

Edge Improvement of Clustered Soybean Seeds by using Sobel Filter

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Abstract— This paper present a method to improved the edges of clustered soybean seeds by using filter method. The method is based on classical morphological operations, and it was designed to work even under far-from-ideal conditions, including variation in the illumination and low contrast between seeds and background. The proposal shows a good performance under a wide variety of condition.

Keywords—Edge Improvement; Clustered Objects; Soybean Seeds; Digital Images.

I. INTRODUCTION

One of the most used method to improve the quality of clustered soybean seeds using digital 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. The image of clustered soybean seeds is shown in the Figure 1.



Figure 1: Clustered Soybean Seeds.

In this paper different methods is used which 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.

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. And morphological operations 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.

II. RELATED WORK

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-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.

A. 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.

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 ($0^\circ, 45^\circ, 90^\circ, 135^\circ$) defined in improved Sobel Operator.

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. The edge information usually present in four different directions ($0^\circ, 45^\circ, 90^\circ, 135^\circ$). The improved Sobel edge detector has

four masks which operate in four directions as shown in the Figure 2 and moved over the image to get edge map.

B. Threshold Detection

Threshold detection technique is very important task in edge detection. It is important in picture processing to select an adequate threshold of gray level for extracting objects from the background. The proposed method uses a fixed or global threshold value from the histogram data which carries image information; the value of the threshold remains constant throughout the image. Fixed threshold is of the form is given by

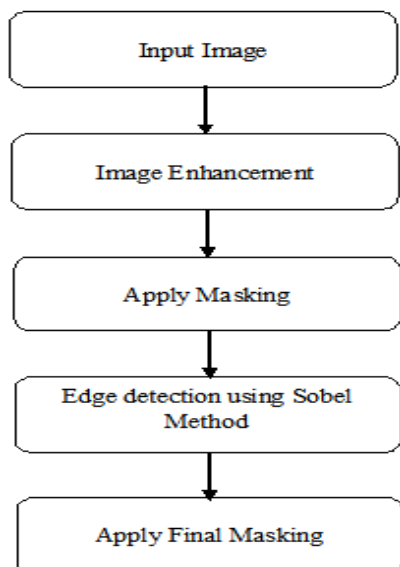
$$g(x,y) = \begin{cases} 0 & f(x,y) < T \\ 1 & f(x,y) \geq T \end{cases}$$

C. Morphological operation on Binary Images

Morphological operations are affecting the form, structure or shape of an object. Applied on binary images (black & white images – Images with only 2 colors: black and white). They are used in pre or post processing (filtering, thinning, and pruning) or for getting a representation or description of the shape of objects/regions (boundaries, skeletons convex hulls).The two principal morphological operations are dilation and erosion. Dilation allows objects to expand, thus potentially filling in small holes and connecting disjoint objects. Erosion shrinks objects by etching away (eroding) their boundaries. These operations can be customized for an application by the proper selection of the structuring element, which determines exactly how the objects will be dilated or eroded.

III. THE METHOD

The method presented here was designed to work with images captured from a distance between 0.5 and 1 meter from the 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. The flow diagram for improving the edges of clustered soybean seeds shown below



IV. EXPERIMENTAL 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 1 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.

The first step of the algorithm is converting the image into a gray scale shown in Figure 3.

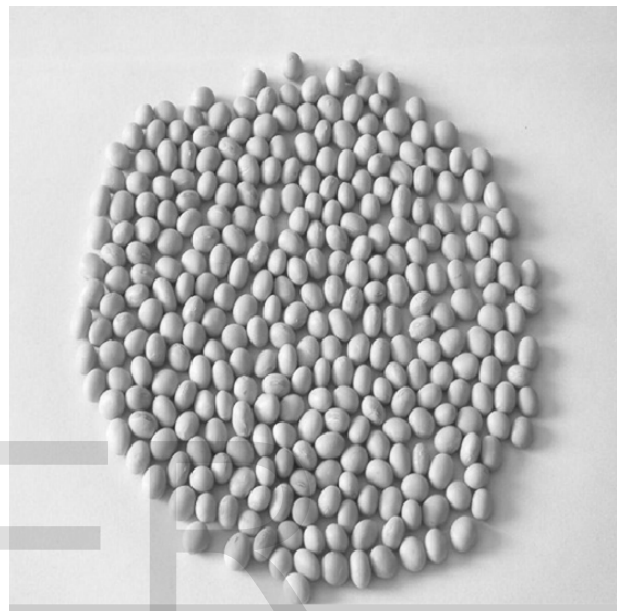


Figure 3: Gray Scale Image.

