Homework Report

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Overview

In this report, we are concerned with 2 problems, one is from edge detection and other is of region merging.

The programming language used is Python.

Problem 1

Results and Discussion

In the first problem, both Difference of Gaussian and Laplacian of Gaussian used for the edge-detection. At first we convolve these above two filters on the image given of UBCampus.jpg to get some fine edges as in Figure 2. After convolving, we check the zero crossing by checking the change of sign for each pixel with its neighboring pixel. We get more populated image with all the pixels even with small change in intensity level given in Figure 3. After getting zero crossing, we apply 1st derivative Sobel filter on the original image. In order to remove weak edges from the image shown in Figure 4 we do bitwise and to the zero-crossing image and we get out final result in Figure 5. Figure 1 shows the original UB Campus images.

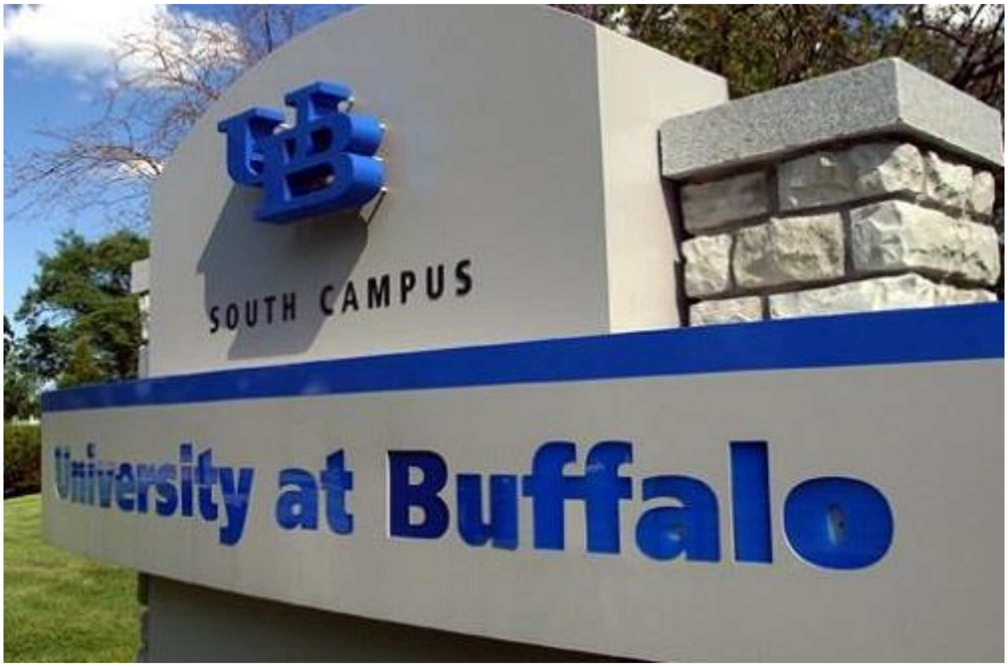

