MIC Assignment 2

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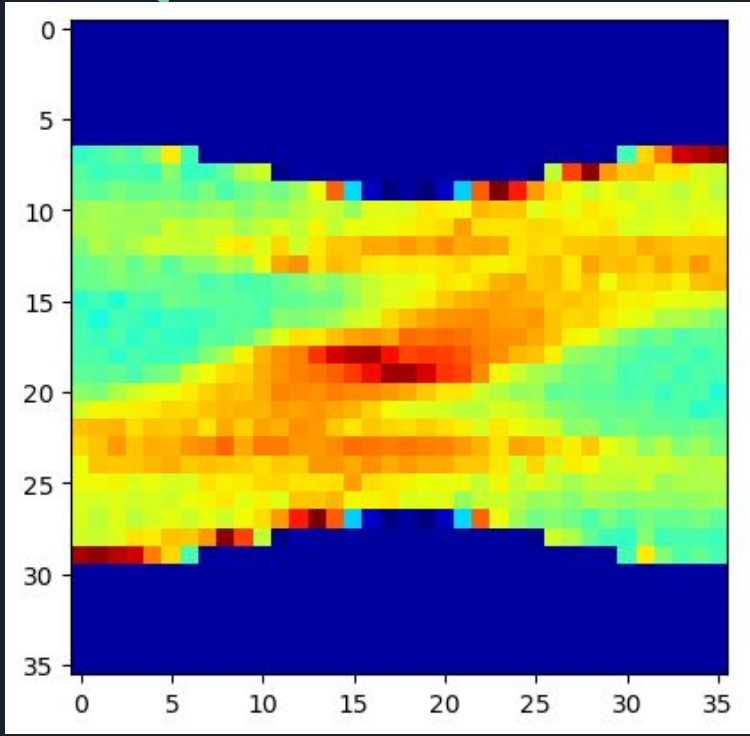
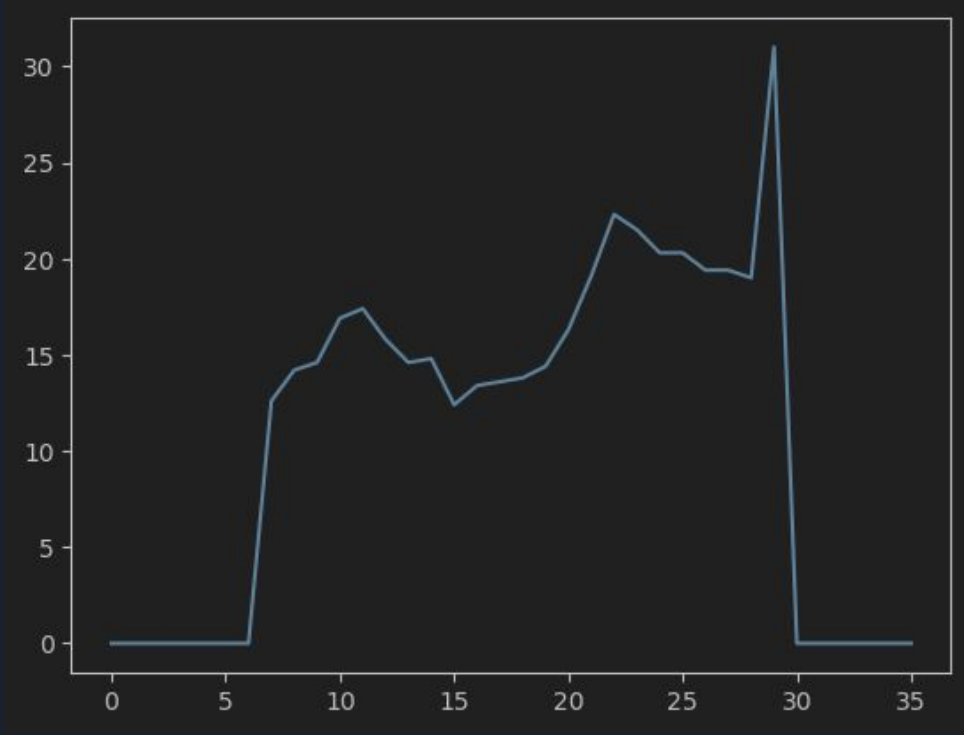
Q1) X-Ray Computed Tomography: Radon Transform

