

Question 1: Choose the correct answer (6 points):

4/6

1- One of the following filters is nonlinear

- a. Gaussian Filter
- b. Averaging Filter
- c. Laplacian Filter
- d. Median Filter

X

2- -----Filter cannot be implemented using convolution mechanism.

- a. Average
- b. Gaussian
- c. Median

✓

3- Both the ----- and ----- filters are used to enhance horizontal edges (or vertical if transposed).

- a. Prewitt and Sobel
- b. Sobel and Gaussian
- c. Prewitt and Laplacian
- d. Sobel and Laplacian

✓

4- An image element is usually called a _____

- a. Pixel
- b. Fixel
- c. Drexel
- d. All of the above

✓

5- The sum of all components of a normalized histogram is equal to _____

- a. Size of the image
- b. Size of rows of the image
- c. Size of columns of the image
- d. One

✓

6- In Canny edge detection, we will get more discontinuous edges if we make the following change to the hysteresis thresholding:

- a. increase the high threshold
- b. decrease the high threshold
- c. increase the low threshold
- d. decrease the low threshold

X

7- Mean-shift is a nonparametric clustering method. However, this is misleading because we still have to choose

- a. the number of clusters
- b. the size of each cluster
- c. the shape of each cluster
- d. the window size

8- If you are unsure of how many clusters you have in your data, the best method to use to cluster your data would be

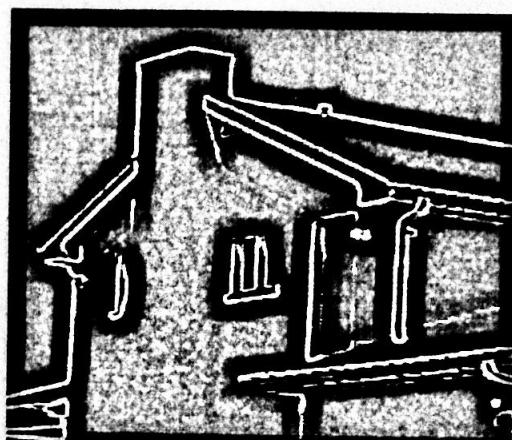
- a. mean-shift
- b. k-means
- c. expectation-maximization
- d. markov random field

9- In HSV color model, hue is more meaningful when saturation approaches 1 and less meaningful when saturation approaches 0.

- a. True
- b. False

10- If the original image is the first figure, and the resulting image after some processing is the second figure, what is the most likely processing from the list below to give this result? ■

- a. Edge detection by a Laplacian operator;
- b. High pass filtering, by subtracting a low pass filtered version of the image from the original image;
- c. Median filtering followed by an edge detection;
- d. Edge detection followed by a median filtering.



Question 2 (16 points):

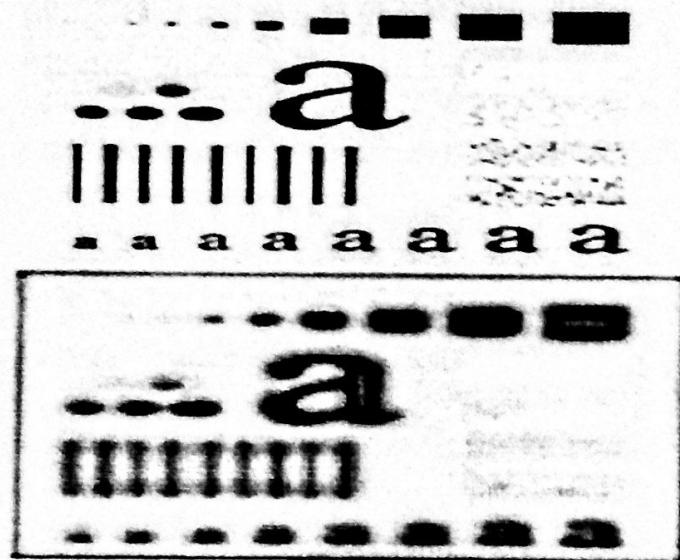
- 1- (6 points) Given the following data points,

A	B	C	D	E	F	G	H	I	J
(0,0)	(0,1)	(1,0)	(-1,0)	(0,-1)	(2,1)	(2,2)	(3,1)	(3,2)	(5,5)

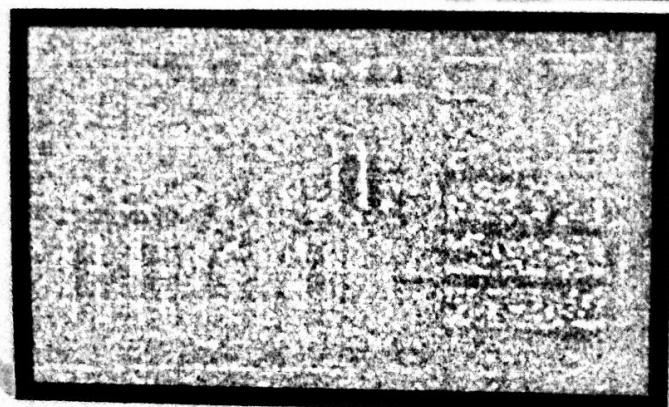
- a. Perform K-means algorithm to classify these data points to two clusters with two initial centroids (-0.5,-0.5) and (0,2)(use back page to solve the problem)
- b. Will the classification result be different if we randomly choose these two initial centroids?

