Quality Analysis of Sharbati Tookdi Wheat using Soft Computing Technique

Rachana parikh[1] Rohit Srivastava[2]
[2]Asstistant Professor
[1]Information Technology [2]C. S. E. Department
[1, 2] Parul Institute of Engineering and Technology, Waghodia, Limda

Abstract---In the Food Industry there are various food stuffs in the form of grains having particular importance of wheat. The ability of identification of characteristics is required. With increased expectation for food products with high quality and high standards, the need for accurate, fast and objective quality determination of these food characteristics in food products continue to grow. Basic problem for quality evaluation of wheat industry is that it is done manually by human inspectors. Machine Vision in food has broaden its range of applications from cereals, grains, vegetables to fruits including processed products in which there is a high degree of quality is achieved as compare to human vision inspection. Machine vision provides one alternative for non-destructive, automated and cost-effective technique.

I. INTRODUCTION

Wheat is one of the main cereals consumed in the India. The highest consumption of the wheat is in Gujarat. Wheat is leading source of the vegetable protein the human food, having higher protein content than other major cereals, maize or rice. Quality Control is one of the major parameters in Food Industry because after harvesting, based on quality a food product has been sorted and graded. The increases awareness and sophistication of consumers have created the expectation for improving quality in consumer Food products. Food quality is complex being determined by combination of sensitive, nutritive, hygienic-toxicological and technological properties. More than one quality attributes therefore in most of the manual food quality grading systems. Quality Evaluation traditionally performed by human vision of some trained people. In Indian scenario grain is inspected by naked eyes and sold commercially. This method is time consuming, tedious and inherently inconsistent therefore quality inspection by human is neither efficient nor perfect.

II. PROBLEM DEFINITION

Fig. 1: Sample of shrbati wheat seeds

Sharbati wheat seeds contain small, normal and large seeds as shown in fig 1. These seeds are having very much importance for quantifying quality. At the time of processing these seeds are differentiated as small, normal and large. Because small seed has lower quality compare to normal seed and normal has lower quality than large seed. This paper proposes a new method for counting the number of shrbati wheat seeds as small, normal and large using machine vision technique.

III. PROPOSED ALGORITHM

– Input: Original 24-Bit Color Image
– Output: Classified food grains

Start

– Step1: Acquire The Food Grain Images.
– Step2: Crop Individual Wheat Grain And Scale It.
– Step3: Enhance Image To Remove Noise And Blurring.
– Step4: Do The Image Segmentation.
– Step5: Extract Morphological Features.
– Step6: Use These Features To Recognize And Classify The Food Grain Image Samples Using Feed-Forward Neural Network.

Stop

A. Image Acquisition: A total of around 60 food grain images are acquired under standardized lighting conditions. The images are acquired with a color Digital Camera (Sony) was used to capture images of rice grain samples keeping fixed distance of approximately 800 mm. To collect data a camera has been placed at a location situated with a plane normal to the object's path. The black & blue background was used. The environment was controlled to improve the data collection with simple plain background. The images acquired were 640 x 480 pixels in size. Images were captured and stored in JPG format automatically. Through data cable these images has been transferred and then stored in disk managing proper sequence.

B. Image Scaling: Image scaling is the process of resizing a digital image. Scaling is a non-trivial process that involves a trade-off between efficiency, smoothness and sharpness. As the size of an image is increased, so the pixels which comprise the image become increasingly visible, making the image appears "soft". Conversely, reducing an image will tend to enhance its smoothness and apparent sharpness. Since Rice Grains looks smaller in image, selecting part(s) of an image, thus applying a change selectively without affecting the entire picture is been done.[2] This has been done with the help of cropping. Cropping creates a new image by selecting a desired *rectangular portion from the image being cropped. The* unwanted part of the image is discarded. Image cropping does not reduce the resolution of the area cropped.

C. Image Enhancement: Image processing modifies pictures to improve them (enhancement, restoration), extract information by analysis, recognition, and change their structure i.e. Composition, image editing. Image enhancement improves the quality and clarity of images for human viewing. Removing blurring and noise, increasing contrast, and revealing details are examples of enhancement operations. Noise reduction merely estimates the state of the scene without the noise and is not a substitute for obtaining a "cleaner" image. Excessive noise reduction leads to a loss of detail, and its application is hence subject to a trade-off between the undesirability of the noise itself and that of the reduction artifacts. Noise tends to invade images when pictures are taken in low light settings. A new picture can be given an 'antiquated' effect by adding uniform monochrome noise. Due to scaling the image has been distorted, hence it is been enhanced by applying special median filtering to the image to remove noise. Image is been compressed using DCT compression. Complement of the image has been done and the image has been properly adjusted for plotting histograms. Smoothing of the image is been done to reduce the number of connected components that is done by applying standard mask and then doing convolution with the image. Finally equalization of image has been done.

