CS474/674 Image Processing and Interpretation
# Fall 2024 – Dr. George Bebis
Programming Assignment 1
Due Date: 9/30/2024 @ 11:59pm

1. [25%] Image Sampling

Write a program to change the spatial resolution from 256 x 256 to 128 x 128, 64 x 64, and 32 x 32 pixels using sub-sampling by a factor of 2, 4, and 8 correspondingly. For comparison purposes, resize the sub-sampled images back to the original size 256 x 256 (as shown in the lecture). Show your results using the "**lenna**" and "**peppers**" images from the image gallery. The example below shows how to sub-sample and resize an image assuming a factor of 2. Use the same idea for factors 4 and 8.
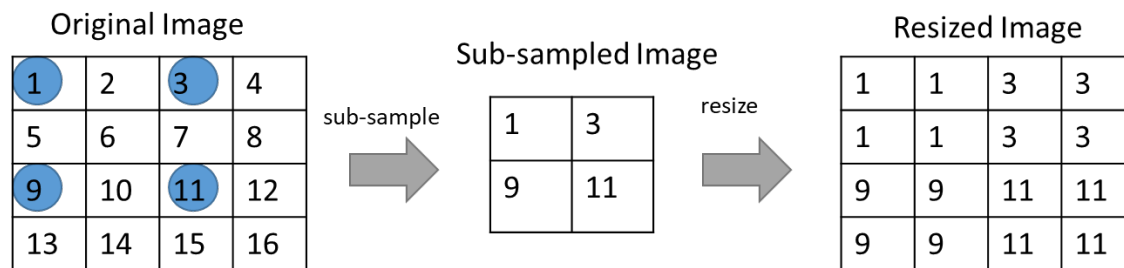
2. [25%] Image Quantization

Write a program to reduce the number of gray levels L in a PGM image from L=256 to: (i) L=128, (ii) L=32, (iii) L=8, and (iv) L=2. Show your results using the "**lenna**" and "**peppers**" images. For comparison purposes, subsample the gray-levels to better visualize the quantized images (e.g., if L=128, you can use 0, 2, 4, …, 254 with Q=255 in the PGM file instead of 0, 1, 2, …, 127 with Q=127; similarly, if L=2, you can use 0, 127 with Q=255 instead of 0, 1 with Q=1).

3. [50%] Histogram Equalization

(a) Implement the histogram equalization technique. Debug your algorithm using a "test" image (e.g., 5 x 5) to make sure that it works correctly.

(b) Perform histogram equalization on the "**boat**" and "**f_16**" images

(c) Show all histograms before and after equalization and discuss your results.

4. [20% extra credit] Histogram Specification

(a) Implement the histogram specification technique. Debug your algorithm using a "test" image (e.g., 5 x 5) to make sure that it works correctly.

(b) Perform histogram specification on "**boat**" and "**f_16**" images. Assume that the specified histogram for the "**boat**" image is the histogram of the "**sf**" image and that the specified histogram for the "**f_16**" image is the histogram of the "**peppers**" image.

(c) Show all histograms before and after specification and discuss your results.

Laboratory Write-up

For each programming assignment, you are to turn in a report by closely following the instructions posted on the course's website. **The report is very important in determining your grade for the programming assignment.** Be well organized, type your reports, and include captions with a brief description for all the figures an tables included in your report.