Figure 1: Original Image UBCampus.jpg

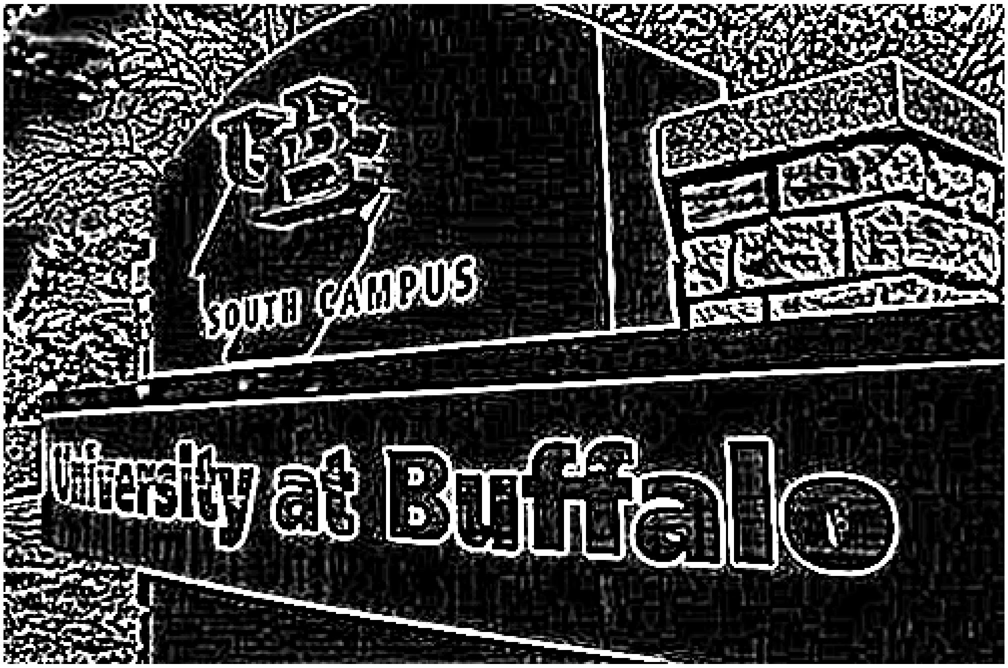

Figure 2(a): Apply DoG filter on the image

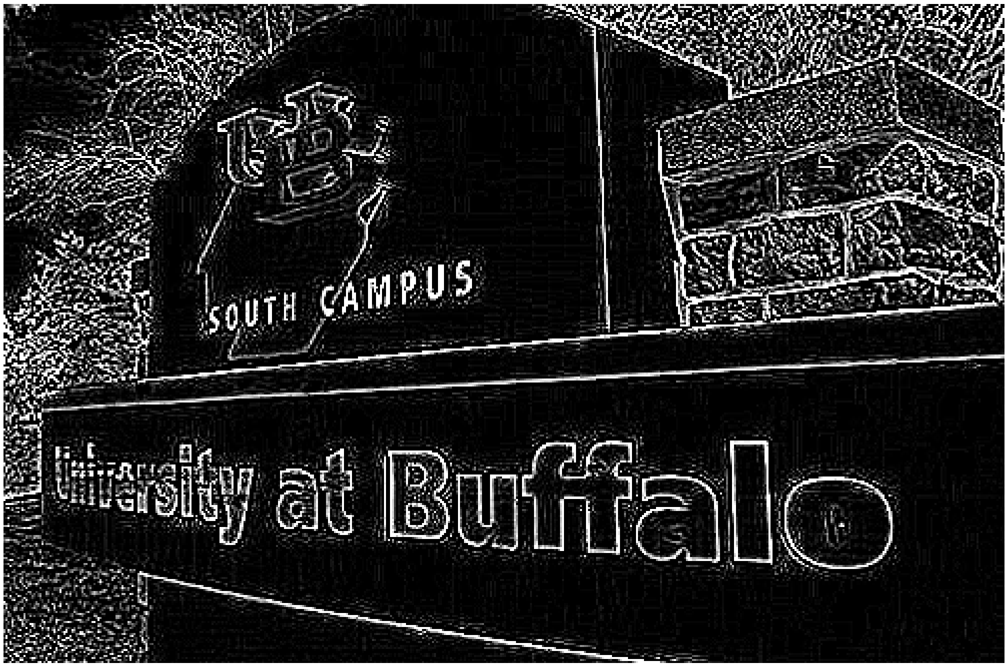

Figure 2(b): Apply LoG filter on the image

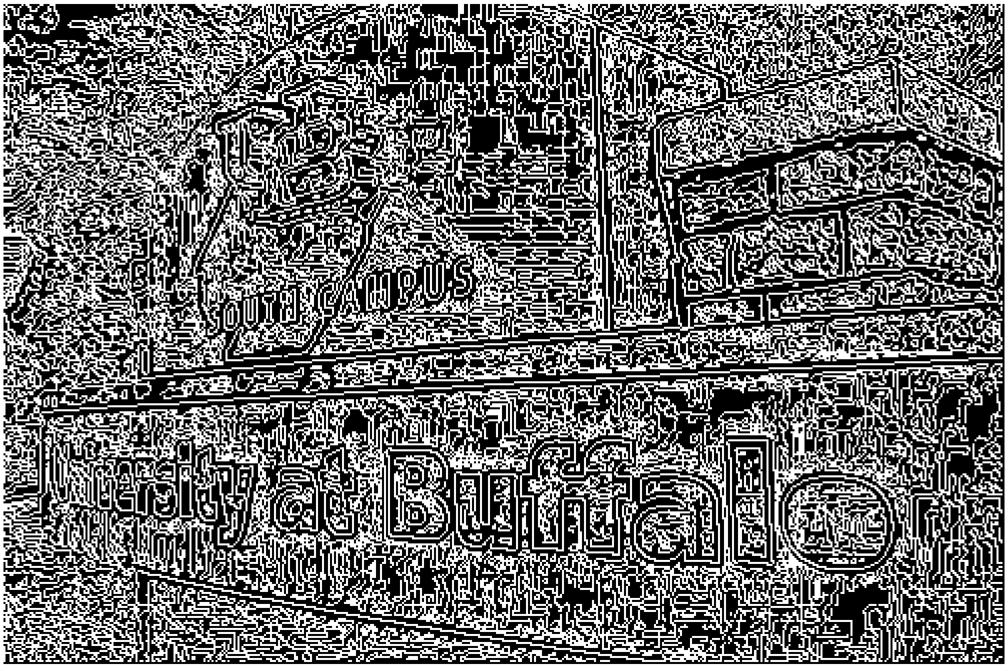

Figure 3(a): Appling zero crossing on the DoG Image

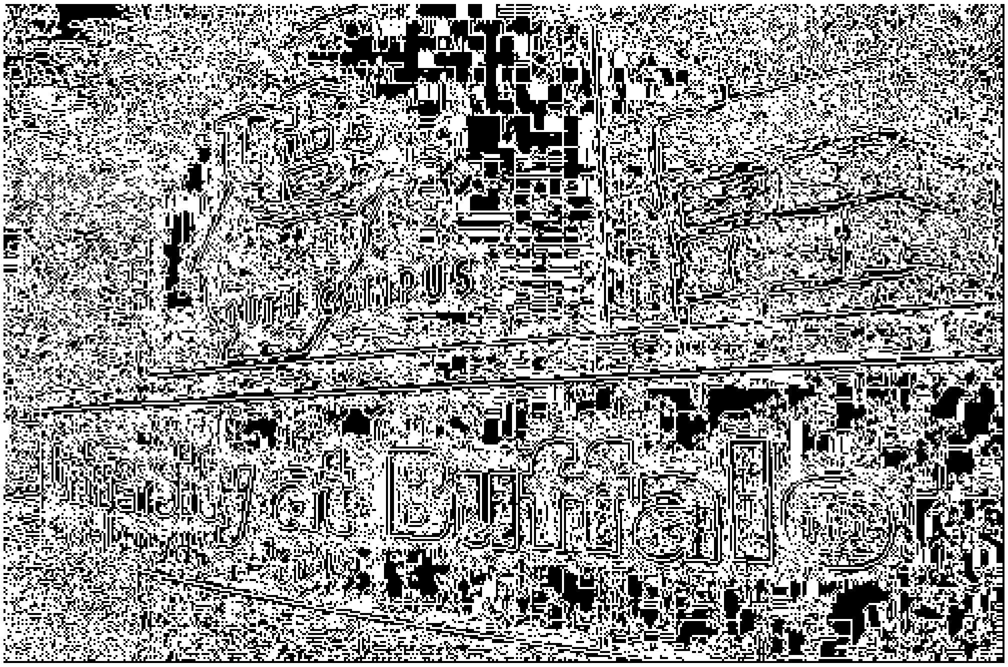

Figure 3(b): Appling zero crossing on the LoG Image

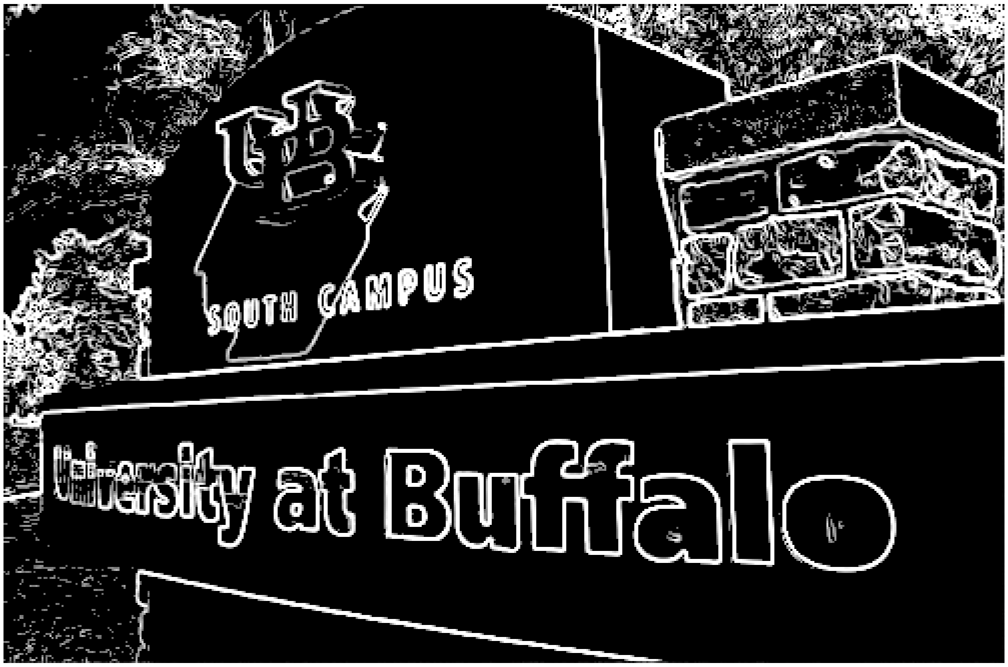

Figure 4(a): Applying Sobel filter on the original Image for DoG.

