BME 493/593 Final Project

The goal of this project is to reconstruct X-ray computed tomography (CT) images from an experimental data set.

The imaging model will correspond to a discrete two-dimensional Radon transform.

In the course shared folder, the following items have been provided:

1. Matlab codes for computing the action of the discrete forward operator and its associated adjoint
2. The experimental data set (i.e., the sinogram)
3. A 'high quality' reference image
4. A README.txt file to provide details regarding these items

The following studies should be performed:

1. *Reconstruction by use of all available tomographic views (540):*
    a. Design an optimization problem that includes a regularization strategy
    b. Provide pseudocode for the algorithm that you will use to solve the problem. Describe how all parameters will be initialized and describe the stopping rule
    c. Implement the algorithm (or use one of the algorithm you already implemented, if appropriate).
    d. Display the reconstructed image that is closest to the reference image in terms of mean squared error (MSE).
        i. Extract the central row of the image and plot the values. Do the same for the reference image and display the two plots on the same figure.
        ii. Describe how you determined the regularization parameter(s) and any other parameters of the algorithm.
    e. Display the reconstructed image that is closest to the reference image in subjective visual appearance. Repeat steps (i) and (ii) above.
2. *Reconstruction by use of 270 uniformly spaced tomographic views:*
    a. Repeat all steps of problem #1.
3. *Reconstruction by use of 90 uniformly spaced tomographic views:*
    a. Repeat all steps of problem #1.

Prepare a report that summarizes all of the above studies. Describe the motivation for the design(s) of the optimization problems. Compare and discuss differences between the reconstructed image MSE and rates of convergence observed in the three studies, as well as anything else of interest.