CS 736

Assignment 2

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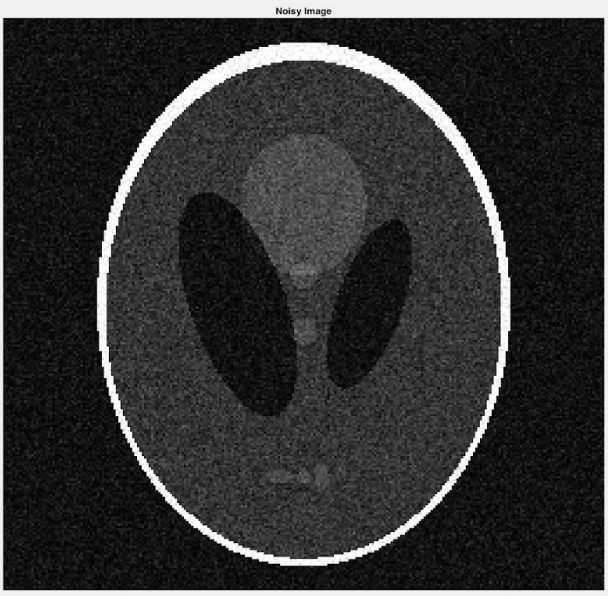
Question 1 - Denoising given Noisy Image

1) RRMSE between the Noisy and Noiseless Image = 0.2986.
2) The optimal values of the parameters and corresponding RRMSE:
    a) Quadratic Function Prior:
        i) Optimized Alpha = 0.04
        ii) Minimized RRMSE = 0.2804
        iii) RRMSE at 1.2 Alpha = 0.2813
        iv) RRMSE at 0.8 Alpha = 0.2810
    b) Huber Function Prior:
        i) Optimized Alpha = 0.98
        ii) Optimized Gamma = 0.0016
        iii) Minimized RRMSE = 0.2358
        iv) RRMSE at 1.2 Alpha = 0.2415
        v) RRMSE at 0.8 Alpha = 0.2837
        vi) RRMSE at 1.2 Gamma = 0.2359
        vii) RRMSE at 0.8 Gamma = 0.2362
    c) Third Function Prior:
        i) Optimized Alpha = 0.9900
        ii) Optimized Gamma = 0.0008
        iii) Minimized RRMSE = 0.2362
        iv) RRMSE at 1.2 Alpha = 0.2369
        v) RRMSE at 0.8 Alpha = 0.2905
        vi) RRMSE at 1.2 Gamma = 0.2363
        vii) RRMSE at 0.8 Gamma = 0.2368

3) Images:

a) Noisy Image:



b) Noiseless Image:

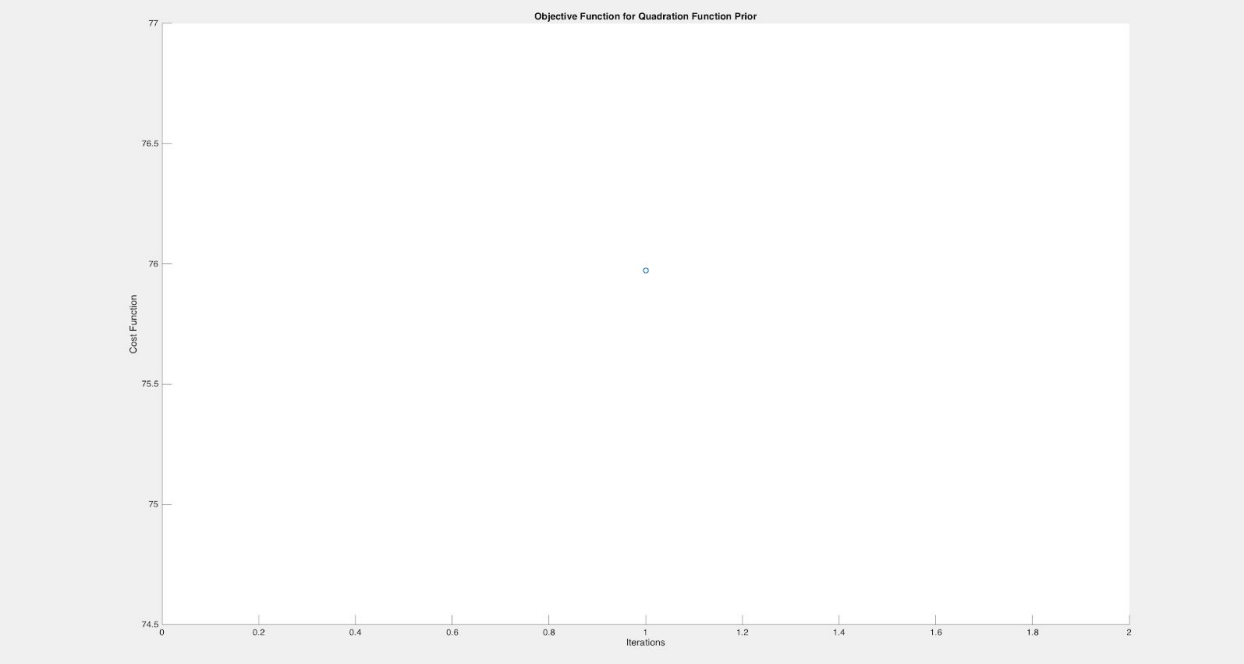
c) Quadratic Prior :

