Shape Enhancement of Clustered Seeds using Edge Detection Algorithm

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Abstract—This paper present a method of shape enhancement of clustered seeds using edge detection algorithm. The method is based on classical morphological operations, and was designed to deal with the main difficulties imposed by images of soybean seeds, namely the clustering of the seeds, variations in the illumination, and low contrast between seeds and background. The method presented designed to improve edges of clustered soybean seeds from digital images captured under non-ideal conditions. This is not mandatory, but the results will be more reliable if that condition is observed. Also, the capture must be as vertical as possible to avoid problems of perspective. As input to the program, the user has to provide the name and the type of the image. The proposed algorithm shows a good performance under a wide variety of condition with better edge defines to improve the edges of clustered soybean seeds.

Index Terms—Clustered Soybean Seeds, Digital Image, Sobel Filter, Edge Detection Algorithms, Matlab.

1 Introduction

One of the most used method to improve the quality of clustered soybean seeds using digital image. A digital image is a numeric representation (normally binary) of a two-dimensional image. The quality of images is improved by filter method. The proposed method is mainly based on morphological operations largely used in digital image processing, in order to make its implementation simple and to keep the computational burden low [2]. The image of clustered soybean seeds is shown in the Figure 1.

Figure 1: Clustered Soybean Seeds.

A simple communication system consists of a transmitter end using computers to do image processing has two objectives: First, create more suitable images for people to observe and identify. Second, we wish that computers can automatically recognize and understand images. The edge of an image is the most basic features of the image. It contains a wealth of internal information of the image. Therefore, edge detection is one of the key research works in image processing. The current image edge detection methods are mainly differential operator technique and high-pass filtration. Among these methods, the most primitive of used for this is differential and gradient edge detection methods are complex and the effects are not satisfactory. The widely used operators such as Sobel, Prewitt, Roberts and Laplacain are sensitive to noises and their anti-noise performances are poor. The Log and Canny edge detection operators which have been proposed use Gaussian function to smooth or do convolution to the original image, but the computations are very large. This paper mainly used the Sobel operator and soft-threshold wavelet de-noising method to do edge detection processing on the images which have been disturbed by white Gaussian noises. It has been proved that the effect by using this method to do edge detection is very good and its anti-noise performance is very strong too accuracy.

2 Morphological Operations

The different methods is used to improve the quality of seeds is based on classical morphological operations. Mathematical morphology is a tool for extracting image components useful in the representation and description of region shape, such as boundaries, skeletons and convex hulls. The language of mathematical morphology is set theory, and as such it can apply directly to binary (two-level) images: a point is either in the set (a pixel is set, or put to foreground) or it isn't (a pixel is reset, or put to background), and the usual set operators (intersection, union, inclusion, complement) can be applied to them[1]. Basic operations in mathematical morphology operate on two sets: the first one is the image, and the second one is the structuring element (sometimes also called the kernel, although this terminology is generally reserved for convolutions). The structuring element used in practice is generally much smaller than the image, often a 3x3 matrix. It is possible, however, to make a generalization to greylevel images. Erosion and dilation are

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two basic operators in mathematical morphology.

3 Related Work

The method for edge detection of color images with removing unnecessary features. Edge detection in color images is more challenging than edge detection in gray-level images automatic threshold detection. The proposed algorithm extracts the edge information of color images in RGB color space with fixed threshold value. The algorithm uses sobel operator for detecting the edge. A new automatic threshold detection method based on histogram data is used for estimating the threshold value. The method is applied for large number of images and the result shows that the algorithm produces effective results when compared to some of the existing edge detection methods.

3.1 Edge Detection Based on Sobel Operator

Sobel is a 3x3 neighborhood based gradient operator. The Sobel operator performs a 2-D spatial gradient measurement on an image and typically it is used to find the approximate absolute gradient magnitude at each point in input image. The convolution matrix of traditional Sobel operator is defined by two kernels which work in two different directions one in 0°, 45°, 90°, 135°horizontal and one in vertical. The edge information usually present in four different directions.

