<u>Lab 1</u>

Medical Imaging

IST 2022-2023

Consider the 3D CT image stored in ct.mat, where the image intensity of each pixel (i,j,k) corresponds to the CT index, defined as $CT_{ijk} = \frac{\mu_{ijk} - \mu_{H_2O}}{\mu_{H_2O}} \times 1000$, where $\mu_{H_2O} = 0.0206mm^{-1}$ with FOV_{xyz} = 19×19×25 cm^3.

1. Display a histogram of the CT image intensities (i.e. CT indexes), and then a histogram of the corresponding attenuation coefficients, by converting CT indexes to attenuation coefficients.
2. Display 9 representative slices of the image of attenuation coefficients for each orientation - axial (x,y), sagittal (x,z) and coronal (y,z):
    a. applying rotations when appropriate;
    b. using an adequate intensity scale for tissue visualization;
    c. using an intensity scale that is matched across slices.
3. Simulate the planar X-ray image that would be obtained by projection along x, assuming that the incident X-ray beam has an intensity I_0 = 1200 photons/pixel.
    a. Compute the voxel size along each direction
    b. Write down the attenuation equation, and apply it
    c. Display the resulting projection image
4. Now simulate the planar X-ray image that would be obtained by:
    a. Projection along x but using twice the X-ray tube current intensity: what changed? (hint: look at the histograms!)
    b. Projection along y (adjust the image intensity scale in order to better visualize the internal organs).