d) Huber Function Prior:

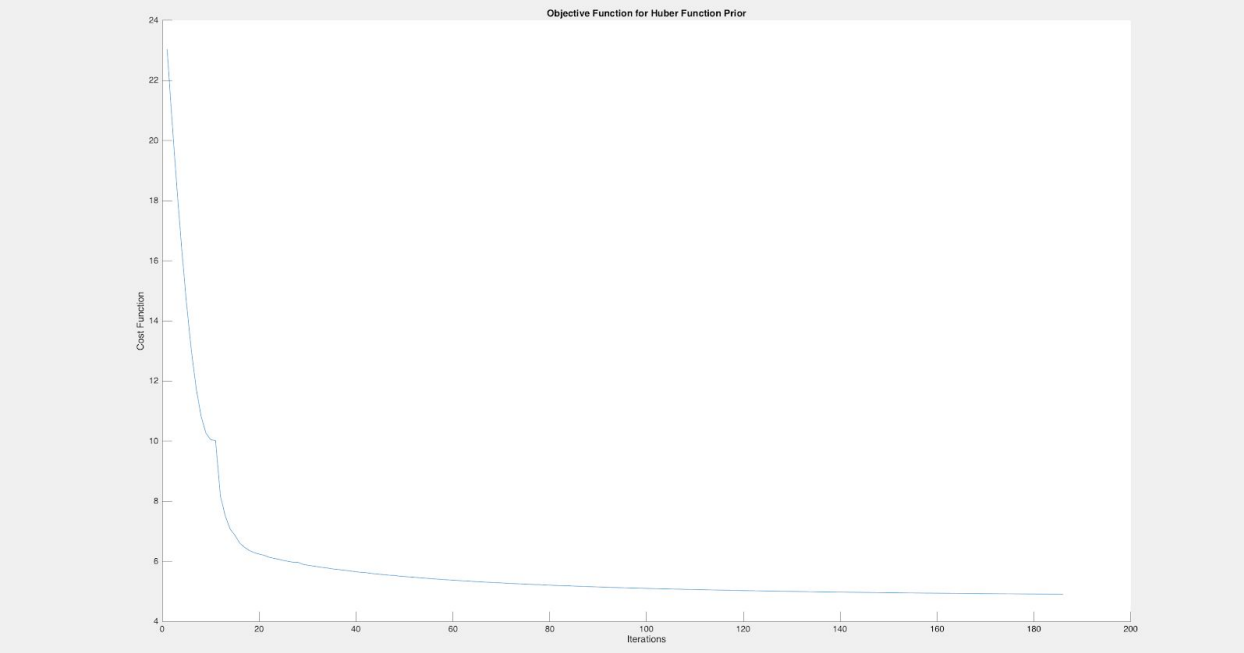
e) Prior 3:

4) Objective Function vs Iterations :