dt = 5, d_theta = 5

ds = 0.5

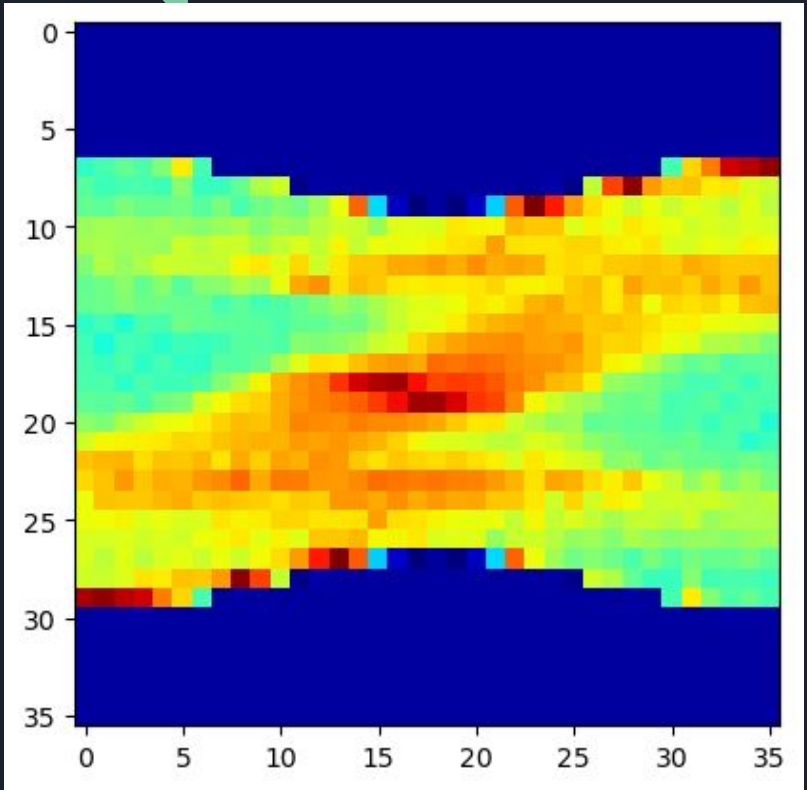


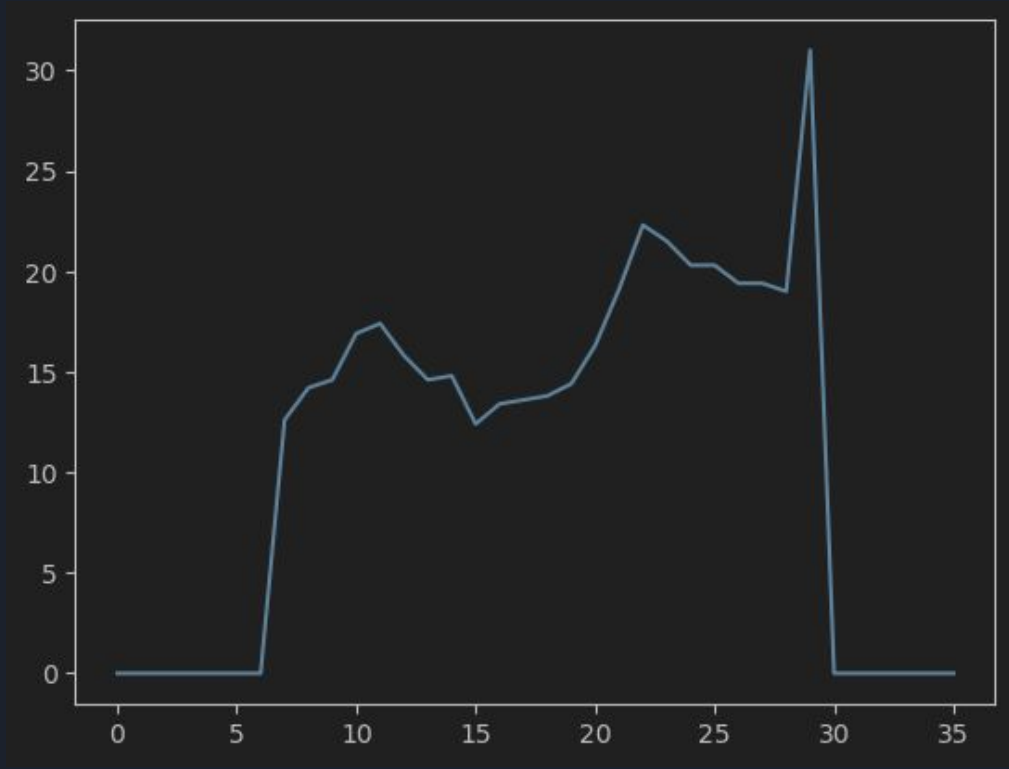


Q1) X-Ray Computed Tomography: Radon Transform

dt = 5, d_theta = 5

ds = 1

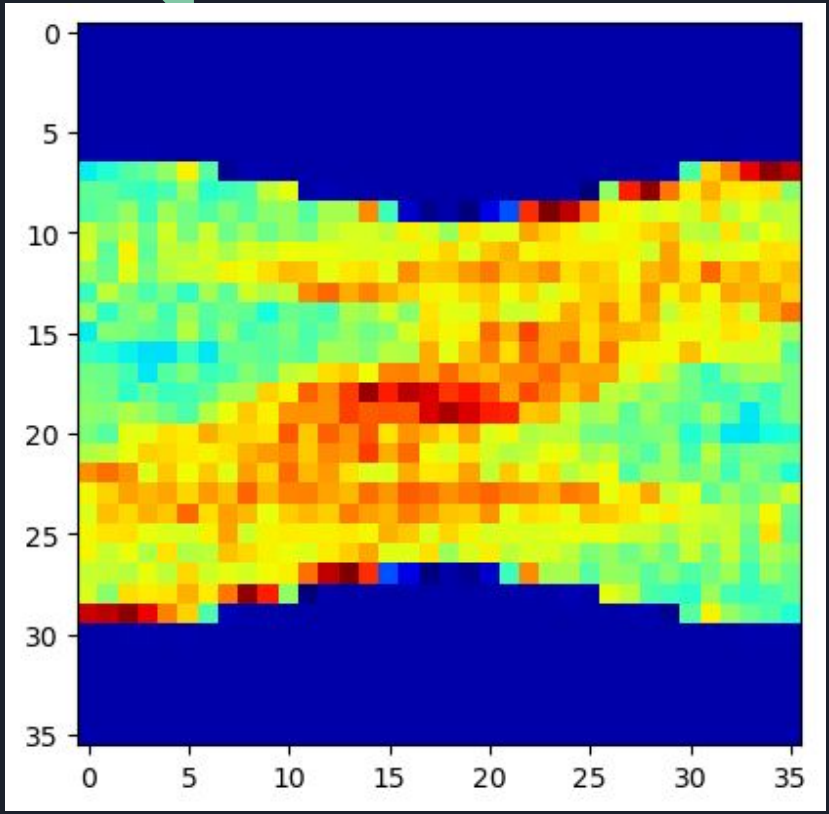


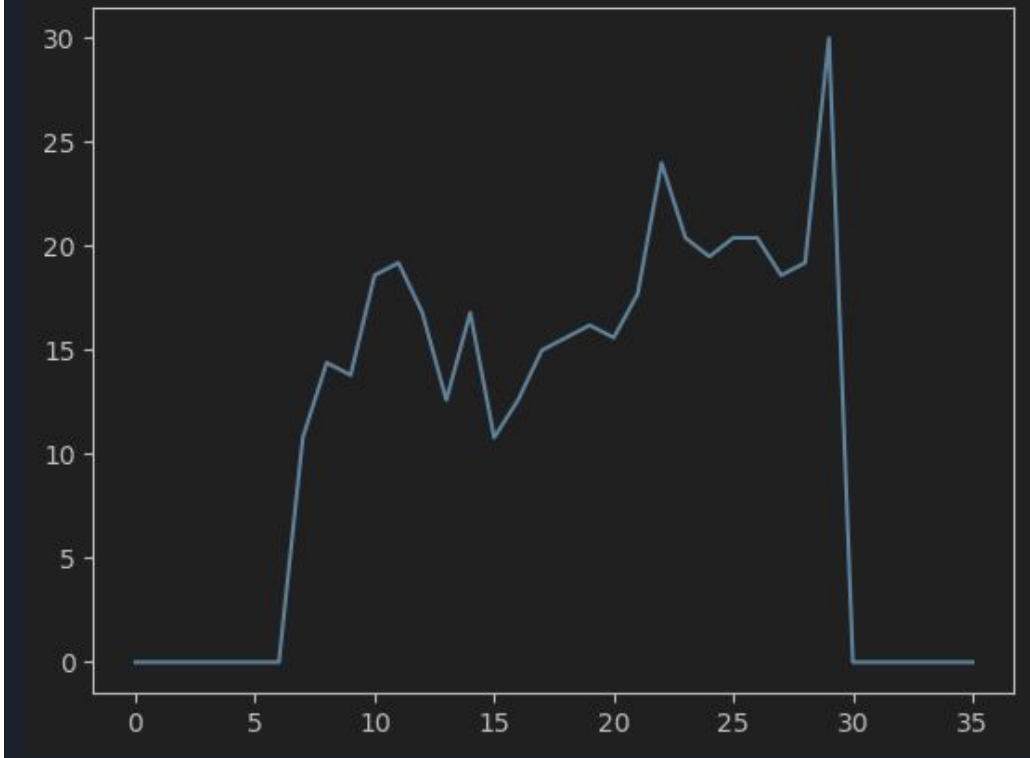


Q1) X-Ray Computed Tomography: Radon Transform

dt = 5, d_theta = 5

ds = 3

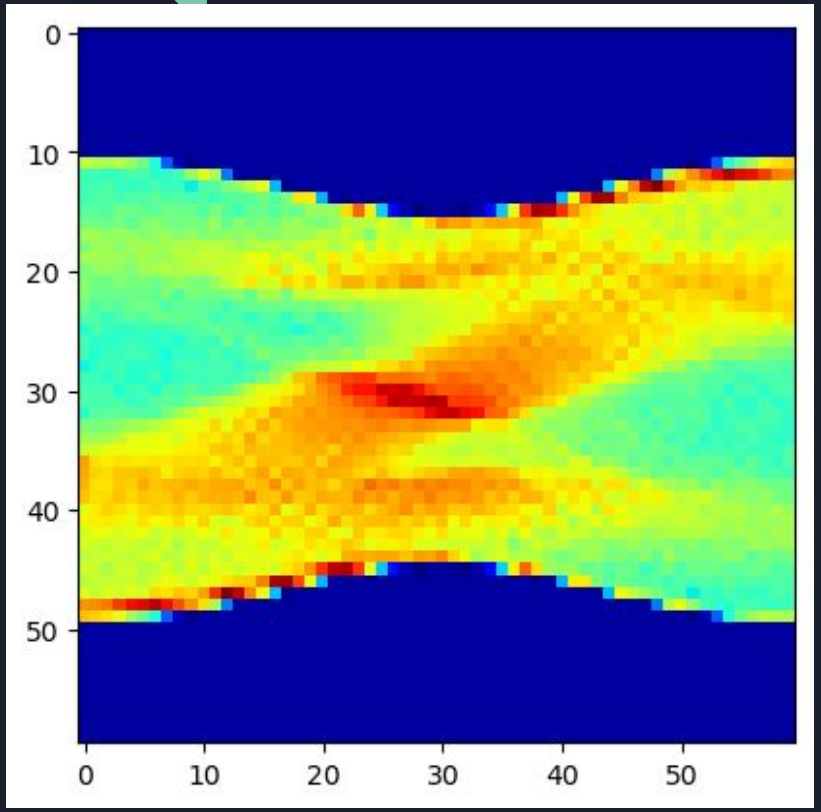


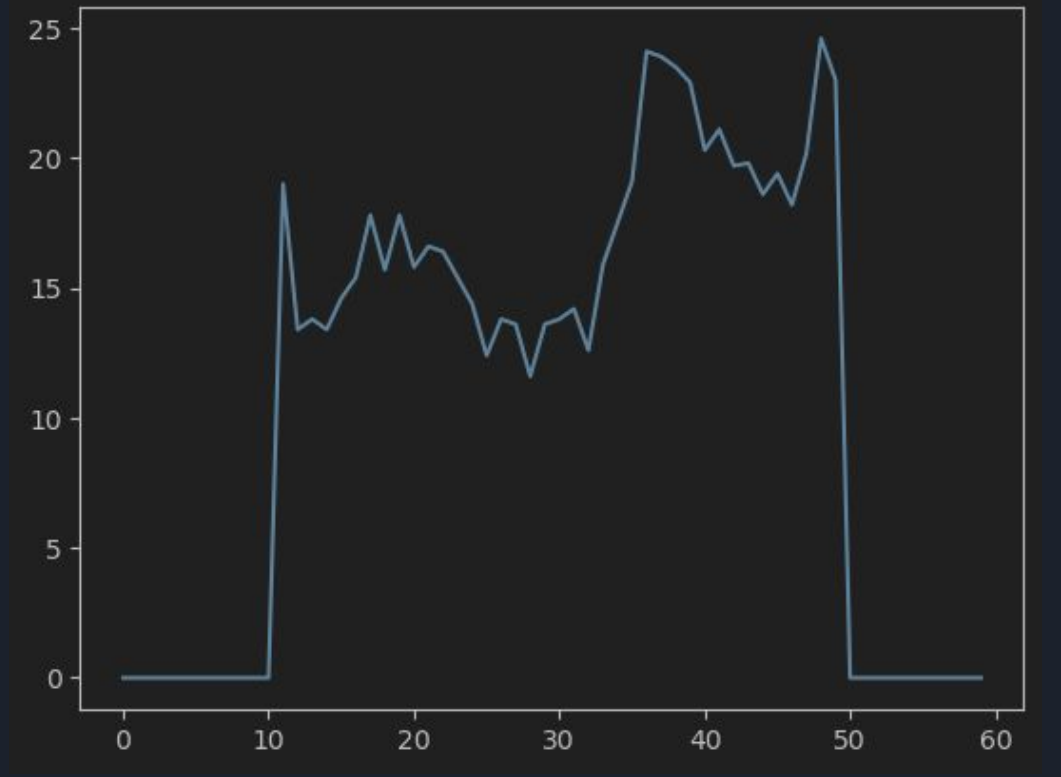


Q1) X-Ray Computed Tomography: Radon Transform

dt = 3, d_theta = 3