NO O

- 2- (3 points) Consider the 3 images given below. The first image is the original image and the next two are processed images. Explain what type of filters has produced the effects in these two images.



→ average filter is done to this image
ex: $\frac{1}{3} \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$
∴ cause blurring (smoothing)

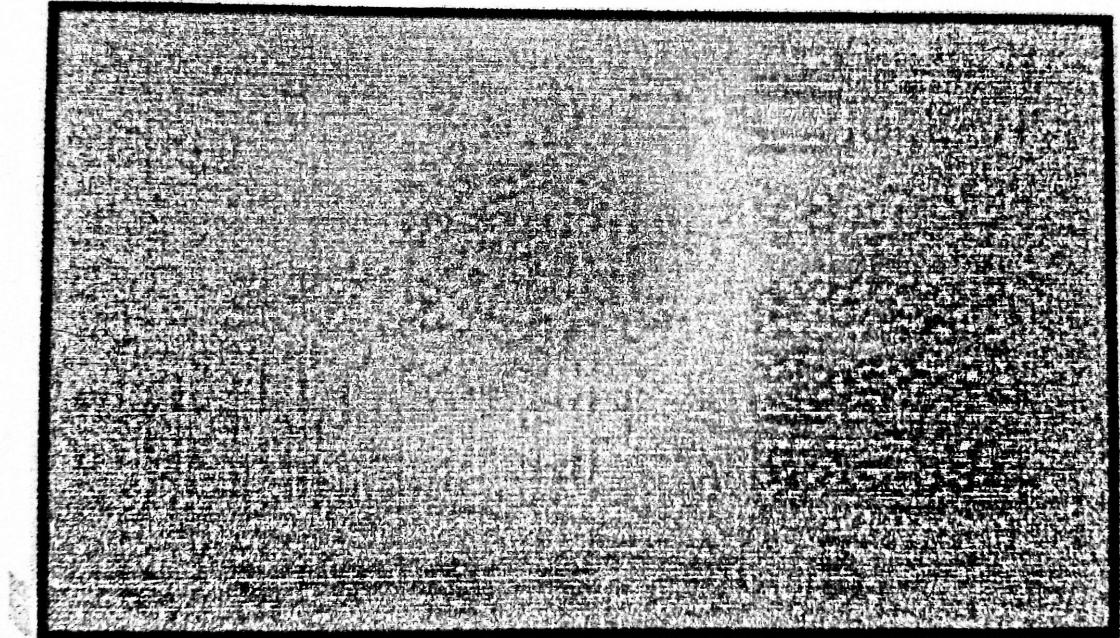


→ edge detection filter is done to this image

$$\text{ex } \begin{bmatrix} 1 & 1 & 1 \\ -1 & -1 & -1 \\ 1 & 1 & 1 \end{bmatrix}$$

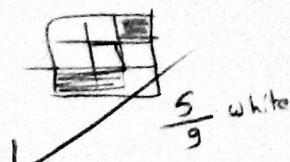
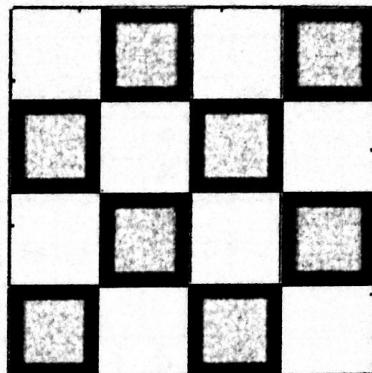
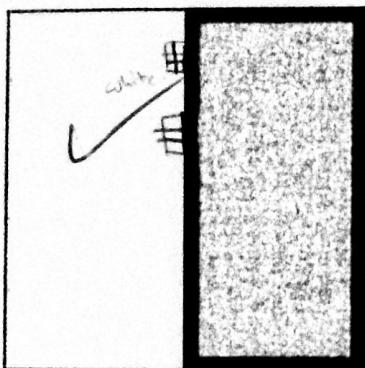
∴ That cause edge detection To The image.

