

ELEC 408 – Fall 2017 Assignment 3

Due: Monday Nov. 27, 2017, 8:00 pm

This assignment is to be done individually. Submit a single pdf document to the dropbox on onQ.

References:

1. Matlab – Getting Started with Image Processing Toolbox (from mathworks.com/help/)
2. M. NessAiver. Simply physics – home of MRI physics put simply: <http://www.simplyphysics.com/>
3. A.D. Elster. Questions and answers in MRI – <http://mriquestions.com/index.html>

Question 1

Two CT scan images are posted in onQ: CTImage1.jpeg and CTImage2.jpg (obtained from <https://emedicine.medscape.com/article/358090-overview>). Both are cross sectional CT scans of the lungs of patients with cancer that has spread to the lung tissue – CTImage1 is from a patient with malignant melanoma, and CTImage2 is from a patient with thyroid cancer.

Go to the Matlab tutorial “Getting Started with Image Processing Toolbox” and select “Basic image import, processing, and export” and do the following:

- i. Read the two images into the workspace; for each image, you should see that the size of the matlab variable which has the image encoding information is $1200 \times 1432 \times 3$ or $1200 \times 1412 \times 3$. Extract a single slice from each image matrix (to get a 2D matrix of dimensions 1200×1432 or 1200×1412). For each image, reduce the image size to $\frac{1}{4}$ of the original size. Plot the resized images; show the resized images beside the original jpeg images and discuss whether you see any differences in the images.
- ii. For each resized image, get the image histogram and perform histogram equalization. Plot the original histograms, equalized histograms and equalized images. Compare the equalized images to the original images – are the images improved or degraded by equalization?
- iii. Calculate the mean absolute difference between the original (resized) images and the equalized images. Give the values for the two images; do the values support your discussion of the effects of equalization on the two images?

Question 2

There are four basic types of NMR signals listed below. Depending on your student number (as indicated below), write a paragraph (approximately $\frac{1}{2}$ page of text) describing the assigned signal. You may use diagrams; if you copy a diagram from a web-page, you must indicate the source.

- a. free induction decay (FID) – student numbers 4379137-10090790
- b. gradient echo (GRE) – student numbers 10091051-10101817
- c. spin echo (SE) and Hahn echo (HE) – student numbers 10105113- 10139186
- d. stimulated echo – student numbers – 10139888-20077636