ds = 1



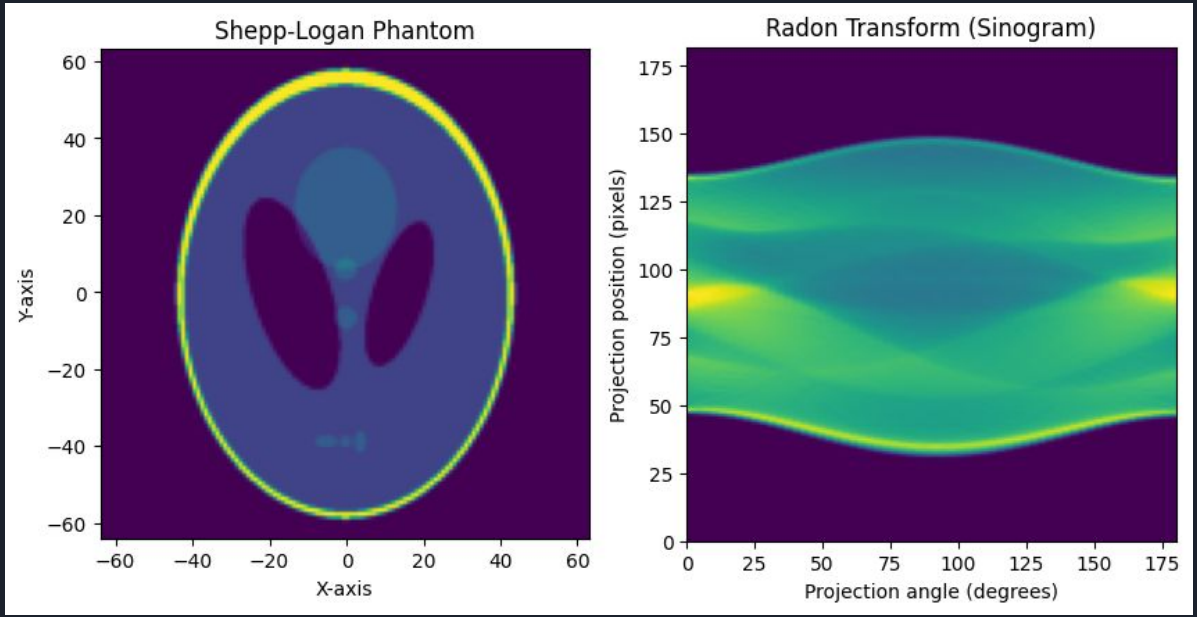


Q1) X-Ray Computed Tomography: Radon Transform

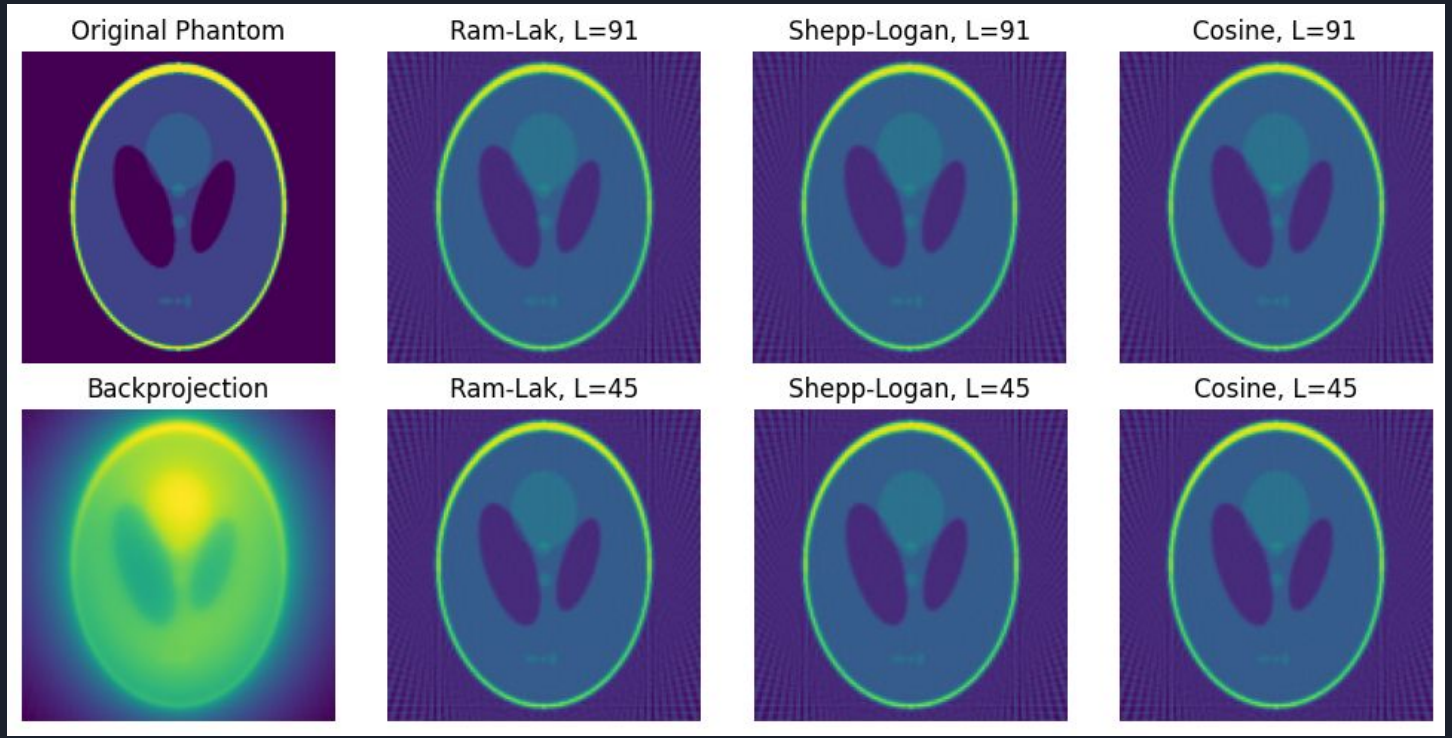
- Smaller the step size, better the accuracy -> ds = 0.5
- The image-interpolation scheme used is spline-based interpolation method because it preserves fine image details while avoiding over smoothing by fitting cubic splines and is also efficient
- Smoothest plot is when ds = 0.5 as we are sampling the most number of points and roughest when ds = 3 and we are sampling the least number of points
- For small dt and d_theta, you have higher accuracy but higher computation time and can introduce noise
- Having a moderate step size (ds = 1) ensures that sufficient detail is captured while not being too computationally heavy
- For ds >> 1 -> undersampled and you lose a lot of the features of the CT
- For ds << 1 -> computationally very heavy and gives weight to small fluctuations caused by noise

Reconstruction by Filtered Backprojection (FBP)