D. Image Segmentation: After image enhancement, the image has been segmented. Image segmentation i.e. subdividing an image into different parts or objects is the first step in image analysis. The image is usually subdivided until the objects of interest are isolated from their background. There are generally two approaches for segmentation algorithms. One is based on the discontinuity of gray-level values; the other is based on the similarity of gray-level values.[1] The first approach is to partition an image based on abrupt changes in gray levels. The second approach uses thresholding, region growing, region splitting and merging. Segmentation of nontrivial images is one of the most difficult tasks in image processing. Segmentation accuracy determines the eventual success or failure of computerized analysis procedures. Segmentation basically includes edge detection. Thresholding is also one of the fundamental approaches of segmentation. Another approach is for region oriented segmentation as Watershed segmentation for an example. In the present research work after enhancement of image the edges of the object in binary image has been detected using Canny and Sobel detector(mask).Using canny/sobel method edged has been detected. Edge detection using Sobel detector results more accuracy than using canny edge detector. Edges are also been detected by applying Laplacian of Gaussian filter. Thresholding has been done according to properties of neighborhood. Thresholding can be done in terms of global or local thresholding. Generally local thresholding is been preferred if the background illumination is uneven. Also watershed segmentation & connected component segmentation can be used. Watershed segmentation is been used for region based segmentation. After image enhancement, the image has been segmented. Image segmentation i.e. subdividing an image into different parts or objects is the first step in image analysis. The image is usually subdivided until the objects of interest are isolated from their background. There are generally two approaches for segmentation algorithms. One is based on the discontinuity of gray-level values; the other is based on the similarity of gray-level values.[1] The first approach is to partition an image based on abrupt changes in gray levels. The second approach uses thresholding, region growing, region splitting and merging. Segmentation of nontrivial images is one of the most difficult tasks in image processing. Segmentation accuracy determines the eventual success or failure of computerized analysis procedures. Segmentation basically includes edge detection. Thresholding is also one of the fundamental approaches of segmentation. Another approach is for region oriented segmentation as Watershed segmentation for an example. In the present research work after enhancement of image the edges of the object in binary image has been detected using Canny and Sobel detector(mask).Using canny/sobel method edged has been detected. Edge detection using Sobel detector results more accuracy than using canny edge detector. Edges are also been detected by applying Laplacian of Gaussian filter. Thresholding has been done according to properties of neighborhood. Thresholding can be done in terms of global or local thresholding. Generally local thresholding is been preferred if the background illumination is uneven. Also watershed segmentation & connected component segmentation can be used. Watershed segmentation is been used for region based segmentation. Thus Image Segmentation is an essential preliminary step in most automatic pictorial pattern recognition and scene analysis problem.

IV. PARAMETER CALCULATION

A. Major Axis Length: It was the distance between the end points of the longest line that could be drawn through the seed. The major axis endpoints were found by computing the pixel distance between every combination of border pixels in the seed boundary.

B. Minor Axis Length: It was the distance between the end points of the longest line that could be drawn through the seed while maintaining perpendicularity with the major axis.

C. Area: The algorithm calculated the number of pixels inside, and including the seed boundary (mm2/pixel).

D. Eccentricity: The eccentricity E is the ratio of the distance between foci of the ellipse and its major axis length.

Diagram for histograms of above calculated features computed from one sample of shrbati Tookdi wheat as shown in Fig 2 to Fig 5. From the histogram of Major Axis Length we can clearly specify the range of Major Axis Length for small, normal and large seed. We marked small seed as circle 1, normal seed as circle 2 and large seed as circle 3. Likewise from the other histograms we can distinguish three classes of wheat seeds. The Minor Axis Length, Major Axis Length, Eccentricity and Area of shrbati Tookdi of wheat seeds for three different classes are calculated from the histograms of all 8 samples of shrbati Tookdi wheat which is shown in table 1.

Sr No.	Major Axis Length	Minor Axis Length	Area	Eccentricity
1	15.02844	9.662832	62	0.765892
2	15.54902	9.004557	62	0.815251
3	16.41277	9.861254	63	0.799378
4	15.99646	8.330801	60	0.853685
5	14.26443	9.388646	56	0.752856
6	15.64827	9.847932	68	0.777138
7	15.89026	8.153172	62	0.858333