The Sobel operator, also called as Sobel Filter, is used in image processing and computer vision, particularly within edge detection algorithms, and creates an image which focuses on edges and transitions. It is named after 'IRWAN SOBEL' who presented the idea of an "Isotropic 3x3 Image.

It is a gradient operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. On the other hand, the gradient approximation that it produces is relatively crude, in particular for high frequency variations in the image.

1	2	1	2	1	0	1	0	-1	0	1	2
0	0	0	1	0	-1	2	0	-2	-1	0	1
-1	-2	-1	0	-1	-2	1	0	-1	-2	-1	0

Figure 2: Directional Masks 0°, 45°, 90°, 135°.

The Sobel operator represents a rather inaccurate approximation of the image gradient, but is still of sufficient quality to be of practical use in many applications. More precisely, it uses intensity values only in a 3×3 region around each image point to approximate the corresponding image gradient, and it uses only integer values for the coefficients which weight the image intensities to produce the gradient approximation.

4 Measurement of Image Quality

The design of an imaging system should begin with an analysis of the physical characteristics of the originals and the means through which the images may be generated. For example, one might examine a representative sample of the originals and determine the level of detail that must be preserved, the depth of field that must be captured, whether they can be placed on a glass platen or require a custom book-edge scanner, whether they can tolerate exposure to high light intensity, and whether specular reflections must be captured or minimized [3]. A detailed examination of some of the originals, perhaps with a magnifier or microscope, may be necessary to determine the level of detail within the original that might be meaningful for a researcher or scholar. For example, in drawings or paintings it may be important to preserve stippling or other techniques characteristic.

With the increasing use of multimedia technologies, image compression requires higher performance. To address needs and requirements of multimedia and Internet applications, many efficient image compression techniques, with considerably different features, have recently been developed. Image compression techniques exploit a common characteristic of most images that the neighboring picture elements (pixel, pels) are highly correlated. It means that a typical still image contains a large amount of spatial redundancy in plain areas where adjacent pixels have almost the same values. In addition, still image contains a large amount of spatial redundancy in plain areas where adjacent pixels have almost the same value. In addition, still image can contain subjective redundancy, which is determined by properties of human visual system (HVS). HVS presents some tolerance to distortion depending upon the image content and viewing conditions. Consequently, pixels must not always be reproduced exactly as originated and HVS will not detect the difference between original image and reproduced image.

The evaluation of lossless image compression techniques is a simple task where compression ratio and execution time are employed as standard criteria. The picture quality before and after compression is unchanged. Contrary, the evaluation of lossy techniques is difficult task because of inherent drawbacks associated with both objective and subjective measures of picture quality. Objectives measures of picture quality do not correlate well and subjective quality measures. Subjective assessment of picture quality is time consuming process and results of measurements should be processed very carefully.

5 Methodology

Edge is an important feature for image segmentation and object detection. Edge detection reduces the amount of data needed to process by. The method for edge detection of color images with removing unnecessary features. Edge detection in color images is more challenging than edge detection in gray-