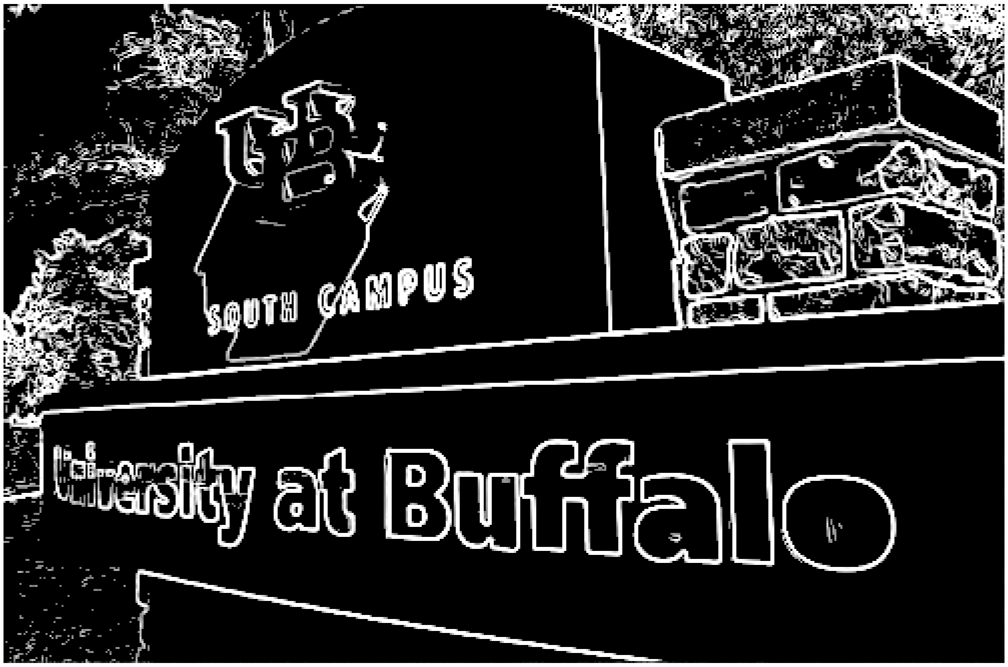

Figure 4(b): Applying Sobel filter on the original Image for LoG.

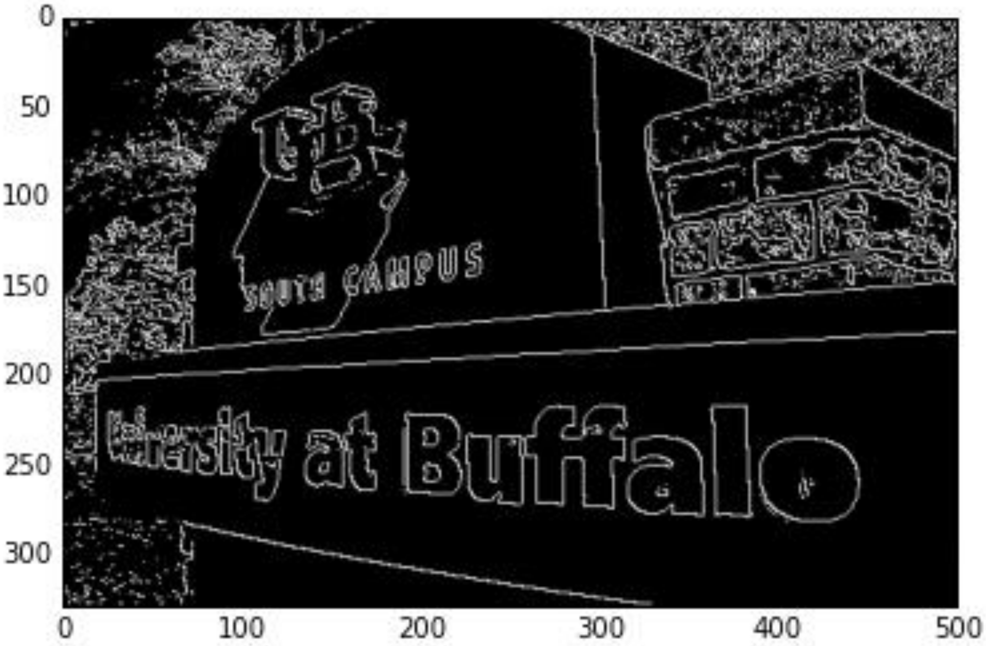

Figure 5(a): Removing strong edges for DoG (final output)