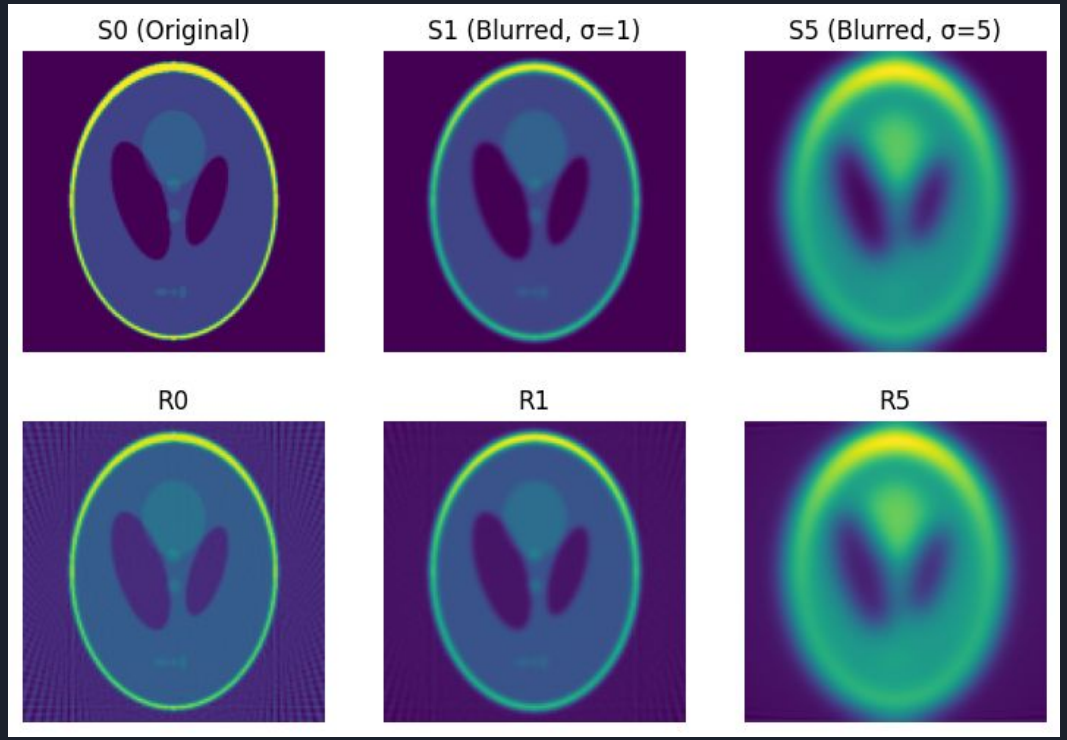
Shepp - Logan Phantom and its Radon Transform



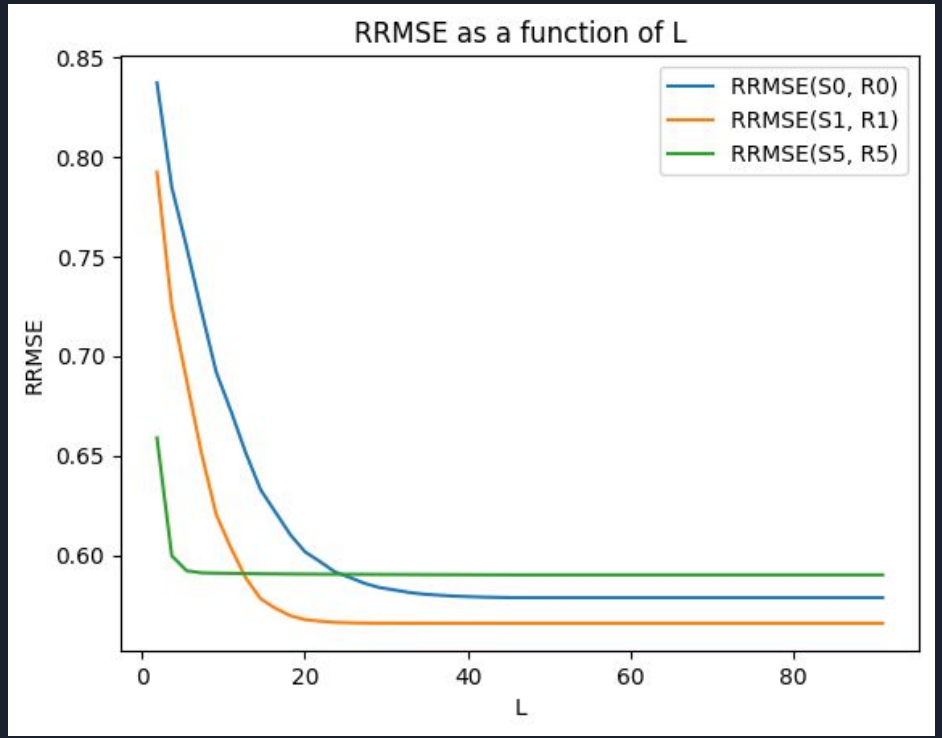
The Inverse Radon Transform with various filters



