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DETECTION OF GOOD QUALITY WHEAT GRAINS USING IMAGE PROCESSING

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Abstract – Globally, wheat is the leading source of vegetable protein in human food, having a higher protein content than other major cereals, maize (corn) or rice. In terms of total production tonnages used for food, India is currently second to wheat as the main human food crop and ahead of maize. Wheat grains detection is the major task of differentiating wheat from other grains (like barley) as well as from impurities. We notice that grain size and other properties of wheat grains which are used to detection of wheat from the mixture. Specifying the quality of wheat manually requires an expert judgment and is time consuming. Sometimes the variety of wheat looks so similar to the other cereals or impurities so that differentiating them becomes a very tedious task when carried out manually. To overcome this problem, Image processing can be used to differentiate wheat according to its quality. This inspection approach based on image analysis and processing has found a variety of different applications in the agro industry.

Keywords- Thresholding, Binarization, Major Axis, Minor Axis, Depth of Field

1. INTRODUCTION

Wheat is the major food crop of India. It is grown in the cooler regions of the country during the mild winter months from November to mid-April. After china, India is the second largest wheat growing country of the world approx. 12% of the total wheat production. But along with this India is also the second largest wheat consuming country making wheat the most important part of the diet [1]. So, it becomes necessary to meet the quality standards of the wheat. Introduction of impurities such as husk, granules are the major reason for the decrease in the quality of the yield of wheat. The major aim of this technique is to remove the impurities so as to make sure that the wheat is of up to the grade. In India specially, the food related health problems are increasing day by day. Major reason behind this is the bad quality of the food materials.

In recent years, many studies [2-10] have been done that includes the boundary detection of the grain that in turn helps in the detection of the size of grain. However, some of these studies use very complicated hardware, costing too much money and energy and some use simple hardware but run at a relatively low speed. In this paper, a method is proposed that efficiently detect the grain from other residual material and also helps in maintaining the proper quality of wheat grain depending upon the size of grain.

2. METHEDOLOGY

The whole system process consists of following steps for the detection of the wheat grains (All steps of algorithm are implemented on MATLAB 7.5.0(R2007b) [11] platform) and hence the quality of grains:

a)   Acquiring Quality Images

The manner in which the system is set up depends on the type of analysis and processing you need to do. The image capturing system should produce images with high enough quality so that one can extract the information which is needed from the images. Five factors contribute to overall image quality, which are given below:

1.   Resolution
2.   Contrast

3. Depth of field
4. Threshold value
5. Noise

Then the image is converted to the binary image, so as to reduce the response time and memory consumption. After that image is scanned from top left corner to right bottom corner to find black bunches of pixels in the image. A range is fixed for the size of bunches which decides which bunches are to be selected and rejected [12].

b) *Binarization*

The first step to localize the eyes is binarizing the picture. Binarization is converting the RGB image to a binary image. For obtaining the binary image first of all only red component is extracted from the original image. Then, using a proper threshold value, it is converted into black and white image to detect the wheat grains. Here, for calculation of best suited threshold value, the concept of histogram has been used.

c) *Removal of Noise*

The removal of noise in the binary image is very straightforward. Starting from the top, (x1, y1), by moving right on pixel by incrementing x1, and in the same way,y value up to the end of picture, the whole picture is scanned.

After the scanning of whole image, the various irregularities such as open area, small black or white spots are removed by using the MATLABcommands. There are three commands for removal of noise in MATLAB [11] given below:

1. bwareaopen(im1,4)

It fills the open areas whose size is less than four pixels. It uses a brush of four pixels (which is Variable).

2. imopen(ir1,strel('disk',2))

It uses a brush of size 2 pixels (Variable/User defined) for filling up the areas which are open at any end.

3. imfill(ir1,'holes')

This fills white holes in a given image (Here in this syntax ir1 is the variable carrying image information).

d) *Calculating the number of black bunches of pixels*

After the selection of bunches, their number has been calculated. It is done using MATLAB [11] commands given below:

1. For the detection and calculation of size:

y=strcats ('y', num2str (i))
x=strcat ('x', num2str (i))
[y,x]=find (lw==i)
[xs,ys]=size(x)

2. For calculating number of black areas in the given image(ir1):

[lw,numr]=bwlabel (ir1)

These are some commands available in MATLAB which are used for the proper/smooth operation of the system.