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

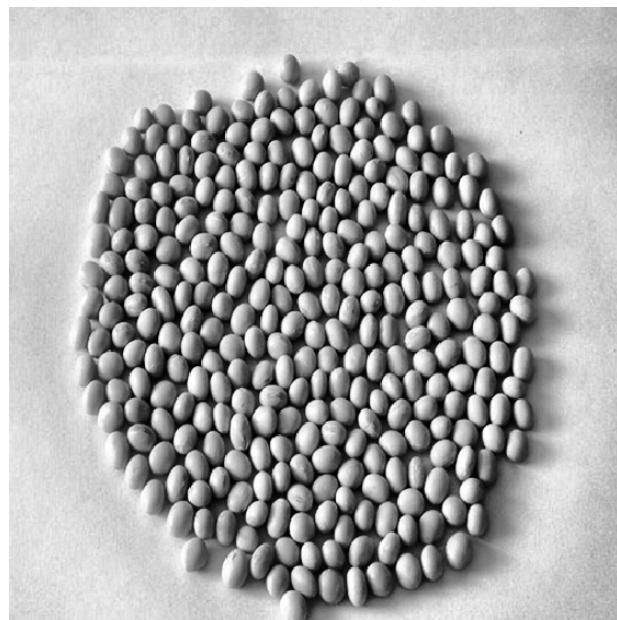


Figure 4: CLAHE applied to Image.

It enhances the contrast of images by transforming the values in the intensity image I . Unlike HISTEQ, it operates on small data regions (tiles), rather than the entire image. Each tile's contrast is enhanced, so that the histogram of the output region approximately matches the specified histogram. The neighboring tiles are then combined using bilinear interpolation in order to eliminate artificially induced boundaries. The contrast, especially in homogeneous areas, can be limited in order to avoid amplifying the noise which might be present in the image. Figure 4 shows the image after this operation.

The next processing only happens if the image is of second type (seeds occupy part of the image). First the image is binarized with threshold at half the full gray scale shown in Figure 5.

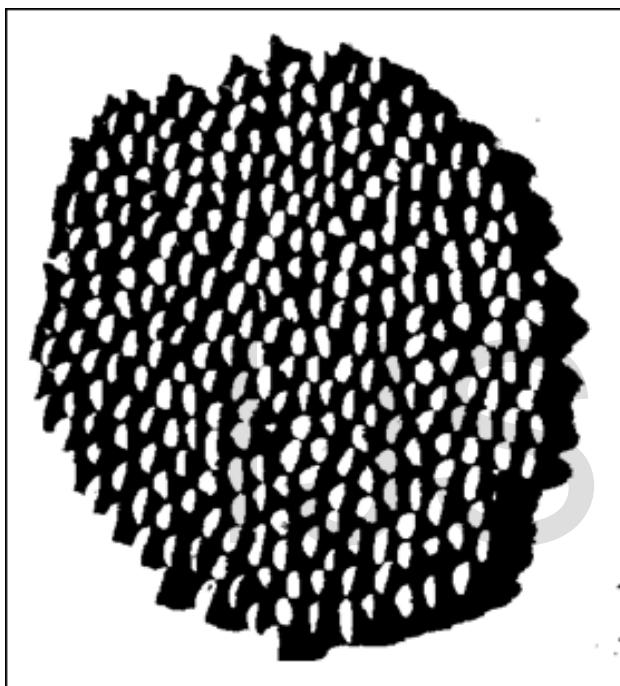


Figure 5: Binary Conversion Output Image.

It produces binary images from indexed, intensity, or RGB images. To do this, it converts the input image to grayscale format (if it is not already an intensity image), and then converts this grayscale image to binary by thresholding. The output binary image BW has values of 1 (white) for all pixels in the input image with luminance greater than LEVEL and 0 (black) for all other pixels. (Note that you specify LEVEL in the range [0, 1], regardless of the class of the input image).

Then, the derivative of the image is calculated in order to identify regions where abrupt changes occur shown in Figure 6. Derivative of the image means that the output binary image BW has values of 1 (black) for all pixels in the input image with luminance greater than LEVEL and 0 (white) for all other pixels. (Note that you specify LEVEL in the range [0, 1], regardless of the class of the input image). Figure 6 shows the binary reverse image. After that, the image is morphologically closed (dilation

followed by erosion) using as kernel a disk with radius of 6% of the image width (value determined experimentally).

