IPBMA. Exercise 8

CT Slice Reconstruction with BackProjection

Implement the BackProjection algorithm to reconstruct a CT slice from a sinogram stored as a NumPy matrix. The Python functions to be implemented will be called from the main program and will be: **reconstructor(), setHounsfield(), displayWL()** and will include the following parameters:

reconstructor*(Sinogram, nProj).*- function implemented to reconstruct each CT slice from the sinogram. The technique known as Back-Projection will be used for this purpose. For its implementation, it is suggested to use the rotate() method from the python Pillow package (PIL) or any other similar.

i) Sinogram → Sinogram normalized
ii) nProj → Number of projections employed for the reconstruction. Each projection is related to each line of the sinogram. When the number of projections is less than the number of lines of the sinogram, take equi-spaced lines.

Output→ Numpy array (2D), whose values represent the pixel values of the reconstructed image.

setHounsfield*(Image, eE).*- function implemented to transform the pixel values of the reconstructed image to Hounsfield units.

i) Image → Reconstructed image.
ii) eE → Effective energy of the incident radiation.

Output→ Numpy array (2D), whose values represent the pixel values of the reconstructed image in Hounsfield units.

displayWL*(Image, W, L, maxGL).*- function to simulate a W/L (window/level) display.

i) Image → Reconstructed image (HU units)
ii) W → Window size
iii) L → Level position
iv) maxGL → maximum pixel value of the display.

Output→ Numpy array (2D), whose values represent the pixel values of the displayed image.

Note.- Teams of one or two students will do this exercise. You must bring a zip file called *lastNameStudent1_ lastNameStudent2_EJ8.zip* to the CV. Inside the zip should be included:

- A jupyter notebook to show how the software works (see the example).
- The html version of the notebook execution.
- A .py file with the Python functions created.
- All the necessary files to verify the correct operation of the application.
- **The deadline will be: Wednesday, November 20, 10:00.**