Report

CS 736 – Medical Image Computing

Assignment 3 - Reconstruction

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By,

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Notes

1. The code is written in Python 3.6. The following libraries are used and hence are necessary for the code to work seamlessly:
    a. matplotlib
    b. numpy
    c. os
    d. skimage
    e. cv2
2. The range of image intensities is $[0, 1]$.
3. The results (images) are saved in "results" folder, in case, the images in the report aren't up to the desired resolution.
4. We use a polar system (t, θ) instead of Cartesian system where a point (x, y) in Cartesian grid is represented by $(x(s), y(s))$ where

$$x(s) = t \cdot \cos(\theta) - s \cdot \sin(\theta)$$

and

$$y(s) = t \cdot \sin(\theta) + s \cdot \cos(\theta)$$

where, $s \in [-\infty, \infty],\ t \in [-\infty, \infty],\ \theta \in [0, 2\pi]$

Part A

To execute part A, uncomment #193. The images used are “ChestCT.png” and “SheppLogan256.png”. We use a pseudo brute-force approach to find the optimal angle θ^*, for which reconstruction RRMSE is the minimum.

1. $\theta^* \in \Theta_{start}$
2. $\Theta_{start} = [\theta_0, \theta_{0.5}, \theta_{1.5}, \cdots, \theta_{179.5}]$.
3. $\theta_i = [i, i+1, i+2, \cdots, i+150]$.

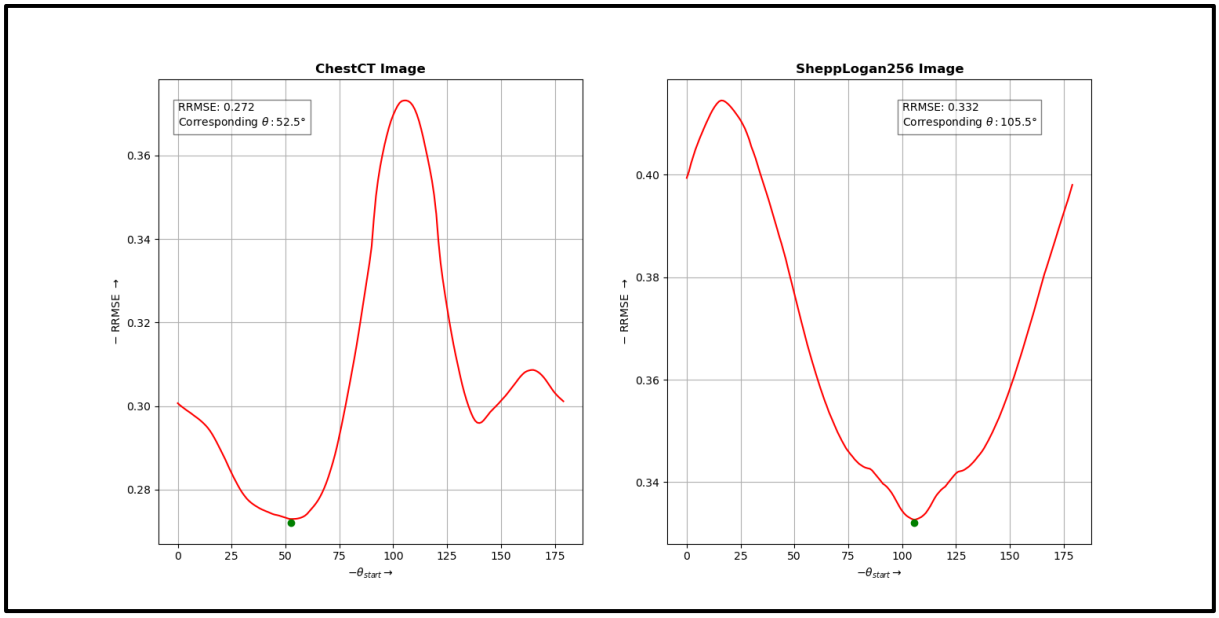
ChestCT

1. Minimum RRMSE = 0.272
2. Corresponding $\theta = 52.5°$

SheppLogan256

1. Minimum RRMSE = 0.332
2. Corresponding $\theta = 105.5°$

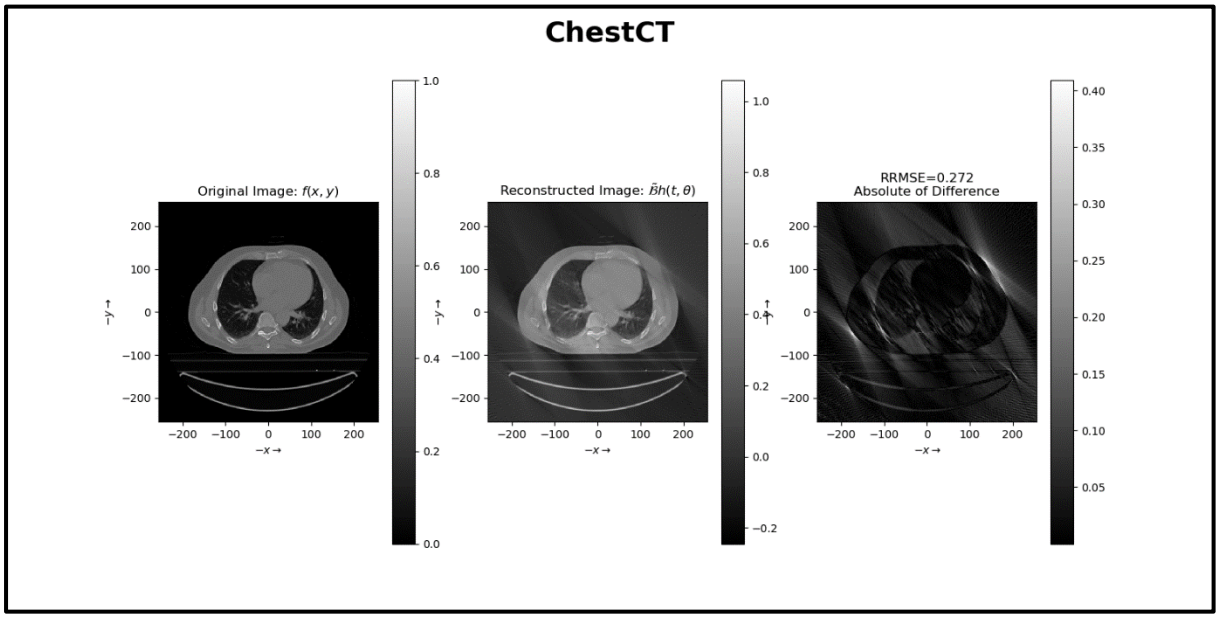
The images are saved under the name “Question 3a.png”.



Part B

ChestCT

The image is saved under the name “Question 3b (ChestCT)”.



SheppLogan256

The image is saved under the name “Question 3b (SheppLoagn256)”.