

# EE 512/CS 653 - Digital Image Processing

## Assignment 1

Issued on: Sept. 28, 2020

Marks: 100

### Submission Instructions:

- Due date is **Thursday, 8<sup>th</sup> October** by 7:00 p.m. Submission is to be made on LMS. No late submissions allowed.
- If a question requires programming, then make sure a separate *\*.m* file is present for each question. *Eg.* Q2.m, Q3.m and so on.
- All processed images should be saved as JPEG or PNG and submitted.
- A **written report** is mandatory. This should contain your solutions for any written or mathematical questions as well as discussions of results or processed images.
- The assignment has to be done individually. Plagiarism policy applies.

### Questions:

1. Derive the relationship between *bits/pixel* and SNR and use peak-to-RMS for Signal-to-noise ratio. Assume noise of a uniform PDF.
2. For this problem use the images '*lums\_g.pgm*' and '*yahya\_g.pgm*'. For both images do the following:
  - a. Quantize both images uniformly to 8 representative levels. Evaluate the mean squared error between original and quantized. Submit both original and quantized images.
  - b. Generate random noise uniformly distributed over  $[-J, J]$ , where  $d$  is the step size for quantization in the previous part, and add this noise to the original images. Now quantize these 'dithered' images uniformly to 8 representative levels. Evaluate the mean squared error between dithered and quantized. Submit both dithered and quantized images.
  - c. In which case, part (a) or (b) did you get higher MSE? Similarly, in which case, did you observe subjectively better image quality? Explain your answers briefly, covering the following points:
    - i. Would it make sense to dither certain types of images? If so, then which types?
    - ii. What are the implications in the perspective of compression?
    - iii. Is MSE a good measure of image quality?
  - d. Repeat the above parts for 4 gray levels and 16 gray levels and comment on your observations.
3. For this problem use '*w.pgm*' use MATLAB to demonstrate the phenomenon of aliasing by repeatedly decimating the image without filtering. Mention how many times to decimate.