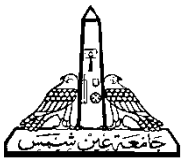

1. Given two digital images I1 and I2 defined as follows:-

I1=

1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	1	1
7	8	9	1	2	3	3	2	1	1
3	3	3	3	3	3	3	2	1	1
5	5	5	5	5	5	3	2	1	1
4	5	4	4	4	4	3	2	1	1
4	4	5	6	7	4	3	2	1	1
4	4	4	5	6	4	3	2	1	1
4	4	4	4	5	4	3	2	1	1

I2=

8	9	10	11	12
12	8	9	10	11
13	12	8	9	10
14	13	12	8	9
15	14	13	12	8

a) Apply a 5X5 smoothing filter on I1.
b) Apply a 3X3 smoothing filter on I2.
c) Apply a 5X5 median filter on I1.
d) Apply a 3X3 median filter on I2.
e) Determine the Laplacian image of I1 and I2.
f) Find I1 and I2 after un-sharp masking. In each case, select a suitable value of the parameter A.

2. Use the center-difference approximation to derive a Laplacian mask by finding the first and second order derivatives of an input image.

3. An arbitrary image f, is scaled homogeneously by a scale factor s. Determine the Laplacian before and after scaling. Explore the relationship!

4. An arbitrary image f, is rotated around its center by an angle θ. Determine the Laplacian before and after rotation. Explore the relationship!

5. Compute the magnitude of the gradient of I1 given in Problem (1) using four different methods.

Computer Programming Assignments

6. Write a MATLAB function that takes an input image and an mXn mask. The function generates a filtered image by carrying out the masking process over each pixel in the image. (**Note that m and n are odd positive numbers**.)

7. Generate different testing images by using the MATLAB function imnoise with the Gaussian noise option. Hint (J = imnoise(I,'gaussian',u,v) adds Gaussian white noise of mean u and variance v to the image I.)

8. Generate different testing images by using the MATLAB function imnoise with the 'salt and pepper' option. Hint (J = imnoise(I,'salt & pepper',d) adds salt and pepper noise to the image I, where d is the noise density.)

9. Now, test your function of Problem (6) with the average smoothing filter. You must illustrate the relation between the amount of noise that the image has and the size of mask needed. Make use of the generated images in Problem (7). Comment on your results.

10. Test the function of Problem (6), to compute the Laplacian of an input image using two different masks.

11. Test the function of Problem (6) with the un-sharp masking with different values of the parameter A.

12. Write a MATLAB function to compute the magnitude of the image gradient using three different methods. Illustrate the results of different images.

13. Write a MATLAB function that takes an image I and a size n. The function performs median filtering of a mask size, nXn.

14. Test the function of (13) with images generated in (7) and (8). Comment on the results and Compare with the average smoothing filter.

15. Measure the performance of your median filter function by recording the execution time for different image and mask sizes. You can think about making a table as follows:-

		Filter Size					
		3X3	5X5	7X7	13X13	25X25	35X35
Image Size	128X128						
	256X256						
	512X512	Record the execution time					
	1024X1024						
	2048X2048						

Comment on your results.

16. Use the function of (12) to construct an edge map of an input image by thresholding the gradient magnitude image.