Medical Image Manipulation

Motivation

Medical images play an important role in medical diagnosis. The quality of the image determines to a great extent the ability of the medical doctors to detect and classify abnormalities within the human body. In this project, we will study the traits of medical images and experiment with several manipulation methods practically used to make such images more useful for different applications. Also, we will investigate different metrics that describe image quality quantitatively.

Research Tasks Involved

A. Reconstruct MRI image from its k-space data using 2DIFT.
B. Study the importance of both magnitude and phase components of the k-space on the resultant image.
C. Study of the effect of quantization on the diagnostic information within a medical image.
D. Study the effect of sampling and bandwidth in k-space and their relationships with the resolution and field-of-view (FOV) size in the image.
E. Study of windowing of CT images and their practical application in medical diagnosis.
F. Investigate interpolation methodologies for image resizing.
G. Design a methodology to extract a region-of-interest (ROI) from an image.
H. Design a methodology to perform simple filters on an image.
I. Implement a methodology to measure the image quality quantitatively.

Design Input

- Raw data (k-space data) for an MRI image with matlab code to read it.
- Sample reconstructed medical images (CT, ultrasound, and mammography images).

Design Output

- A lab notebook (preferably in Microsoft OneNote® format) with all the experiments done to address each of research tasks listed above including documented Matlab code for each.

References

[1] Roger Bourne, *Fundamentals of Digital Imaging in Medicine*, Springer-Verlag, London, 2010.

[2] ImageJ, Image Processing and Analysis in Java, Web: http://imagej.nih.gov/ij/.

[3] Christos P. Loizou and Constantinos S. Pattichis, *Despeckle Filtering Algorithms and Software for Ultrasound Imaging*, Morgan & Claypool Publishers, 2008.