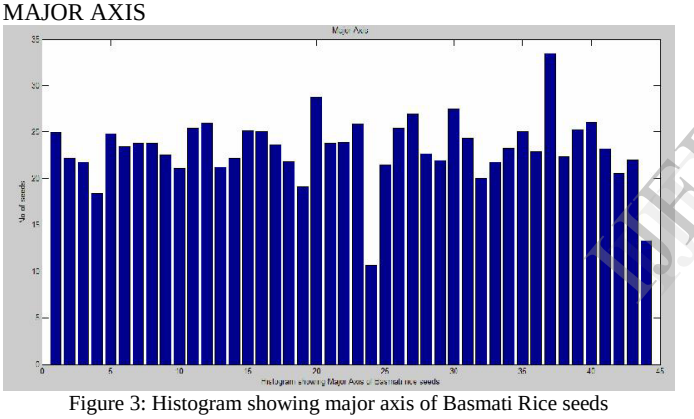

Figure 3: Histogram showing major axis of Basmati Rice seeds

MINOR AXIS

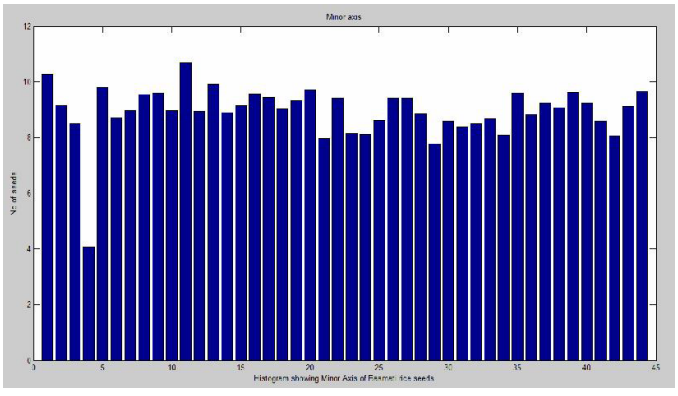

Figure 4: Histogram showing minor axis of Basmati Rice seeds

ECCENTRICITY

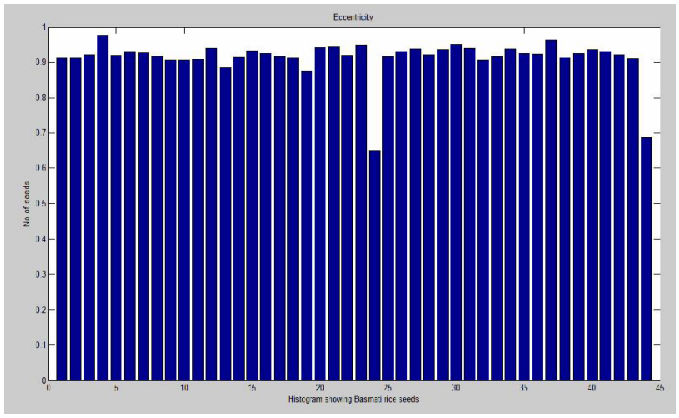

Figure 5:Histogram showing eccentricity of Basmati Rice seeds

AREA

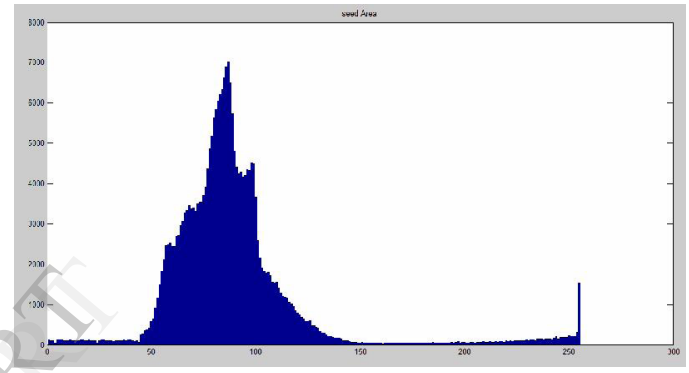

Figure 6 : Histogram showing area of Basmati Rice seeds

Figure 7: Represents RGB image

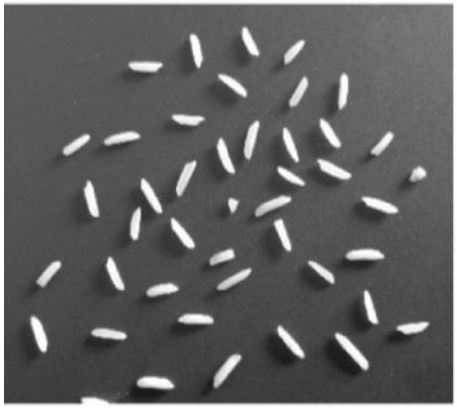

Figure 8: Represents Gray scale image

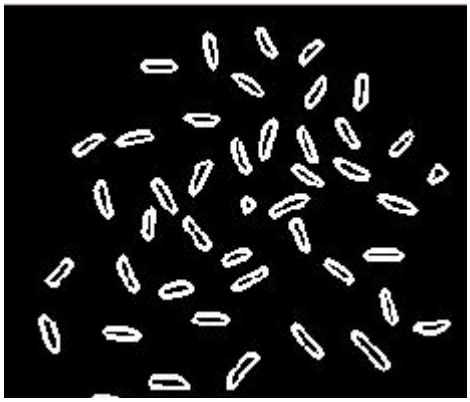

Figure 9: Represents Edge detected image.

IV RESULT ANALYSIS

Classification of rice seeds can be done based on assessment of parameters like area,major axis,minor axis and eccentricity.The original image,gray scale image, and image after performing edge detection operations are discussed.

Table 1: Analysis for Several Seed available in one Sample

Sl.no	Total	Major	Minor	Area	Eccentricity
1	15	37.6152	12.1222	188	0.9466
2	15	39.3401	11.6998	196	0.9548
3	15	32.2356	12.6169	165	0.9202
4	15	35.5869	10.9677	144	0.9513
5	15	38.1358	11.5916	174	0.9527
6	15	28.7601	10.9672	148	0.9244
7	15	38.2363	13.4426	197	0.9362
8	15	36.1248	14.4407	162	0.9166
9	15	34.9698	12.5584	153	0.9333
10	15	40.0050	14.0965	213	0.9359

Table 2: Result analysis of various samples based on algorithm

Sample No	Total seed	Normal seed	Small seed	Long seed
1.	20	75	26	11
2.	19	95	0	5
3.	26	96	0	4
4.	28	75	17	7
5.	25	24	8	8
6.	26	96	0	4