First and foremost step is to take the images of grains according to which grading of wheat is done. Out of all the grains, three grains possessing different sizes which are varying from bigger to smaller are selected. Next step is to calculate the dimensions of these selected grains according to which other grains are selected or rejected. These dimensions are pixel sum of each grain and major and minor axis defining the shape of grain. These axis which are calculated helps to remove the impurities present in grains during the harvesting. Then, next step is to compare the test grains with the database generated from reference grains dimensions. This is done by capturing the image and its binarization is done using thresholding process.Now the pixel sum and dimensions of grains is compared to that of reference limits. If the size of the grain is out of the fixed limits, it is rejected otherwise selected. Similarly, minor and major axis length is fixed and test image is compared to that limits fixed before. AND operation is performed on both the outputs of pixel sum and minor major axis comparison. If output is 1, grain is selected otherwise not. This process is applied to the every grain and hence a quality can be obtained.
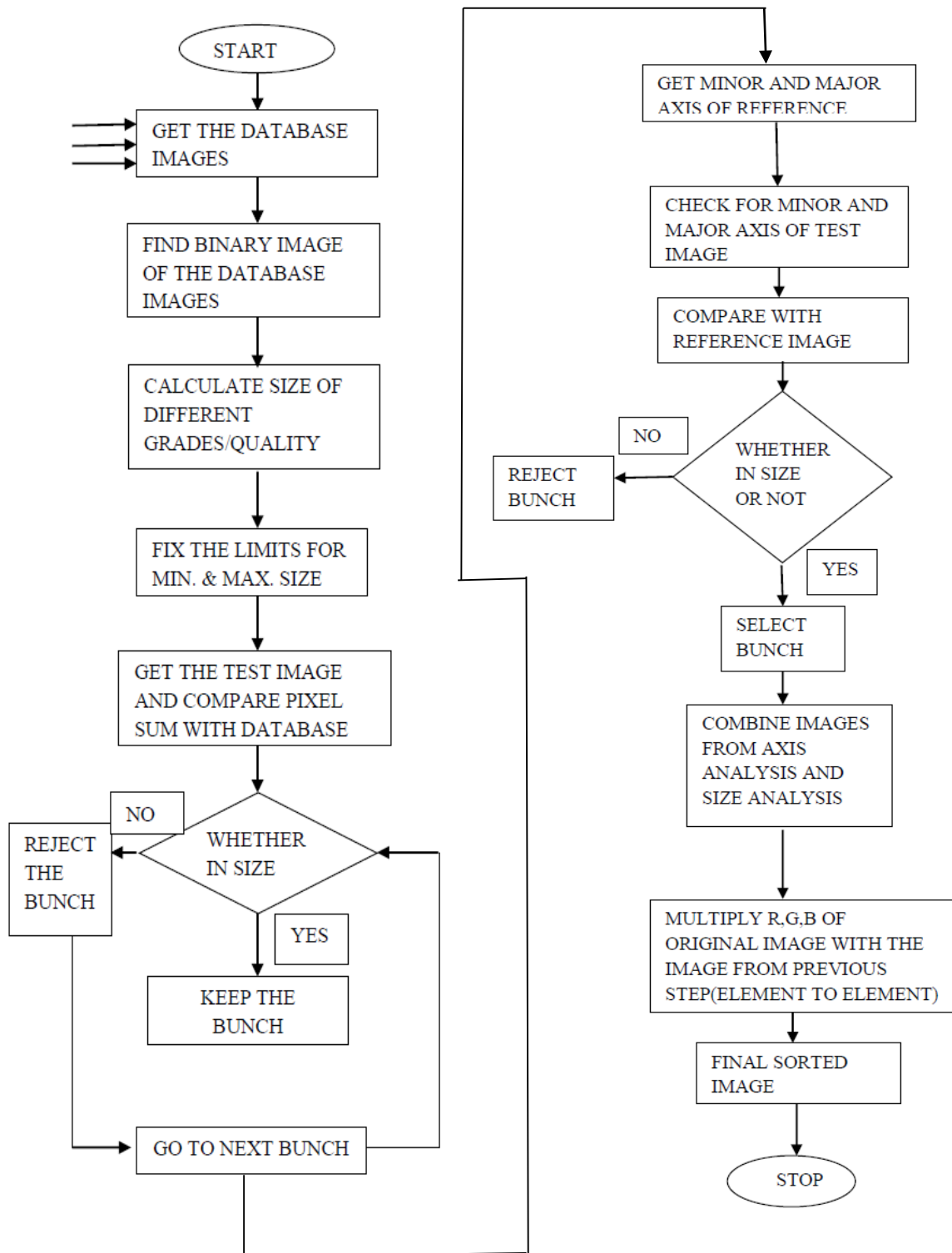
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Fig. 1 Flow of Algorithm

3. RESULTS

This part of paper includes the results obtained from the proposed algorithm. First and foremost thing is to obtain the high quality image of the wheat grains along with the impurities from which proper size wheat

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grains have to be detected. Firstly, the good quality grains are selected which give the limits that helps in differentiating the wheat grains from impurities and broken grains.

