

Closed book/closed notes. Show all of your work clearly in the space provided or on the additional page at the end of the exam. If the additional page is used, be sure to clearly label the content for each problem. Be sure to *read each problem carefully*. You should answer all 5 questions. Note: The exam is double-sided.

1. (15 points) Briefly describe any two of the edge detection algorithms discussed in lecture. How are they similar? How are they different?

Answer:

See course notes.

2. (10 points) Explain your reasoning for agreeing or disagreeing with the following statement:

APPLYING HISTOGRAM EQUALIZATION TO AN IMAGE A SECOND TIME
WILL NOT IMPROVE THE CONTRAST IN THE IMAGE.

Answer:

I agree with this statement because the first histogram equalization operation will flatten the histogram as much as possible. The second application will not change the histogram significantly.

3. (15 points) Suppose an image experiences a histogram modification of some sort. The histogram of the image before and after histogram modification are shown below. Postulate on changes in appearance to the image as a result of the histogram modification. Be sure to explain your reasoning.



Original histogram



Modified histogram

Answer:

It appears that the contrast in the image is enhanced since the graylevels are more polarized at the ends of the graylevel spectrum.



4. (25 points) Filter the following image using the filter kernel provided. You may use any of the methods discussed in class for dealing border pixels but be sure to indicate which method you selected.

0	0	0	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
0	0	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
0	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1
0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1	1
$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1	1	1

Image

-1	0	1
0	1	0
-1	0	1

Filter Kernel

Answer:

I assumed the region outside of the image was black (0).

0	0	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	0
0	$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{3}{2}$	1	$-\frac{1}{2}$
$\frac{1}{2}$	$\frac{1}{2}$	1	$\frac{3}{2}$	1	$\frac{3}{2}$	$-\frac{1}{2}$
$\frac{1}{2}$	1	$\frac{3}{2}$	1	$\frac{3}{2}$	$\frac{3}{2}$	-1
1	1	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{3}{2}$	1	0

5. In each part you are given a filter kernel. Explain how you expect applying the filter to an image would change the original image. Be sure to explain your reasoning.
- (a) (15 points)

-1	0	1
0	0	0
-1	0	1

Answer:

This will highlight edges in the image. In uniform regions, the filter will sum to 0. For edges that are brighter on the Western side, the filter sum will be negative. For edges that are brighter on the Eastern side, the filter sum will be positive.

- (b) (10 points)

0	0	0
0	1	0
0	0	0

Answer:

The output image will be the same as the input image.

- (c) (10 points)

0	0	0
0	$\frac{1}{4}$	$\frac{1}{4}$
0	$\frac{1}{4}$	$\frac{1}{4}$

Answer:

This will blur the image.



Additional work area for any problem. Clearly identify to which problem the work on this page is related.