	Average	86	8	6

Table 3: Result analysis of various samples based on percentage value

Sample No	Total seed	Normal seed	Small seed	Long seed
1.	20	14	4	2
2.	19	16	2	1
3.	26	22	3	1
4.	28	21	5	2
5.	25	20	2	3
6.	26	24	1	1

Table 4: Result analysis of various samples based on human sensory Evaluation panel

Sample No	Total seed	Normal seed	Small seed	Long seed
1.	20	70	20	10
2.	19	84	10	5
3.	26	84	11	3
4.	28	75	17	7
5.	25	80	8	12
6.	26	92	4	4
	Average	81	12	7

Table 5: Result analysis of various samples based on percentage value of human sensory evaluation

Sample No	Total seed	Normal seed	Small seed	Long seed
1.	20	15	3	2
2.	19	18	0	1
3.	26	25	0	1
4.	28	21	5	2
5.	25	21	2	2
6.	26	25	0	1

CONCLUSION AND FUTURE WORK

This paper illustrates new method, which is nondestructive for quality analysis. Here we present a quality analysis of Basmati rice seeds via image analysis. We are calculating area, major axis length, minor axis length and eccentricity for counting normal seed and foreign element in terms of long as well as small seed for a given sample. Traditionally quality evaluation and assessment is done by human sensory panel which is time consuming, may be variation in results and costly. For quality analysis, more parameters can be calculated to make results that are more accurate.

For quality analysis, more parameters can be calculated to make results that are more accurate by using soft computing classification can be possible for any unknown sample.

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