The Inverse Radon Transform with blurred images

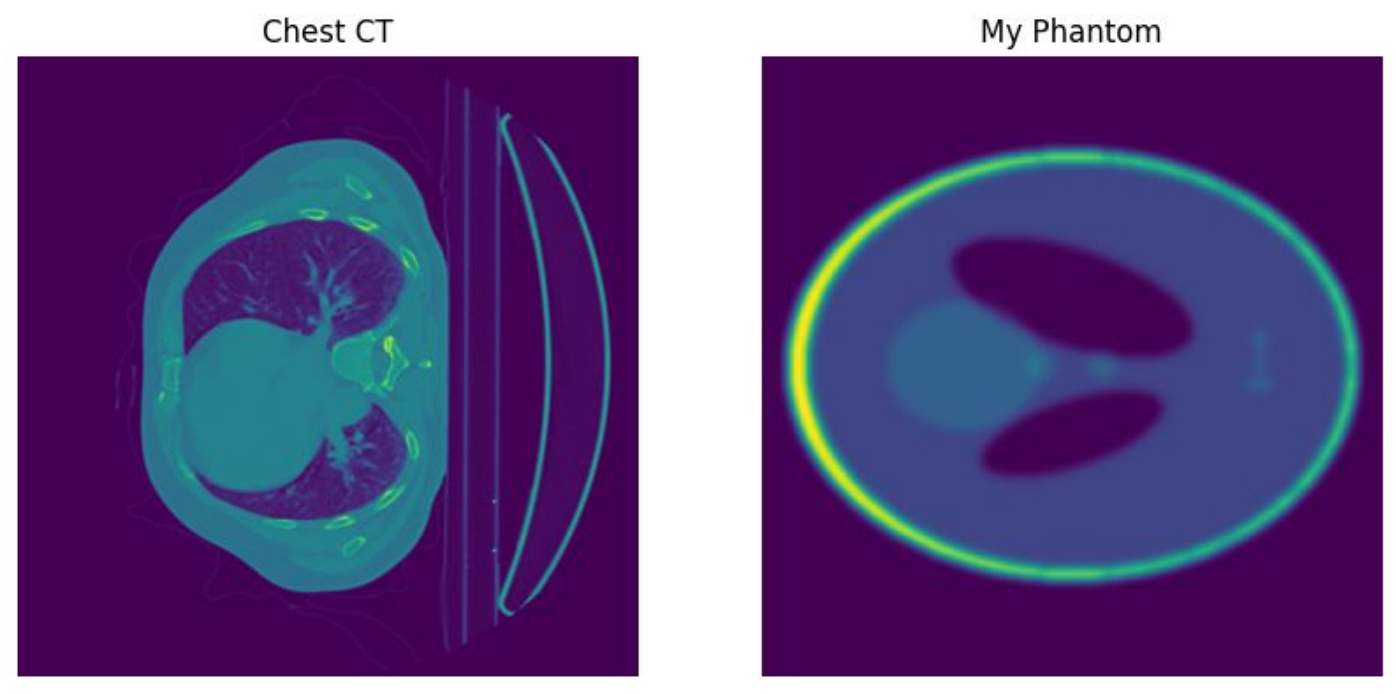


The RRMSE values v/s L graphs ($w_{max}/50$ to w_{max})

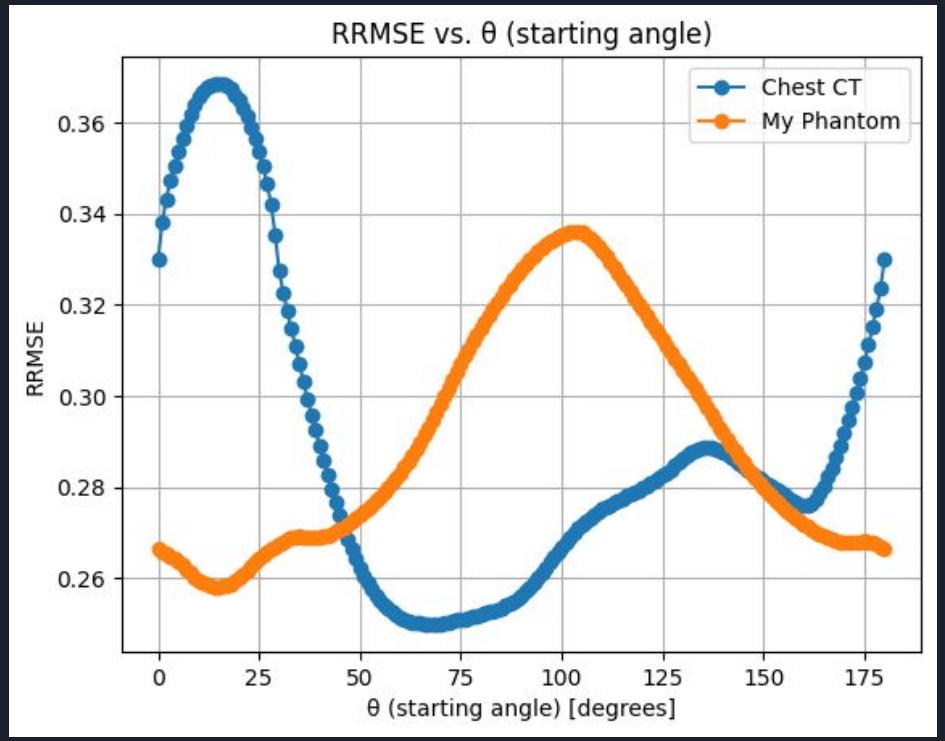


Backprojection (FBP) with Incomplete Data

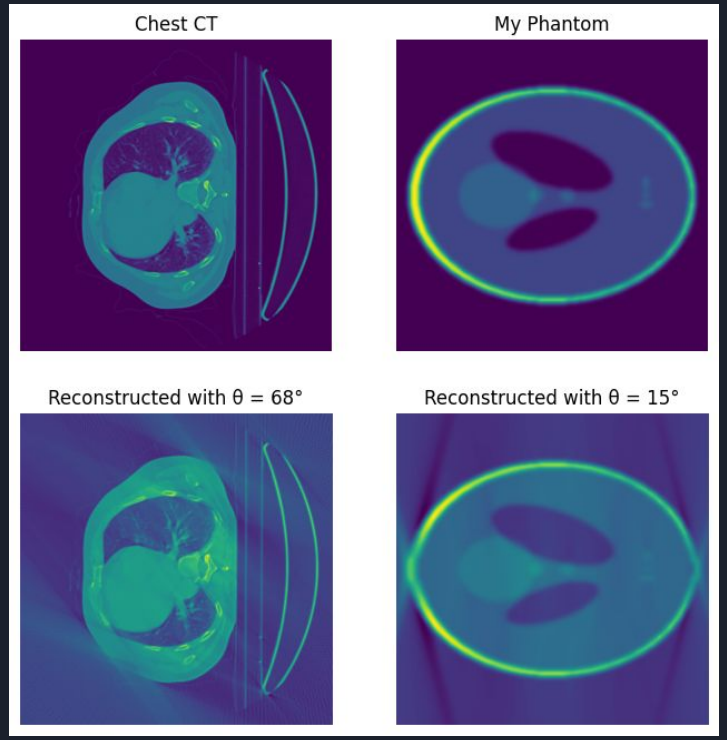
The given Images: Chest CT and My Phantom