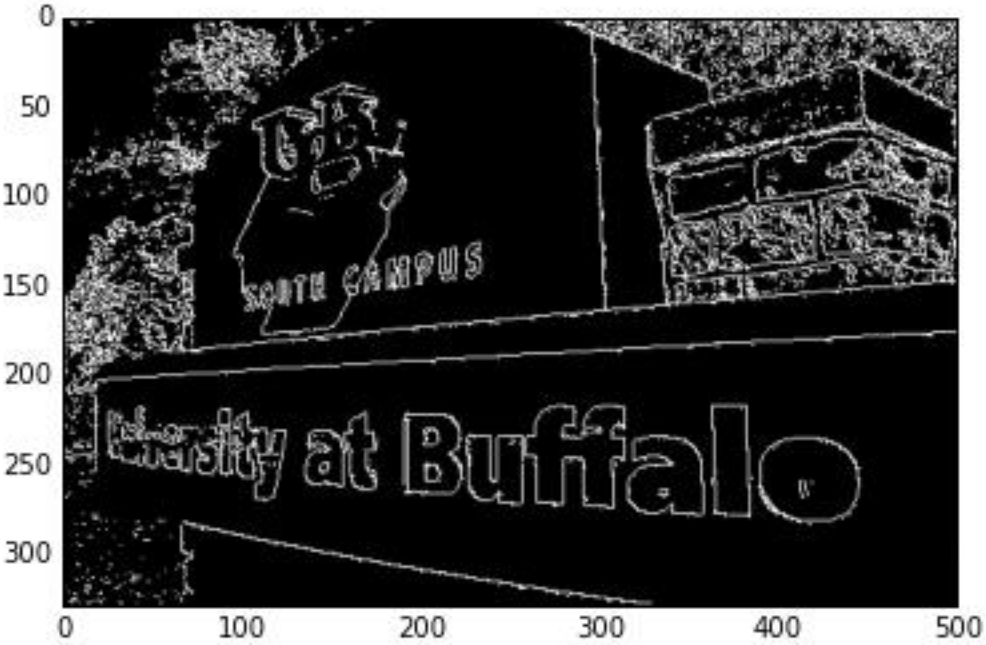

Figure 5(b): Removing strong edges for LoG (final output)

It is noticed that in both Figure 4(a) and 4(b), there is a difference of some noise in the image i.e. final output for LoG has more noise as compared to final output of DoG. However, we can get both the output nearly same by simply changing the value of the threshold. Thhreshold value taken for DoG was 105 and LoG was 120.

Problem 2

It is a region merging segmentation problem in which first we construct a supergrid edge data structure of the original image. At first we expand the image into twice of it's original size both horizontally and vertically and copying pixel at alternate position of the grid from the original image. Then we take adjacent difference both horizontally and vertically and copy the difference in-between them which is known as crack edge (edge strength). This crack image contains the edge strength which we can control by the threshold which we can provide. Results regarding the above findings can be found in figure 7 and figure 8.

Also, we tried different set of threshold on the adjacency pixels of the image, at T = 55 we get some of the crack edges denoted by white pixel as shown in figure 9.

