

## Assignment 1

Due date: October 9, 2023, at 5:00 PM

### 1 Convolution and Correlation

Given a 7x7 grayscale image (Image (a)), apply the provided 5x5 filter (Image (b)) using both convolution and correlation. Ensure zero padding is applied to maintain the output size (7x7).

#### Operations:

1. Convolution (15 Marks)
2. Correlation (15 Marks)

0	1	4	1	5	9	0
3	2	4	1	1	9	2
3	3	2	1	3	0	2
0	1	0	3	5	9	2
3	1	1	1	0	0	2
3	2	2	1	5	1	2
7	1	4	1	5	9	1

(a) Image (7x7)

3	1	1	4	5
1	2	0	3	0
0	1	3	0	3
1	0	1	1	0
2	3	0	3	1

(b) Filter (5x5)

### 2 Enhancing the "NuclearMedicine.tif" Scan Image

Using MATLAB, perform the following tasks on the image:

1. Read the Image into MATLAB.
2. Apply noise reduction. (5 Marks)
3. Equalize the histogram of the left half of the image. (10 Marks)
4. Sharpen the image using unsharp masking with K=3. (10 Marks)
5. Further sharpen the image with the Laplacian technique. (5 Marks)
6. Smooth the image with a Gaussian filter. (5 Marks)

Save each processed image with a corresponding filename (e.g., "Step1.jpg").

### 3 Bit-Plane Manipulation

#### Question 3-A

Write MATLAB code to manipulate the "Galaxy.png" image through bit plane extraction and enhancement techniques:

1. Extract and save all 8 bit planes individually. (3 Marks)
2. Use the three most significant bit planes (5th, 6th, and 7th) to reconstruct the image. Here is the reconstruction formula:  $2^0 \times \text{Bit\_Plane } 0 + 2^1 \times \text{Bit\_Plane } 1 + \dots + 2^7 \times \text{Bit\_Plane } 7$ . (10 Marks)
3. Enhance edges with the Sobel operator. (4 Marks)
4. Reduce noise with a median filter. (4 Marks)
5. Apply gamma correction using the best gamma parameter for this specific case. (4 Marks)

**Note for both programming questions:** For each step, save the processed image with a corresponding filename (e.g., "Step1.jpg", "Step2.jpg", Step 2.2.jpg etc.). Each subsequent step should use the image from the previous step.

#### Question 3-B

Find and list all the bit planes of the following 4x4 image: (10 Marks)

4	12	15	1
14	0	9	2
3	7	8	13
1	0	10	11