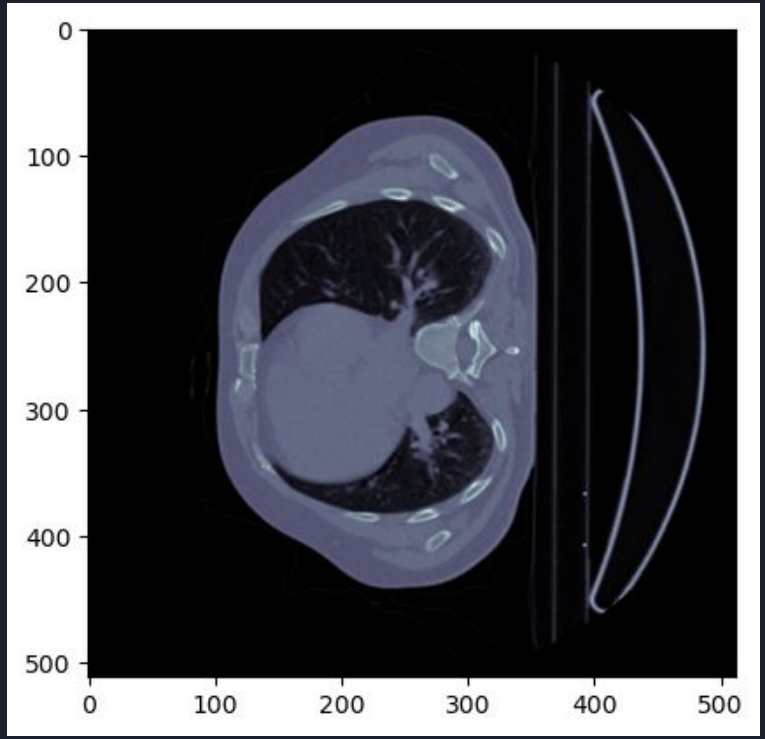
Radon Transform v/s the starting θ (θ to θ + 150°)