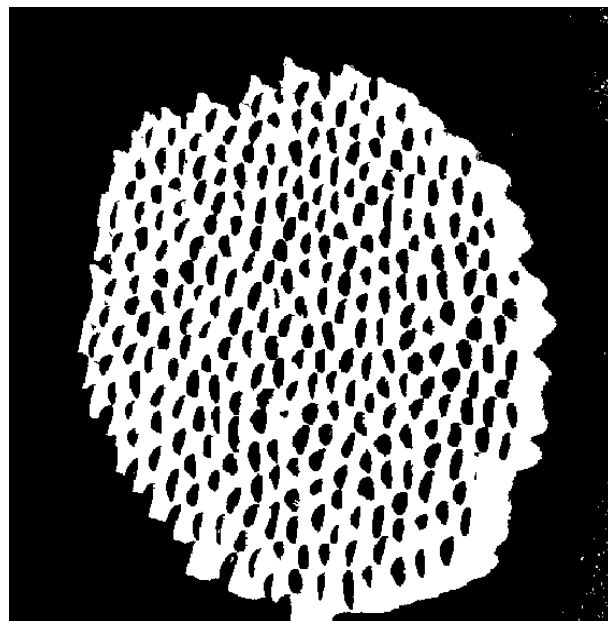


Figure 6: Binary Reverse Output Image.

This operation merges all areas with derivative value (dilation) and then erodes the image back to the original size. As a result, the area of interest of the image is delimited shown in Figure 7.

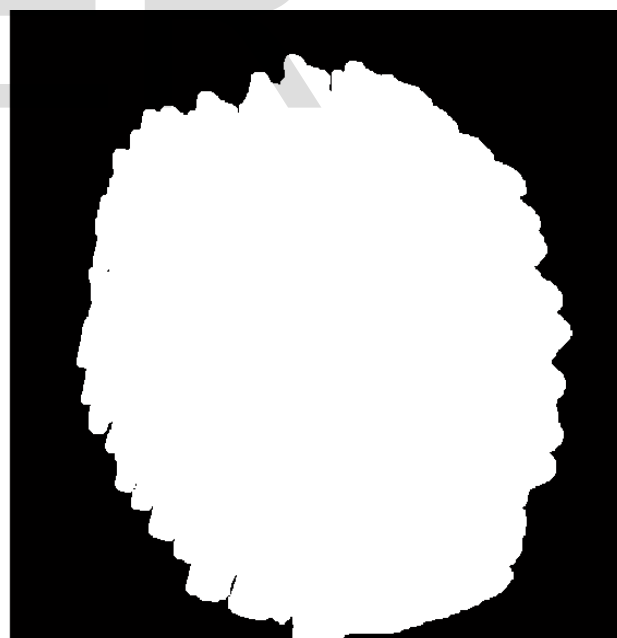


Figure 7: Dilate Output Image.

The white region is used as a mask inside which all elements are to be considered in the remainder of the algorithm. Depending on the angle of the light source, and if the background is bright, this region may include a small portion of the background, and may also exclude parts of some seeds as can be seen in Figure 8. This may lead to

some errors, which explain why the accuracy for this kind of situation tends to decrease, as stated in the beginning of this section. Back to general processing, the image is morphologically opened using as kernel a disk with a radius of 1% of the image width, in order to eliminate noise and artifacts. The result is shown in Figure 8.

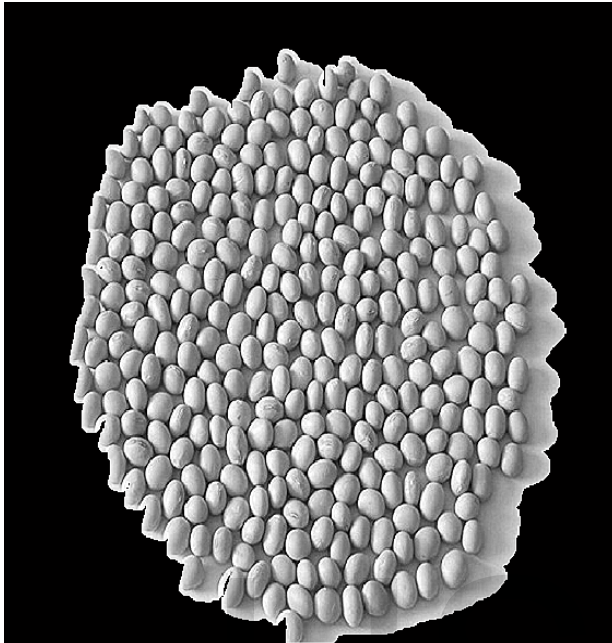


Figure 8: Enhancing the Shape of Output Image.