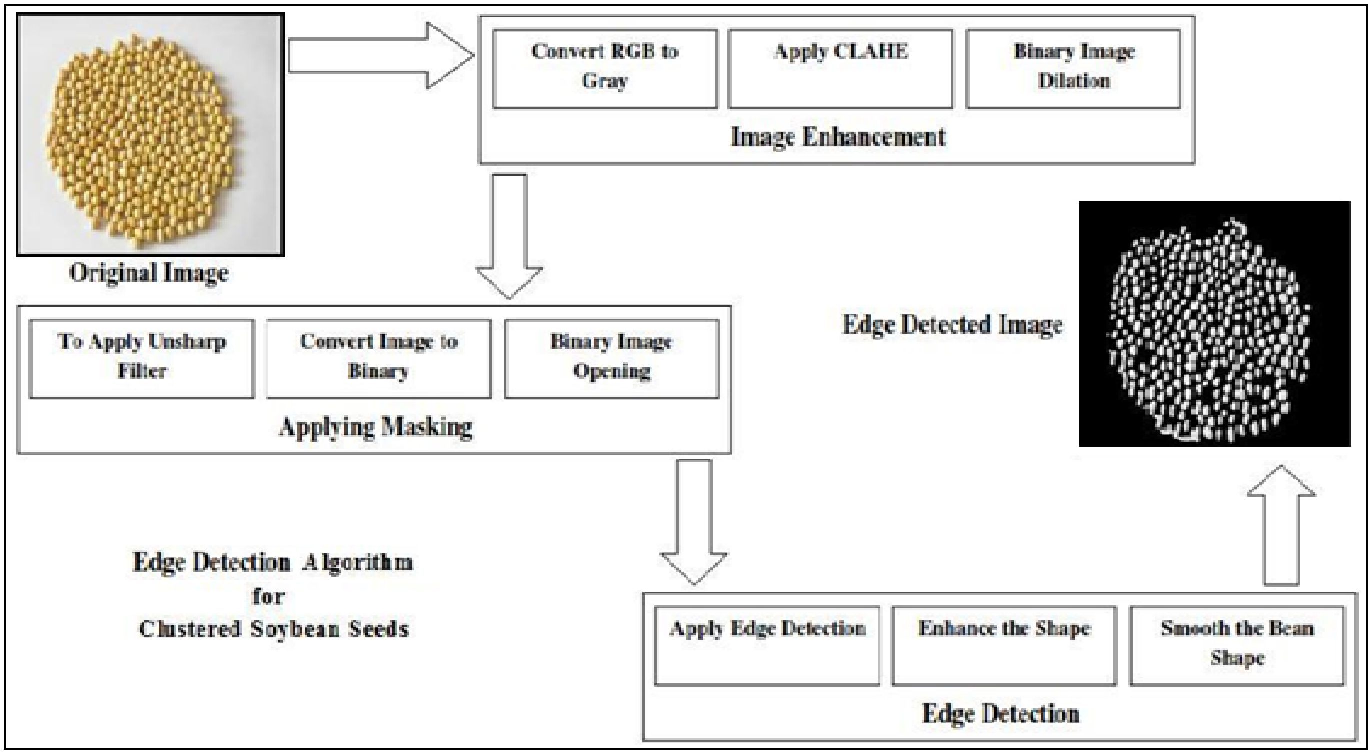

Figure 3: Edge Detection Algorithm for Clustered Soybean Seeds.

level images automatic threshold detection. The proposed algorithm extracts the edge information of color images in RGB color space with fixed threshold value. The algorithm uses Sobel operator for detecting the edge. A new automatic threshold detection method based on histogram data is used for estimating the threshold value. The method is applied for large number of images and the result shows that the algorithm produces effective results when compared to some of the existing edge detection using Sobel operator. Sobel is a 3x3 neighborhood based gradient operator. The Sobel operator performs a 2-D spatial gradient measurement on an image and typically it is used to find the approximate absolute gradient magnitude at each point in input image. The convolution matrix of traditional Sobel operator is defined by two kernels which work in two different directions one in horizontal and one in vertical.

8 Simulated Results

The images used in the tests were collected from public databases throughout the Internet. All images contain strongly clustered seeds. The contrast between the seeds and the backgrounds varies from image to image. Figure 4 will be used as reference for the remainder of the paper, because it presents a challenging situation: clustered seeds, low contrast between seeds and the background, and variation in the illumination.In this section, the proposed algorithm is evaluated via computer simulation using MATLAB (Matrix Laboratory) simulator. All simulation results are obtained with new edge detection algorithm is used. Figure 4 shown edge detection algorithm for clustered soybean seeds. The method presented here was designed to work with images captured from a distance between 0.5 and 1 meter from the clustered soybean seeds. This is not mandatory, but the results will be more reliable if that condition is observed. Also, the capture must be as vertical as possible to avoid problems of perspective.