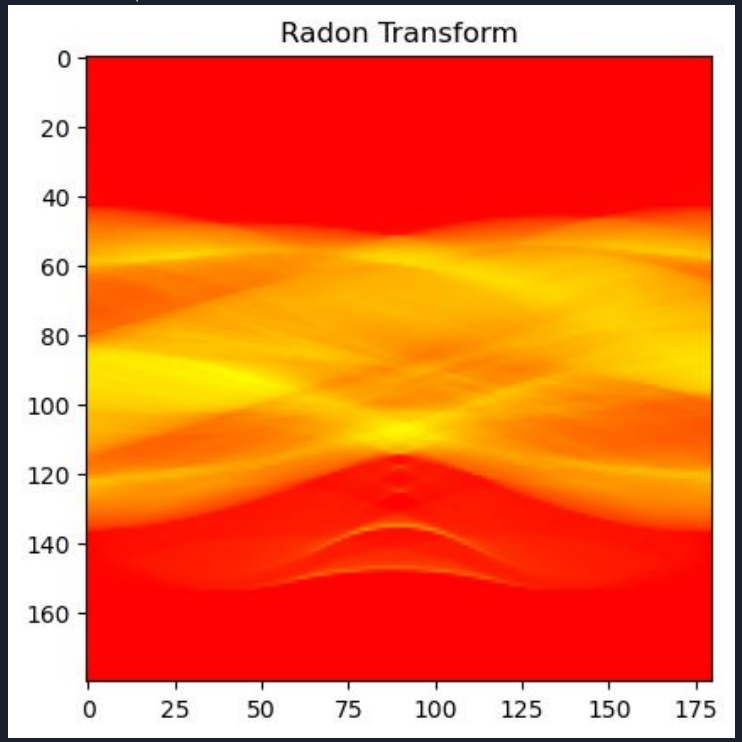
Inverse Radon Transform for the best θ

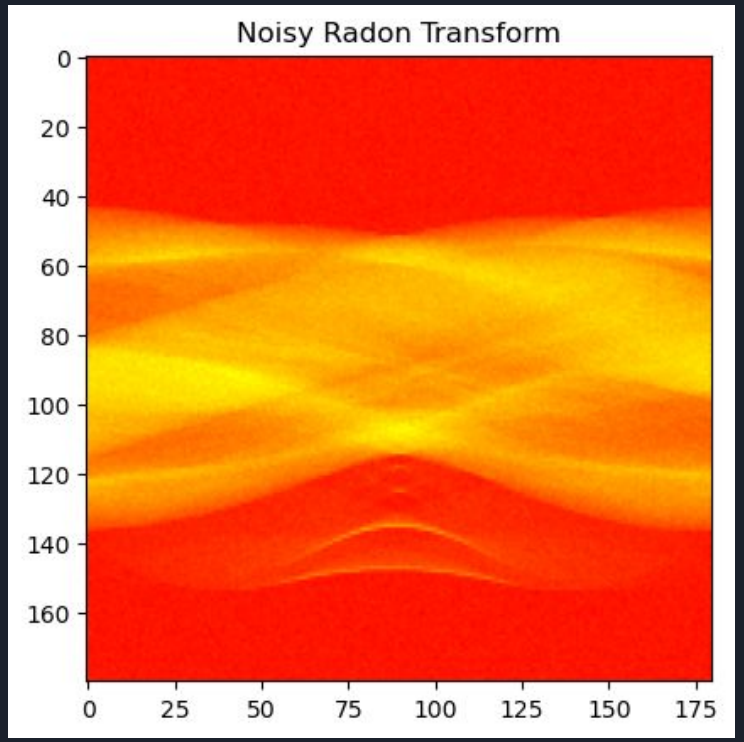


Q4) ART

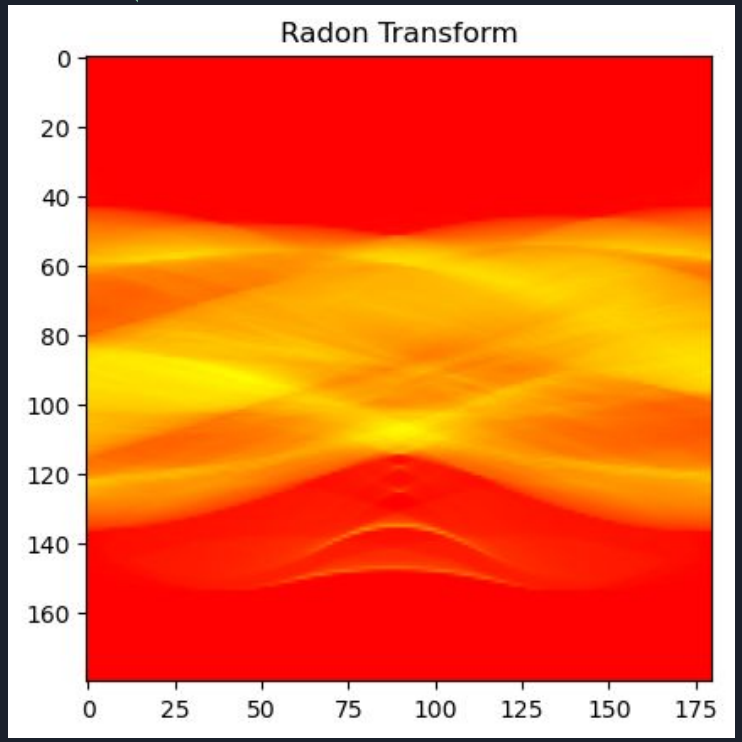


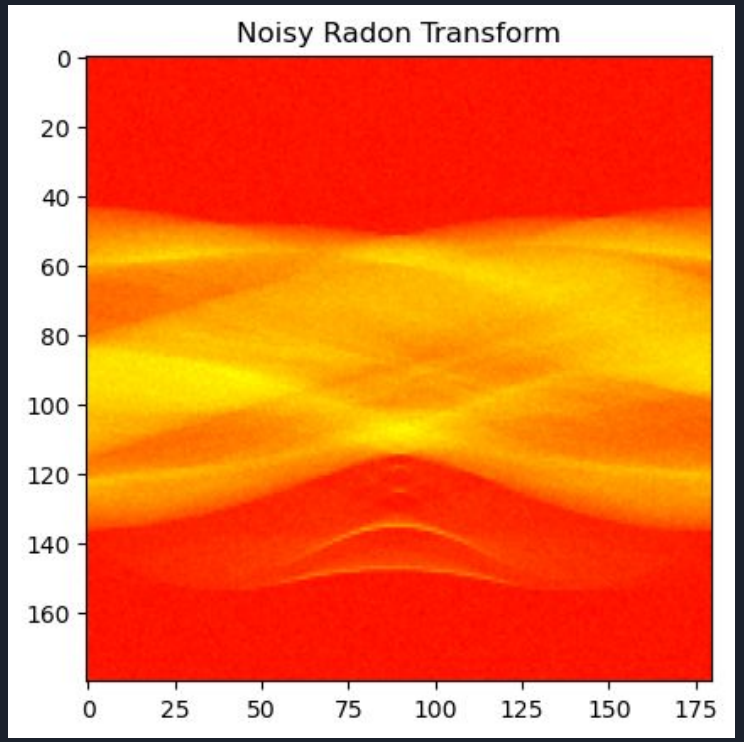
Q4) ART


Radon Transform
0
20
40
60
80
100
120
140
160
0
25
50
75
100
125
150
175

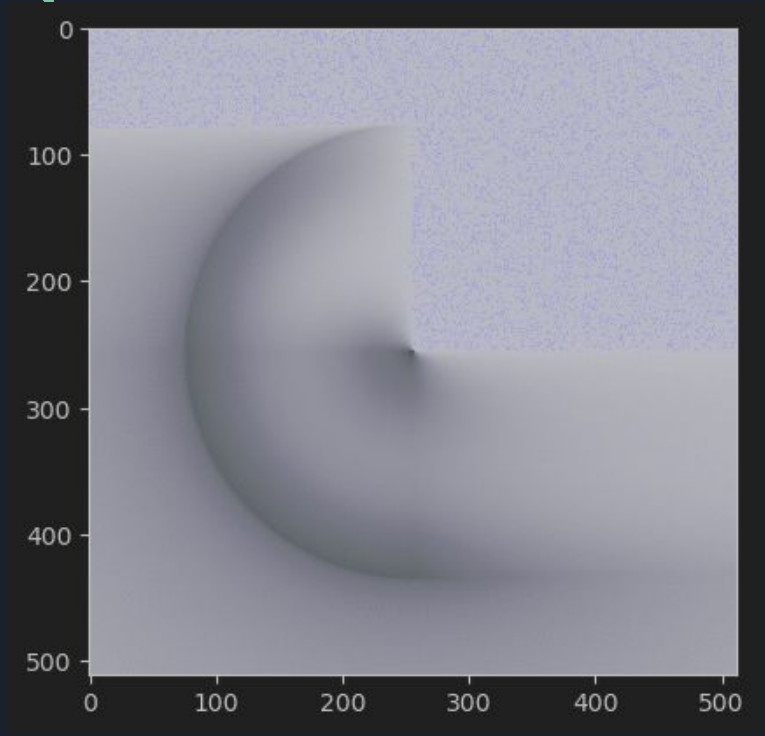

Noisy Radon Transform
0
20
40
60
80
100
120
140
160
0
25
50
75
100
125
150
175

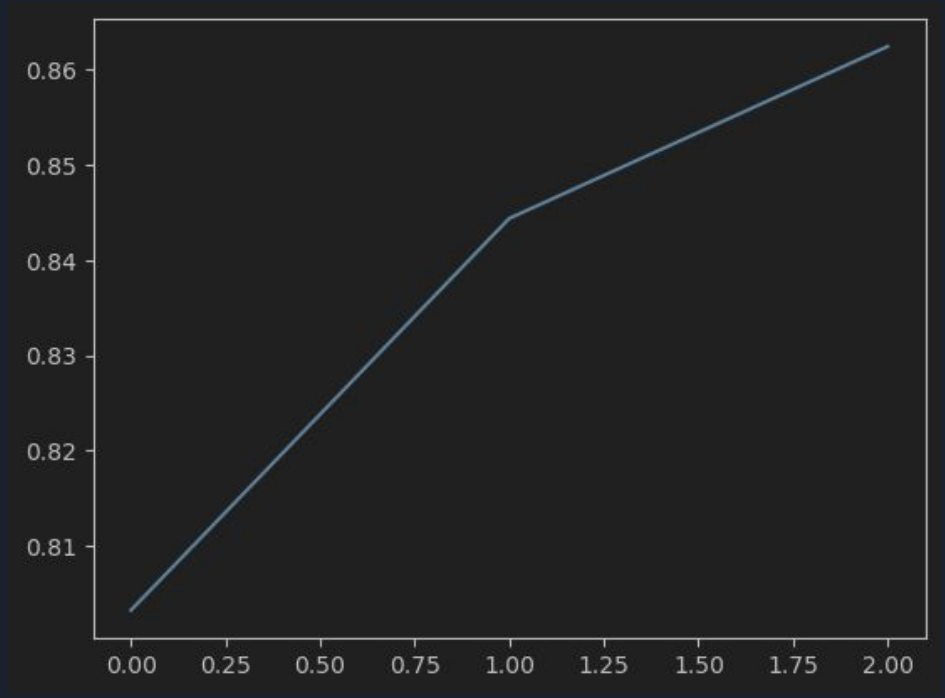
Q4) ART


Radon Transform
0
20
40
60
80
100
120
140
160
0
25
50
75
100
125
150
175


Noisy Radon Transform
0
20
40
60
80
100
120
140
160
0
25
50
75
100
125
150
175

Q4) ART


0
100
200
300
400
500
0
100
200
300
400
500


0.86
0.85
0.84
0.83
0.82
0.81
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00

Q4) ART, ds = 0.5`