CMPEN/EE455: Digital Image Processing I
Fall 2017
Project #1

assigned: 22 August 2017
due: Friday 8 September 2017
—report should be deposited in CANVAS Project #1 Drop Box by 5PM.

reading assignment:
1. G&W Ch. 2.1-2.5
2. MATLAB documents under **Project Material** on CANVAS

Lab Introduction and Digital Image Quantization

This project counts **50%** of a regular project.

It introduces you to project requirements and to MATLAB's capabilities for digital image processing. Its main technical task is to consider the effects of spatial and gray-scale resolution changes on a digital image.

To acquaint you with MATLAB for our course, the following files appear under **Project Material** on CANVAS:

- Introductory MATLAB documents:
  `MATLABprimer.pdf`, `G-W-Matlab-Ch2.pdf`, and `MATLAB Introduction for CMPEN/EE455`
- Sample MATLAB *.m files:
  `main.m`, `mean3x3.m`, and `zero.m` plus input image `lake.gif`

  These files follow the coding and image-processing conventions I want you to use for the projects.
- Our Images database in archive `Images.zip`

For the 512×512 digital image "walkbridge.tif" in our **Images** database, do the following:

1. Write a MATLAB program to change (downsample) the spatial resolution to 256×256, 128×128, and 32×32 pixels. Save these three images as 512×512 images. To do this, you will replicate pixels (upsample) to reach the desired size; i.e., perform nearest-neighbor interpolation. (Do not change the gray-scale resolution.)

   Note that you must write MATLAB code that explicitly scans through the 2D array of an image in the x and y directions, per the example `main.m` file.

   WARNING: It is forbidden to use MATLAB functions that perform complete 2D array processing in one command during our course!

2. Create an interpolated 512×512 image from your 32×32 image of part 1 (*before* you upsampled it to 512×512!) using either bilinear, bicubic, or inverse-distance interpolation, as discussed in G&W Sect. 2.4 and the **Project Material** document "Proj1-Interpolation.pdf."

3. Write a program to change the gray-level quantization of the original 512×512 image by reducing the number of bits per pixel from 8 to 7, 6, 5, 4, 3, 2 and 1 bits/pixel. Save these 7 new images. Be sure that the available gray levels span the 8-bit range in the new images! For example, for the 7 bits/pixel case, the image pixels should use the 128 gray levels 0, 2, 4, 6, ... 254.

4. Make a 512×512 image that: (i) changes the spatial resolution to 256×256 pixels and (ii) gray-scale resolution to 6 bits/pixel. Does this image depict obviously perciptible artifacts relative to your original high-resolution image?

5. Write a project report using the given project report template. All methods should be described, in addition to the structure of your code. All results should be presented and discussed.

   Per the project protocol, also upload all Matlab files with your submitted report.