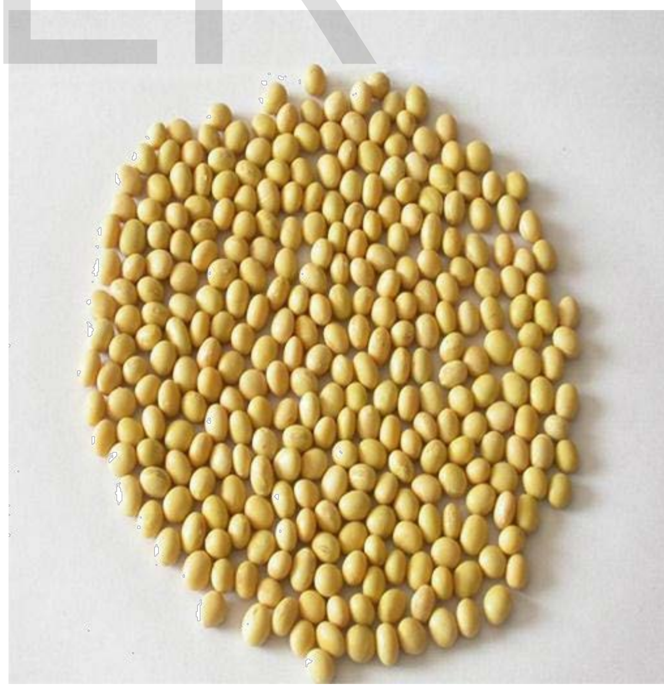

Figure 4: Original Image.

The first step of the algorithm is converting the image into a gray scale shown in Figure 5.

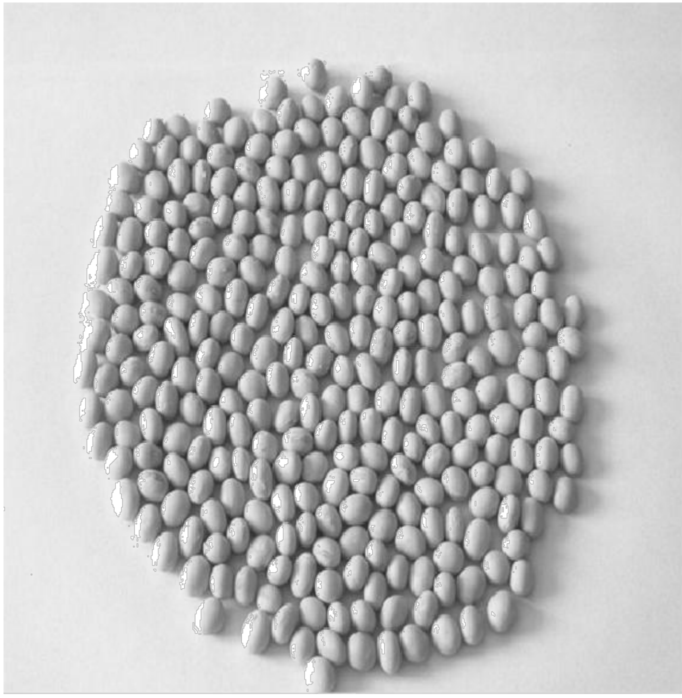

Figure 5: RGB to Gray Image.

In the following, the contrast limited adaptive histogram equalization (CLAHE) is applied.

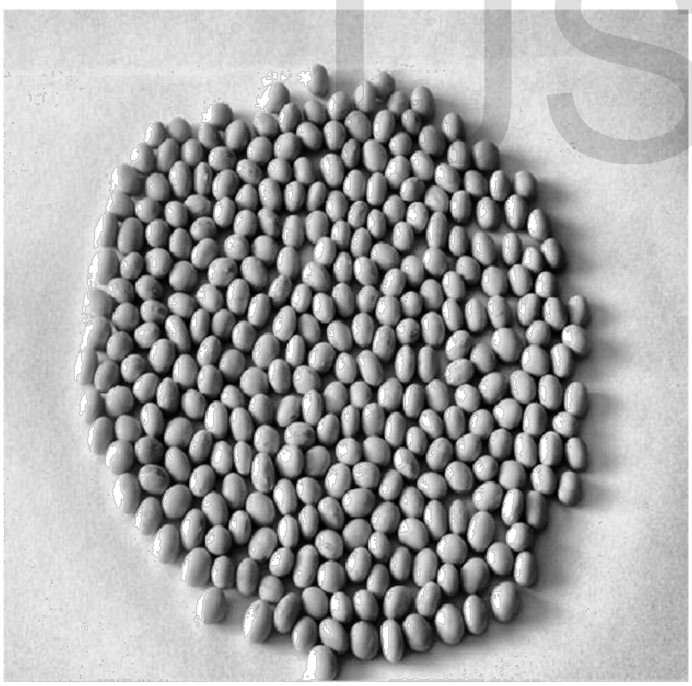

Figure 6: CLAHE applied to Image.