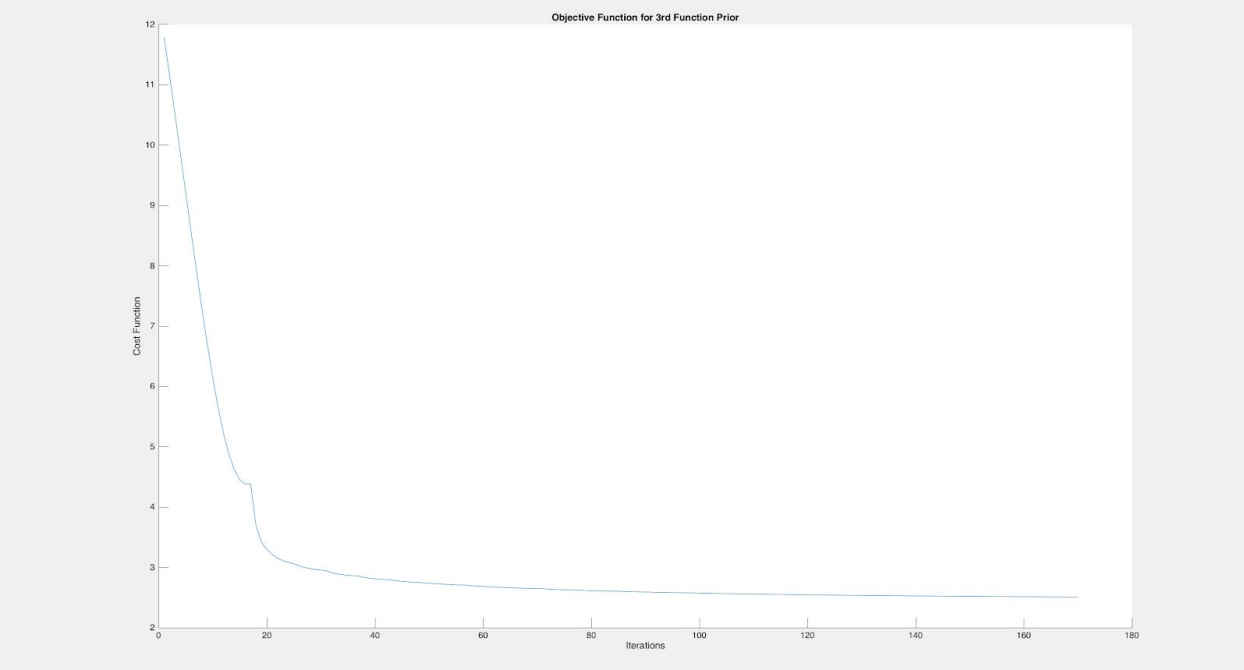
a) Quadratic Prior Objective Function: Only one iteration.



b) Huber Function Prior Objective Prior:



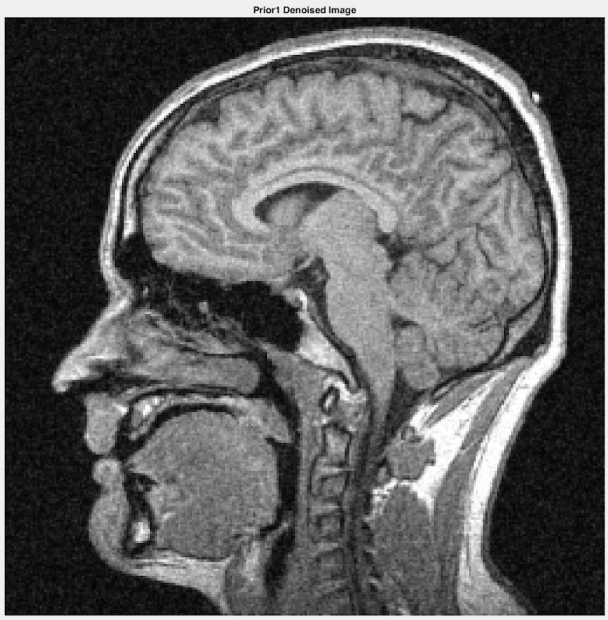
c) Prior 3 Objective Function:



