**Lab 2**

**Medical Imaging**

**IST 2020-2021**

Consider the formation using a 1st generation scanner of a CT image of the modified Shepp-Logan phantom, which approximately models X-ray attenuation in a human head.

Note: for this lab you will need the `scikit-image` toolbox in Pyhton (`Image Processing Toolbox` in Matlab).

1. Generate the modified Shepp-Logan phantom using the function `shepp_logan_phantom`, and then using the function `rescale` to get a 256x256 dimension (`phantom` in Matlab).
2. Simulate the sinogram obtained by collecting projections covering [0;180]° in steps of 1° (using the function `radon`).
3. Simulate the associated reconstructed image using the inverse Radon transform (using the function `iradon`).
4. Repeat the simulations in 2. and 3. by covering: [0;45]°, [0;90]°, [0;180]° and [0;360]°, in steps of 1°.
5. Repeat the simulations in 2. and 3. by covering [0;180]°, in steps of 0.25, 1, 5 and 10°.
6. Repeat the simulations in 2. using the original angles, by adding noise to the projection data. For this purpose, first scale the sinogram using maximum number of counts per pixel of $10^3$ photons, and then add the appropriate type of noise using the function `random_noise` (`imnoise` in Matlab).
7. Now reconstruct the image from the noisy projection data using `iradon` (with the original filter, i.e. the Ram-Lak filter).
8. Repeat 7, by replacing the original Ram-Lak filter by modified filters (available in `iradon`), and explain the results as a function of their different frequency responses.