It enhances the contrast of the grayscale image I by transforming the values using contrast-limited adaptive histogram equalization (CLAHE). CLAHE operates on small regions in the image, called tiles, rather than the entire image. Each tile's contrast is enhanced, so that the histogram of the output region approximately matches the histogram specified by the 'Distribution' parameter. The neighboring tiles are then combined using bilinear interpolation to eliminate artificially induced boundaries. The contrast, especially in homogeneous areas, can be limited to avoid amplifying any noise that might be present in the image. Figure 7 shows the binay conversion output image.

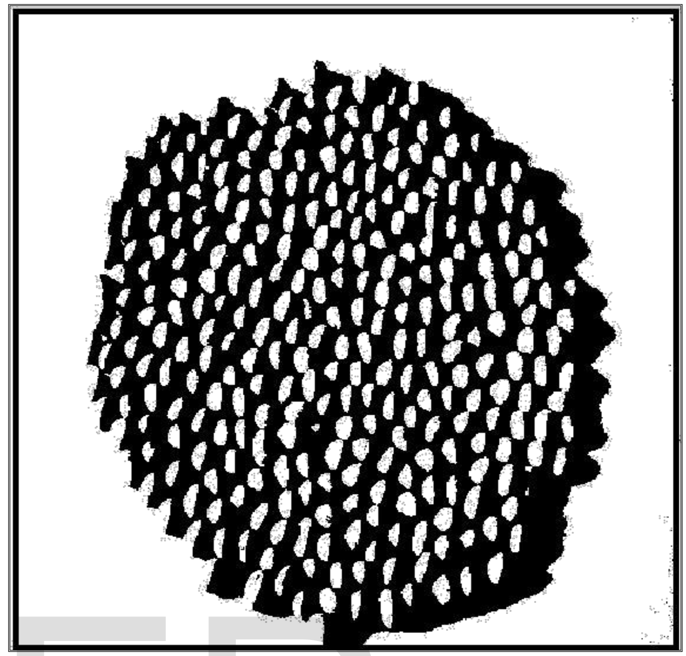

Figure 7: Binary Conversion Output Image.

Figure 8 shows the binary reverse image.

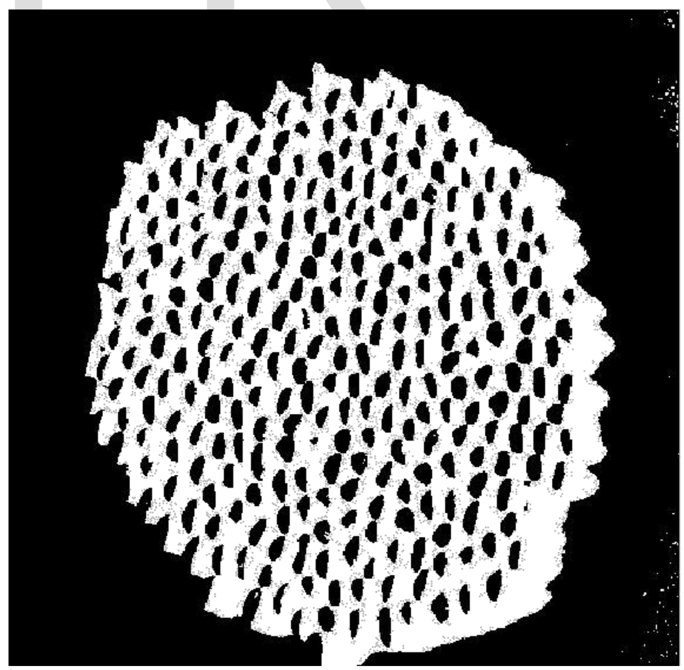

Figure 8: CLAHE applied to Image.

Figure 9 show enhancing the shape of output image in which predefined 2-D filters.