Convolution

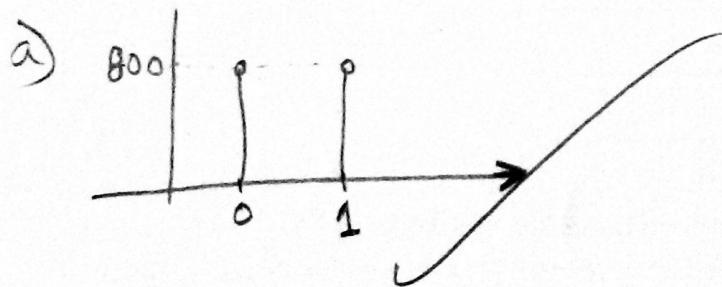


∴ T
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3- (7 points) The binary images shown below are quite different, but their histograms are the same. Suppose that each image is convolved with 3×3 averaging mask.



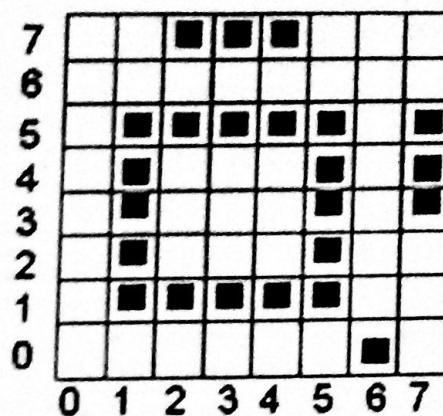
- (1 point) Draw the histogram of the original images given that the size of the images is 40×40 .
- (2 points) Would the histograms of the new images after averaging still be equal?
Explain
- (4 points) If your answer is no, sketch the two histograms after averaging.



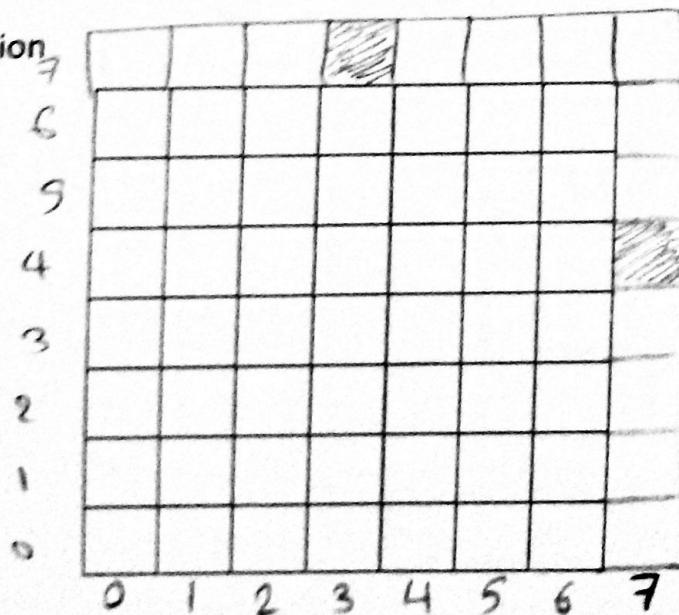
- b) as the image is binary so the average mask will not change
 The histogram of both images, as the only contribution is at the edge and after averaging the center pixel will have the same value
 be cause it will be rounded to '0' or '1'
- c) The same as a)

Question 3 (8 points):

- 1- In the image below, Show what will happen with the image if you perform the following operations for one iteration with a structuring element 3x3.

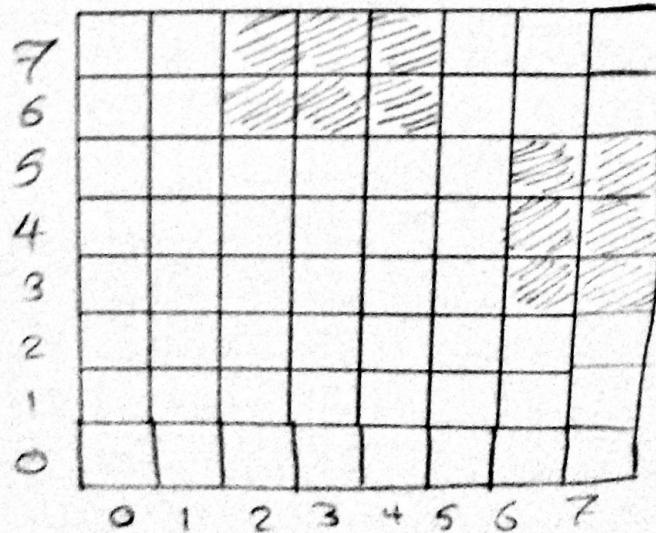


a- Erosion



~~X~~

b- Dilation followed by Erosion



~~L~~