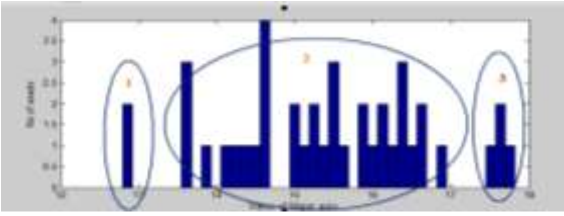

Fig. 2: Histogram showing Major Axis Length of shrbati Tookdi wheat seeds

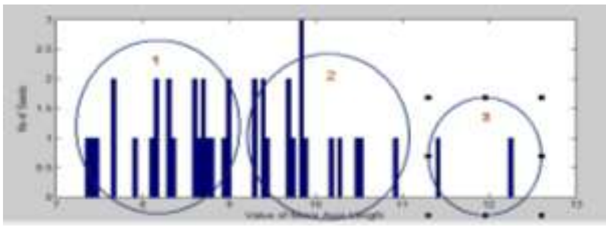

Fig. 3: Histogram showing Minor Axis Length of shrbati Tookdi wheat seeds

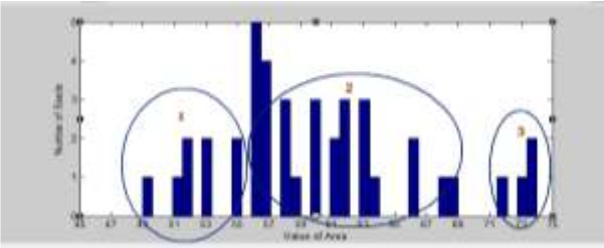

Fig. 4: Histogram showing area of shrbati Tookdi wheat seeds

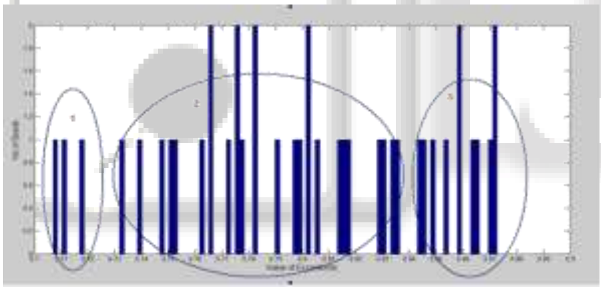

Fig. 5: Histogram showing Eccentricity of shrbati Tookdi wheat seeds

V. RESULT ANALYSIS

Classification of wheat seeds can be done based on parameters like Major Axis length, Minor Axis Length, Area and Eccentricity

Table5.1 shows intended parameters based on histogram for normal seeds, large seeds and small seeds. It shows value of major axis length, minor axis length, area and eccentricity of various wheat seeds available in one sample. Same way values of all four parameters for 15 wheat samples are found.

Table 5.1 Analysis of several shrbati wheat seeds available in one sample

For finding out the number of small normal and long wheat seeds we compute the threshold value using the histograms of figure 4.1 to 4.4 of major axis length, minor axis length, area and eccentricity as mentioned in table 5.2

Table 5.2 Parameter Extraction of Shrbati Tookdi wheat seeds with specified range

Parameters	Small Seed	Normal Seed	Large Seed
Major Axis Length	12-13	13-17	17-18
Minor Axis Length	7-9	9-11	11-13
Area	45-55	55-69	69-75
Eccentricity	0.7-0.72	0.72-0.84	0.84-0.9

VI. CLASSIFICATION OF WHEAT SEEDS

A two layer feed forward network with six nodes is used for Classification. The training function using gradient descent with momentum weight as learning function, and maximum like hood as performance function, is used to train NN. The training of the neural network was performed using 8 samples of shrbati wheat and then an unknown sample is tested. [1]

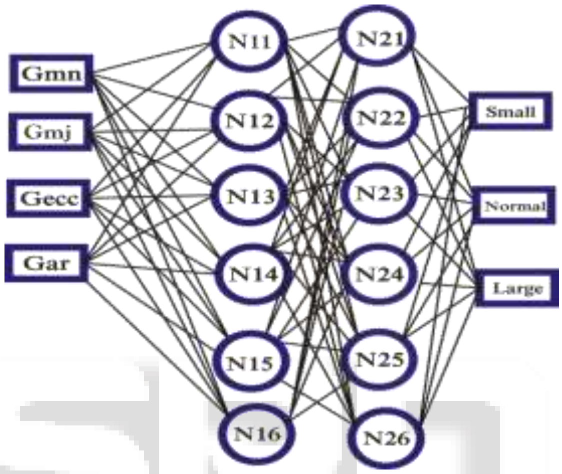

Fig. 6: Schematic diagram of two layer feed forward neural network

For training the neural network, wheat seeds in image are divided into three types i.e. large seed, normal seed, and small seed by considering the values of Major Axis Length, Minor Axis Length, Area and Eccentricity. The model for trained neural network for wheat seed as shown in fig 6.1.

Table 6.1 shows grading of several shrbati wheat seeds of one sample. Here Gmj. Gmn, Gar ane Gecc are grades of major axis length, minor axis length, area and eccentricity respectively. We define parameter of small seed as 1, normal seed as 2 and large seed as 3.

Table6.1 Grading of several Shrbati wheat available in one sample.

Gmj	Gmn	Gar	Gecc	Grade
2	1	2	3	222
2	1	2	3	222
1	1	1	2	111
2	2	3	2	222
2	1	2	3	222
2	2	1	2	222
2	1	1	3	111
2	2	2	2	222
1	1	1	3	111
3	2	2	2	222

When training phase of neural network is finished then it is tested with unknown samples and classification accuracy is 97.7%.

VII. CONCLUSION

This paper presents a quality analysis of shrbati wheat seeds by image analysis and soft computing technique. We are calculating major axis length, minor axis length, area and eccentricity for counting small, normal and large seed for a given sample.

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