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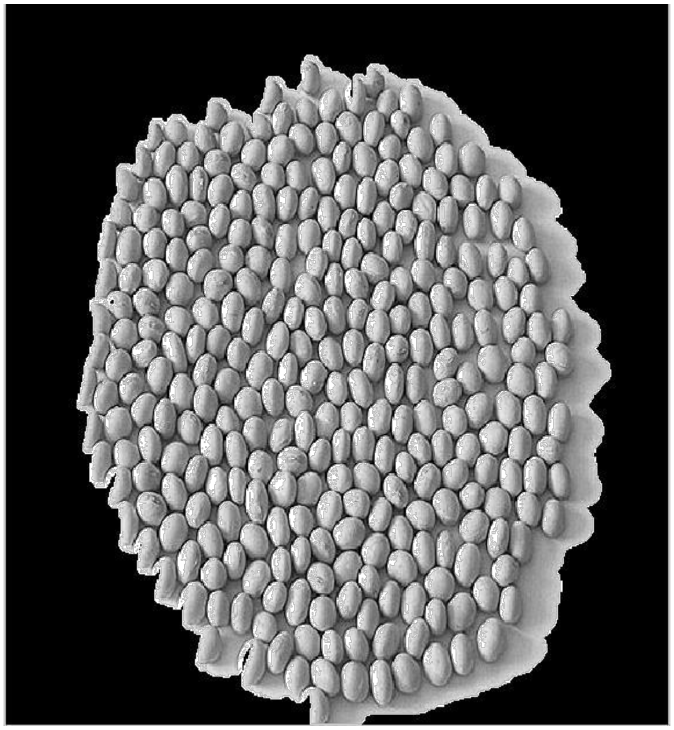

Figure 9: Enhancing the Shape of Output Image.

Figure 10 shows apply edge detection in which find edges in intensity image.

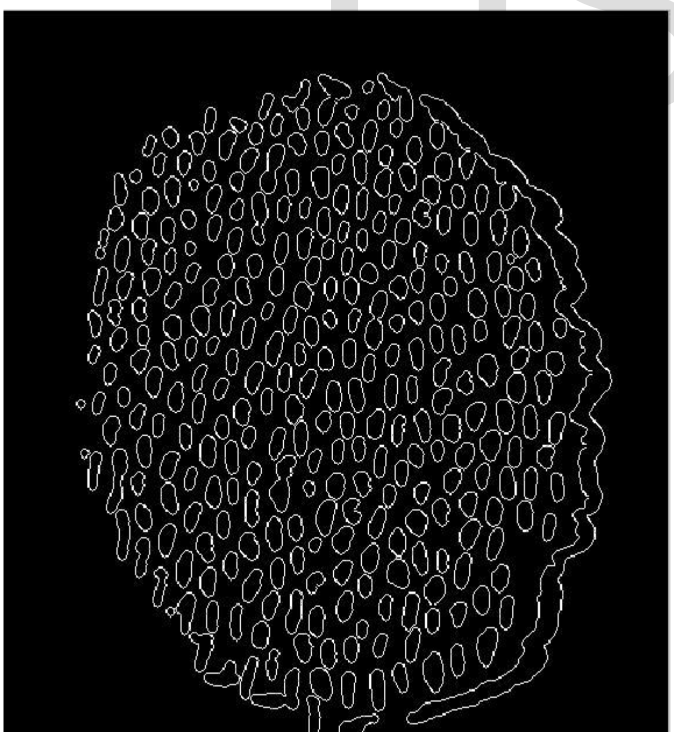

Figure 10: Apply Edge Detection.

According to previous approaches not better edge define i.e. instead of better edge define only circles are shown but using proposed edge detection algorithm to enhance the shape of clustered soybean seeds. Figure 11 shows refining the shape of beans in which morphologically open image. It performs morphological opening on the grayscale or binary image with the structuring element.

