

# Digital Image Processing (ELL715)

## Assignment-1

1. Image denoted as  $f(x, y)$ , is transformed to image  $g(x, y)$ .  $g(x, y)$  is 3 times larger along y-axis and 2 times larger along x-axis than  $f(x, y)$ . Also  $g(x, y)$  is at 6 units horizontal and 7 units vertical distance from  $f(x, y)$ .  
Write a code to do this. Show  $f(x, y)$  and  $g(x, y)$ .  
Compute  $h(x, y)$ , third image, by rotating pixels of image 2,  $g(x, y)$  by  $75^\circ$  degrees counter clockwise.  
Write a code to do this. Show  $f(x, y)$ ,  $g(x, y)$  and  $h(x, y)$ .  
Make your code generic enough so that you can do these transformations with any given values or images.
2. Take an 8-bit gray scale image and perform the following operations using MATLAB,
  - a.  $-ve$  of the image, log and antilog of the image.
  - b. Apply Gamma correction for gamma = 0.4, 2.5, 10, 25 and 100.
  - c. 2, 3, 4 power of image.
  - d. Plot Bit-planes of image (show all the 8-plane images).
  - e. Plot the histogram of original image and apply Histogram equalization and plot the resulted image.
  - f. Apply a transformation that highlights range [120,200] but preserves all other levels.
3. Use the test images.
  - a. Create a function to calculate the histogram and then implement histogram equalization on the test image without using inbuilt MATLAB functions.
  - b. Use the built-in function on the same image and compare with the histogram from step 1. Check mean squared error of both matrices.
  - c. Apply adaptive histogram equalization (CLAHE) and compare with other mapped images.
    - Subplot the original image with the other 3 mapped images.
    - Plot the 3 histograms as well, keeping the axes same on each figure.
    - Mention the MSE from 2.
4. Design image filters to get better understanding and presentation of filtering.
  - a. Design images using `identify_filter`, `blur_filter`, `large_blur_filter`, `sobel_filter`, `laplacian_filter`, and `high_pass_filter`.
  - b. Use these filters to make high-frequency and low-frequency images.
  - c. Can you construct the hybrid image by combining the filtered high-frequency and low-frequency images?
  - d. Experiment with your own image and your loved pet's image.

Note : Filtering is being done with zero padding pad the boundaries with zero values. The padding width is determined by the filter's size. So that operations are smooth.(I forgot this in class)

General instructions:

1. The assignment has to be submitted in the pre-made groups.
2. Plagiarism would be heavily penalized.
3. All codes should be properly commented.
4. MATLAB users need to submit a pdf by using the run live script functionality of MATLAB.
5. Python users must use Jupiter notebook and submit the pdf report generated using the same.
6. A report not submitted using points 4/5 will not be evaluated.
7. Use 4 or 5 test images from 'C:\Program Files\MATLAB\R2023a\toolbox\images\imdata', as applicable to the questions. The images can be called directly using MATLAB commands, and if used on some other platform, it should be saved as a matrix in .csv (using MTALAB) to maintain the intensity levels.