Homework-2 Solutions

Question 1

A technique for computing optimal thresholds was developed in class under the assumption that if a single pixel x is changed into q the error is $(x-q)^2$. Derive equations for computing the optimal threshold if the error of moving a pixel of value x to a pixel of value q is $|x-q|$ and not $(x-q)^2$. Follow the same steps as the derivation in class. You may want to use the fact that the derivative of $|x|$ is 1 if $x > 0$ and -1 if $x < 0$.

Question 2

You are given the following image:

6	6	6	10
6	6	6	10
17	17	17	17
17	17	17	88

1.

What is the image histogram?

Answer:

Pixel value	6	10	17	88
# pixels	6	2	7	1

2.

What would be the result of applying the optimal thresholding algorithm that was discussed in class to this image?

Answer:

The threshold value is $t = 18$. ($q_1 = 11.7$, $q_2 = 88$.) The picture after the threshold is applied is:

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	255

3.

What image is obtained by linearly scaling the pixel values to the $0-255$ range?

$$x \rightarrow (x-6) * 255/82$$

0	0	0	12
0	0	0	12
34	34	34	34
34	34	34	255

4.

What image is obtained by histogram equalization to the $0 - 255$ range?

48	48	48	112
48	48	48	112
184	184	184	184
184	184	184	248