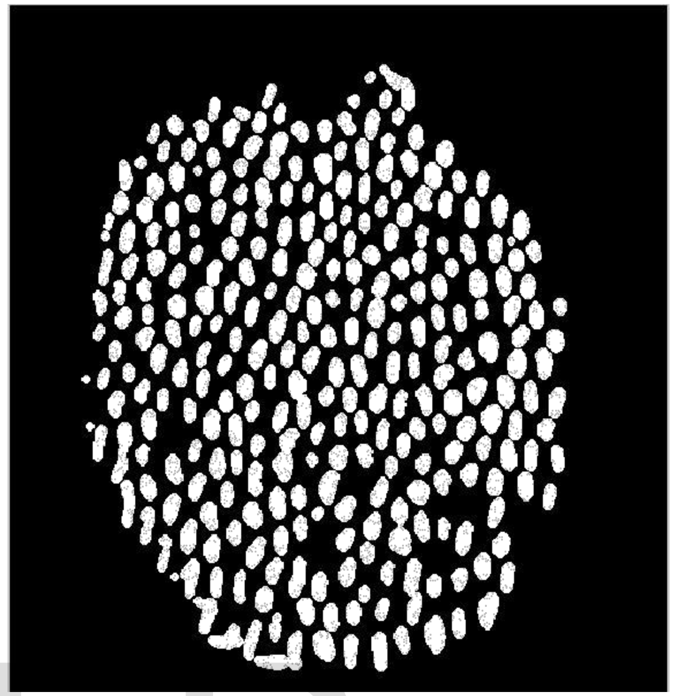

Figure 11: Smoothing the Bean Shape.

Figure 12 shows been extracted with respect to bean shape in which firstly convert to double precision.

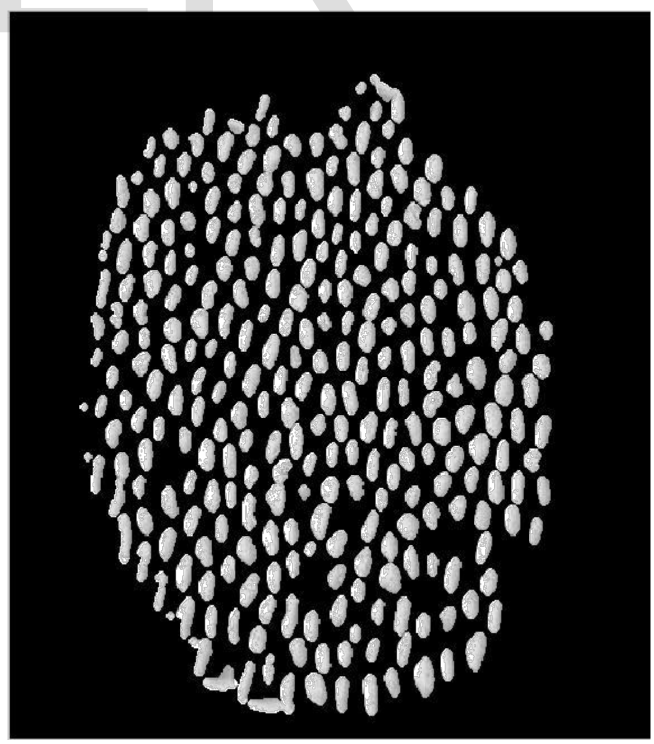

Figure 12: Beans Extracted With Respect to Gray Scale Image.

7 Conclusion

The method presented designed to enhance the shapes of clustered soybean seeds from digital images captured under non-ideal conditions. The method presented here was designed to work with images captured from a distance between 0.5 and 1 meter from the clustered soybean seeds. This is not mandatory, but the results will be more reliable if that condi-tion is observed. Also, the capture must be as vertical as possible to avoid problems of perspective. As input to the program, the user has to provide the name and the type of the image. The table of calculated parameters of the resulted images is given below:

Table 1: Comparative Analysis with Parameters

Parameters	Comparative Analysis	
	Previous Work	**Proposed Work**
Energy	12743423	18221630
Mean	34.8861	61.0070
Median	8928393	15983156
Range	7844653	10486408

So here above table compares the different parameters with respect to base paper. It is clear from these values the better edges will be obtained using edge detection algorithm. For further extent of work, researches should concentrate in the development of a more effective way to improve the edges of clustered seeds by new artificial intelligence techniques.

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