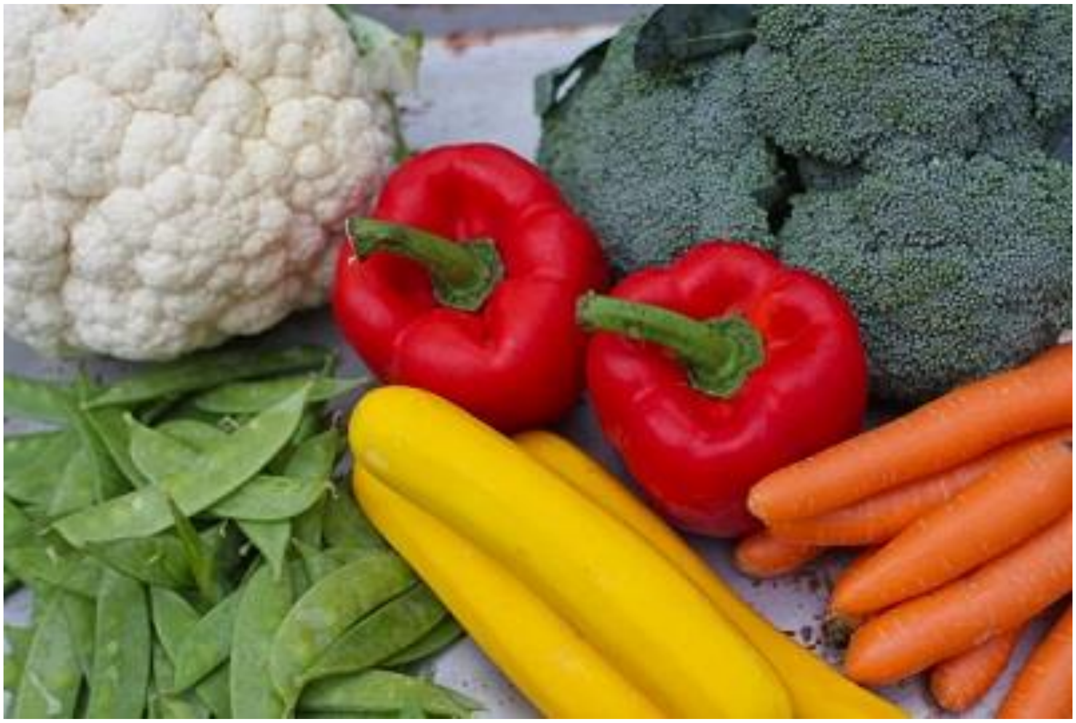

Figure 6: Original Image MixedVegetable.jpg

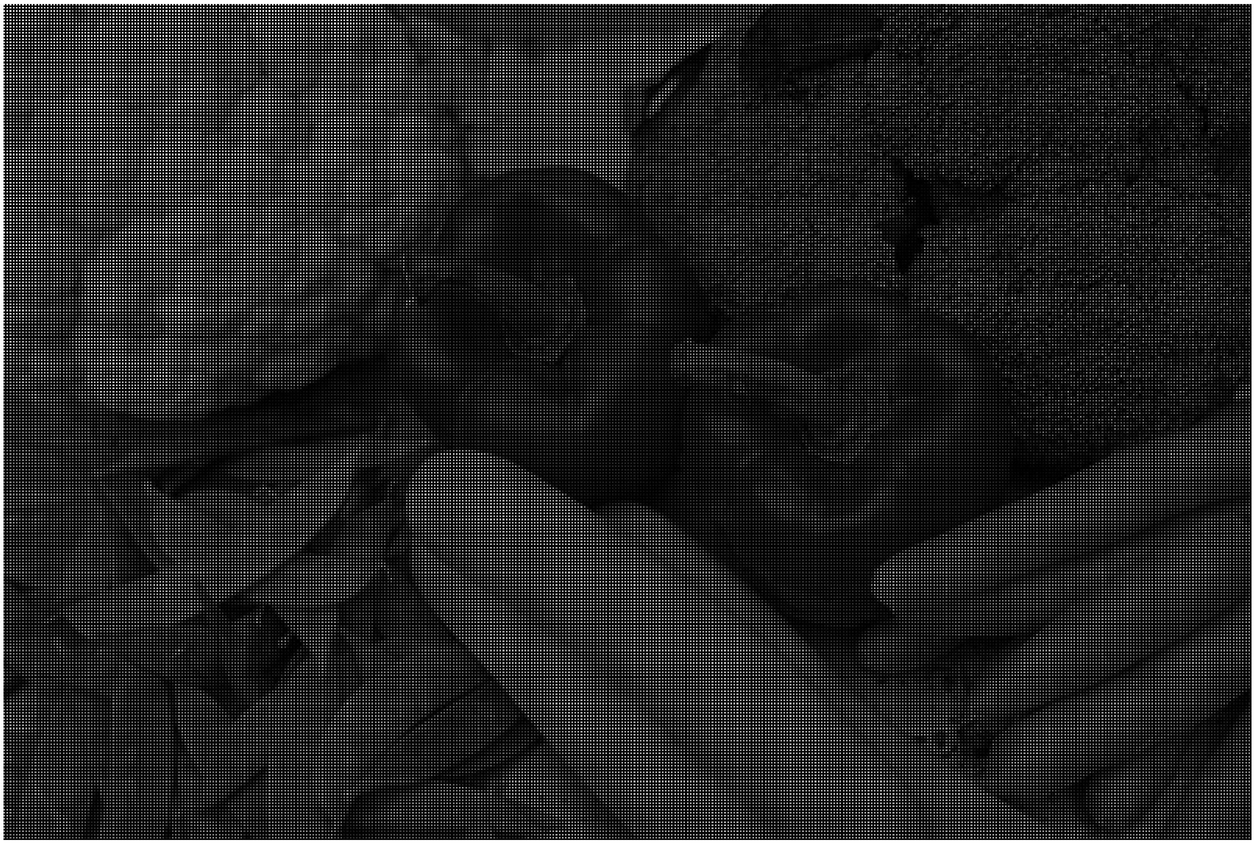

Figure 7: Expanded image with supergrid structure

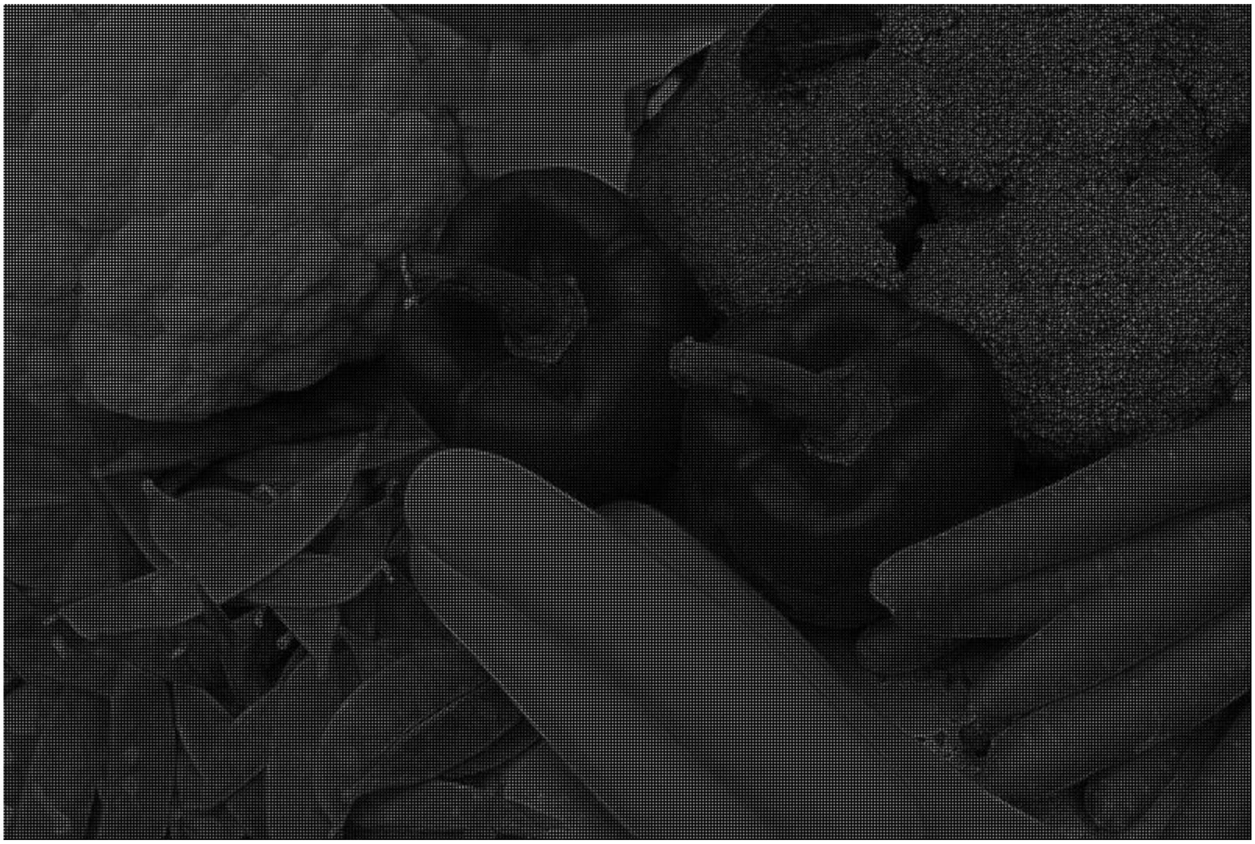

Figure 8: Image with cracked edges without setting threshold

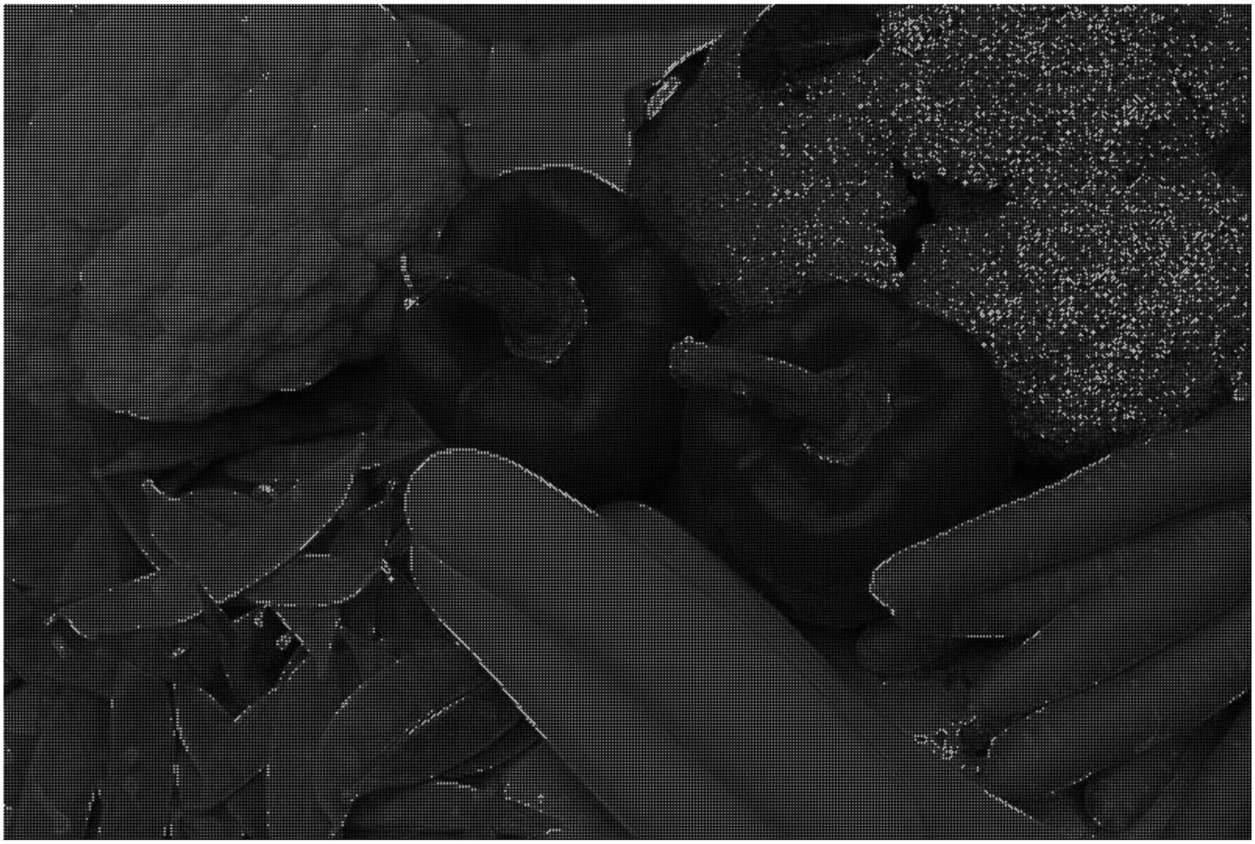

Figure 9: Image displaying crack edges setting threshold thresh = 55

By setting a threshold value, we remove all the weak edges in the image and display strong edges of some part of the boundaries of the objects. The boundary pixels are denoted by 255.
After detecting crack edges we recursively remove the adjacent regions by setting a threshold