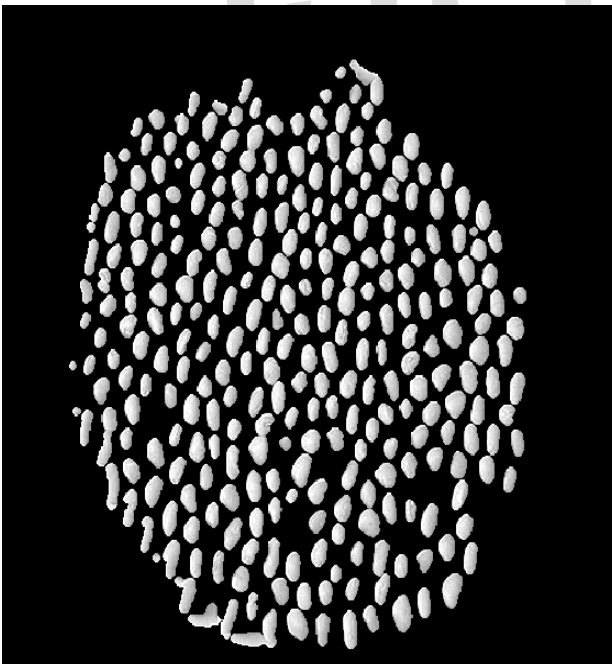


Figure 9: Beans Extracted with respect to Gray Scale Image.

As can be seen the image has now a smoother texture. In the following, the image is equalized again, so the best contrast is achieved. This contrast enhanced image is morphologically opened once more, giving rise to plateaus

that are local maxima in the image. Figure 9 shows the beans extracted with respect to gray scale image.

V. CONCLUSION

This paper presents a method to improve edges of clustered soybean seeds from digital images captured under non-ideal conditions. The method is entirely based on largely used morphological operations, which results in an easy implementation and low computational burden. Results show that the method works well even under challenging conditions, like seed clustered in one region of the image and low contrast between seeds and background.

REFERENCES

- 1) Jayme Garcia Arnal Barbedo, "Counting Clustered Soybean Seeds" Published in 2012 12th International Conference on Computational Science and its Applications.
- 2) Chen, X., Chen, H., Chen, H. "A Novel Approach for Color Edge Detection in RGB Color Space". In: 10th IEEE International Conference on Signal Processing, pp. 793-797. IEEE Press, Germany (2010).
- 3) Niu, L., Li, W. "Color Edge Detection Based on Direction Information Measure". In: 6th World Congress on Intelligent Control and Automation, pp. 9533-9536. IEEE Press, China (2006).
- 4) Zou, J., Li, H., Liu, B., Zhang, R. "Color Edge Detection Based on Morphology". In: 1st International Conference on Communication and Electronics, p. 291. IEEE Press, China (2006).
- 5) Wang, J., Liu, L. "Specific Color-pair Edge Detection using Quaternion Convolution". In: 3rd International Congress on Image and Signal Processing, pp. 1138-1140. IEEE Press, China (2010).
- 6) Datta, S., Chaudhuri, B.B. "A Novel Edge Detection in RGB Color Space". In: IEEE International Conference on Advances in Recent Technologies in Communications and Computing, India, p. 337 (2009).
- 7) N. Suchowerska et. al, "Automated cell colony counting and analysis using the circular Hough image transform algorithm.(CHITA)" physics in medicine and biology, vol.53, pp.5991-6008, on IEEE 2008.
- 8) P. Wiejethunga, S. Samarasinghe, D. Kulasiri, and I. Wood head, "Digital image Analysis based automated kiwifruit counting technique" in Proc. int. conf. image And vision computing 2008.
- 9) Y.L, Hou and G.K.H pang, "People counting and human detection in a challenging Situation." IEEE trans. on systems man, and cybernetics part A: System and human Vol 41 pp.2009.
- 10) P. Zhao and Y. Li, "Grain counting method based on image processing," in Proc. Int. Conf. Information Engineering and Computer Science, 2009.