BMI/CS 567 Medical Image Analysis
University of Wisconsin-Madison
Assignment #3

Instructor: Jeanette Mumford
Due April 4, 2019 *before* 2:30PM

For this assignment you should turn in a single pdf file containing your code and output requested.

(1) (5 points) For this problem you will do the second additional task associated with Practical Lesson 7.6.2. Specifically, using the nearest neighbor interpolation example that we went over in class (in the book-related file: `NNInterpolation_7.m`), which applied a rotation image transformation with Nearest Neighbor interpolation, adapt it to instead use a bilinear interpolation. Plot the nearest neighbor result along with the bilinear interpolation result, side-by-side.

(2) (5 points) This problem is similar to part of the first additional exercise for Practical Lesson 9.9.2. You may not use any built in MATLAB functions for computing histograms, entropy or mutual information. Note, we went through the code for this practical lesson in class. Compute and display entropy for each image (the CT and T1), which was defined in class as

$$H = \sum_i p_i log\left(\frac{1}{p_i}\right).$$

Be sure to leave out any probabilities of 0 in the computation, since this will give you a `Nan` or `inf` result. Use the natural log, which is simply `log` in MATLAB. Next, for angles between -90 to 100 (in increments of 10, as we did in class) compute the joint entropy, which was defined in class as

$$H(CT, T1) = \sum_{i,j} p_{i,j} log\left(\frac{1}{p_{i,j}}\right),$$

were CT and $T1$ refer to the CT and T1 images used and p_{ij} are the probabilities in the joint histogram. *Be sure you use the probabilities in your calculation.* Change the figure heading of each joint histogram to show the joint entropy value as well as the normalized mutual information,

$$\frac{H(CT) + H(T1)}{H(CT, T1)}.$$

You may need to use the newline command (`\n`) and `%.4g` in your `sprintf` command to make the figure headings readable.