W/min(l1,l2) >= T2

Where W is the number of weak edges on the common boundary l1 and l2 are the perimeter of the regions for R1 and R2 respectively and T2 is another threshold.
Recursively remove the common boundaries of the adjancency region R1 and R2 if

W/l >= T3 or W>= T3

Where l is the length of the common boundary and T3 is a third threshold.

Region segmentation

The region segmentation is done by comparing the variation of the neighboring pixel in the supergrid image. 4 neighbor comparison is done in the image. The concept behind the comparison is the similarity of the pixels in terms of intensity of the image. If the intensity of the variation of the reference pixel is large, then it is considered as the border pixel, else if the variation is less, then the pixel is within the region. The threshold value set was 110.

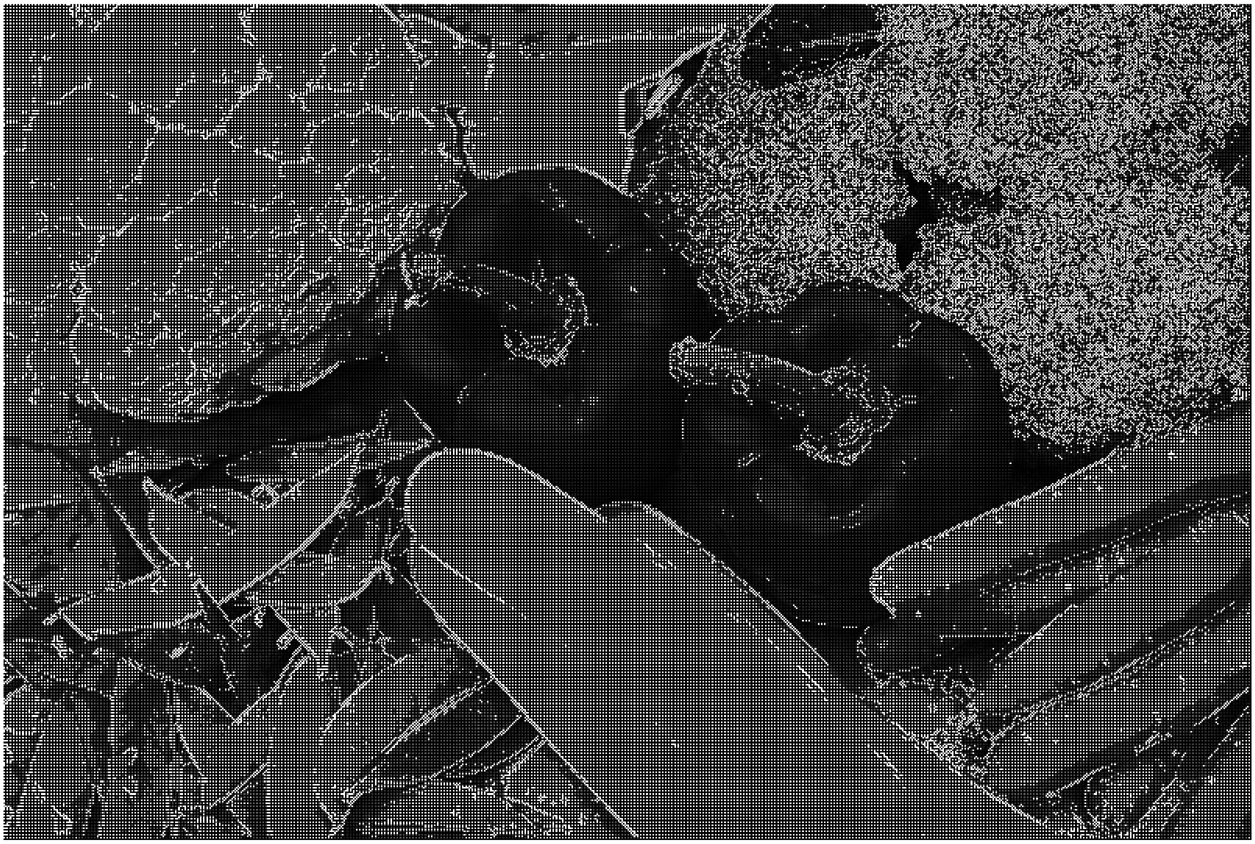

Figure 10: Image with some same value of pixel has same intensity