Fig. 2 Reference image 1

Figure 2 represents the reference image having the largest size whose features are extracted to compare with the test image. The pixel sum, minor and major axis are calculated as given below:

Pixel sum is 4444

The value of Minor Axis Length of this image is 59.5570

The value of Major Axis Length of this image is 95.3750.

Fig. 3 Reference image 2

Figure 3 represents the reference image having the smallest size whose features are extracted to compare with the test image. The pixel sum, minor and major axis are calculated as given below:

Pixel sum is 3047

The value of Minor Axis Length of this image is 46.6836

The value of Major Axis Length of this image is 83.2715

Fig. 4 Reference image 3

This image represents the reference image having the medium size whose features are extracted to compare with the test image. The pixel sum, minor and major axis are calculated as given below:

Pixel sum 4444

The value of Minor Axis Length of this image is 52.6466

The value of Major Axis Length of this image is 90.2036

After calculating the pixel sum and both axis dimensions, a database is created with which the each grain size is compared. Next step is to capture the test image having all grains and impurities as shown below.

As it is clear from the figure 5 that along with grains a lot of impurities and broken grains are also present. So, to have good quality wheat these impurities and the grains that do not meet the standards are removed.
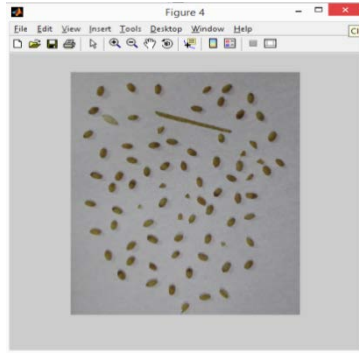
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Fig.5 Test Image
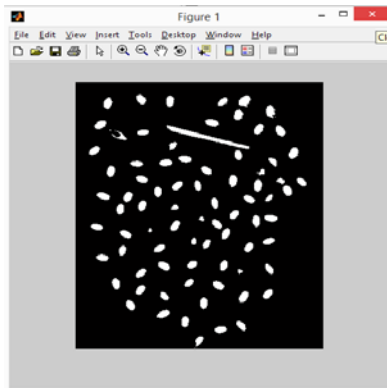

Fig.6 Binary Image

Figure 6 is test image converted to b/w format by using q=im2bw (k, 45/100); command. This process is known as thresholding. Here the pixels above 45 are given logic 1 and pixels which are below 45 are given logic 0.
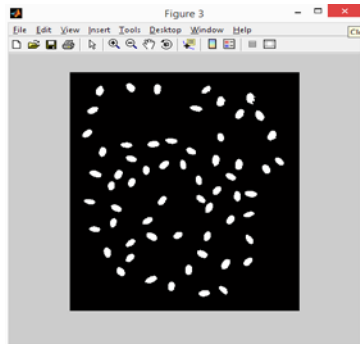

Fig.7: Image showing removed impurities

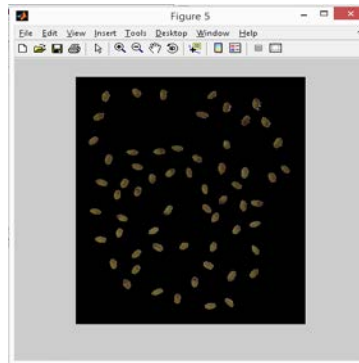**Harshwardhan kakkar[1], Jaspreet Kaur[2], Amandeep Singh[3]**

Fig.8: Output Image

Figure 7 is the image in which impurities are removed by comparing the particular bunch axis and pixel sum with reference images of the grains. If these two conditions are satisfied only then that particular grain bunch is selected otherwise it is rejected giving the good quality grains only. Now, last step is to change this black and white image into colored format and to do this element to element wise multiplication of this resultant image and original test image is done and final result is shown in figure 8. After getting this refined image a percentage impurity is calculated using formula:

percentage_impurity= ((originalamount-processedamount)/originalamount)*100

After applying this formula it is calculated that 19% impurity is present in the test image which includes husk, broken grains etc.

5. CONCLUSION

In this paper, an effective method to detect the good quality wheat is designed. In this method after detecting grains a percentage of impurity present is calculated and it is observed that it gives approximately 95% accuracy. Also, it is fast, less memory consumable and cost effective. In the up gradation of this method, a grading of wheat grains can be done on the basis of grain size.

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