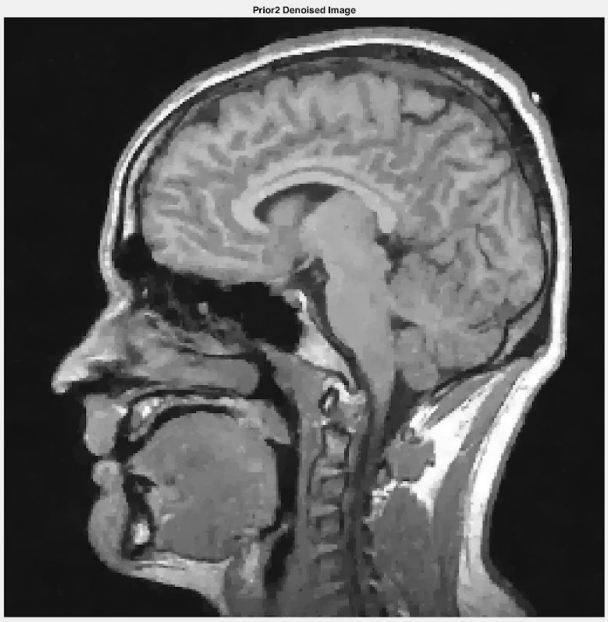
Question 2 - Denoising given Noisy Image

1) I took first 50x50 pixel portion as the background for given 256x256 image. The standard deviation of the background data is the Noise Level of the Noise added the the Image.
   Gaussian Noise Level = sigma = 0.0847
   Gaussian Noise Level 1 (Only considering real part of the data) = 0.0609
   Gaussian Noise Level 2 (Only considering Imaginary part of the data) = 0.0589
2) Images;
   a) Noisy Image:

b) Denoised Image with Quadratic Prior:



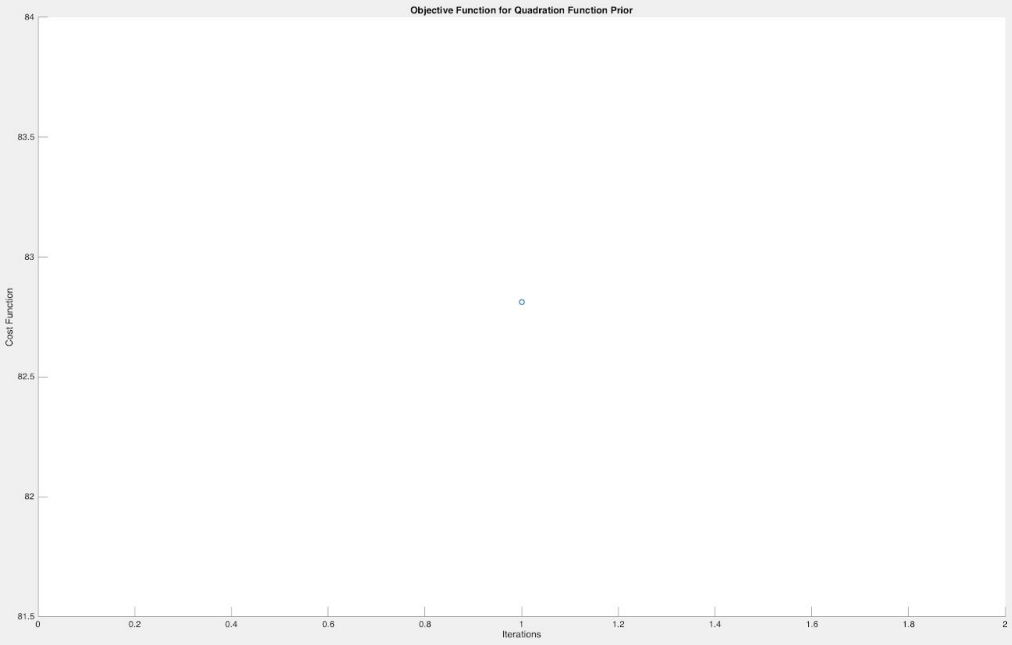
c) Denoised Image with Huber Function Prior:



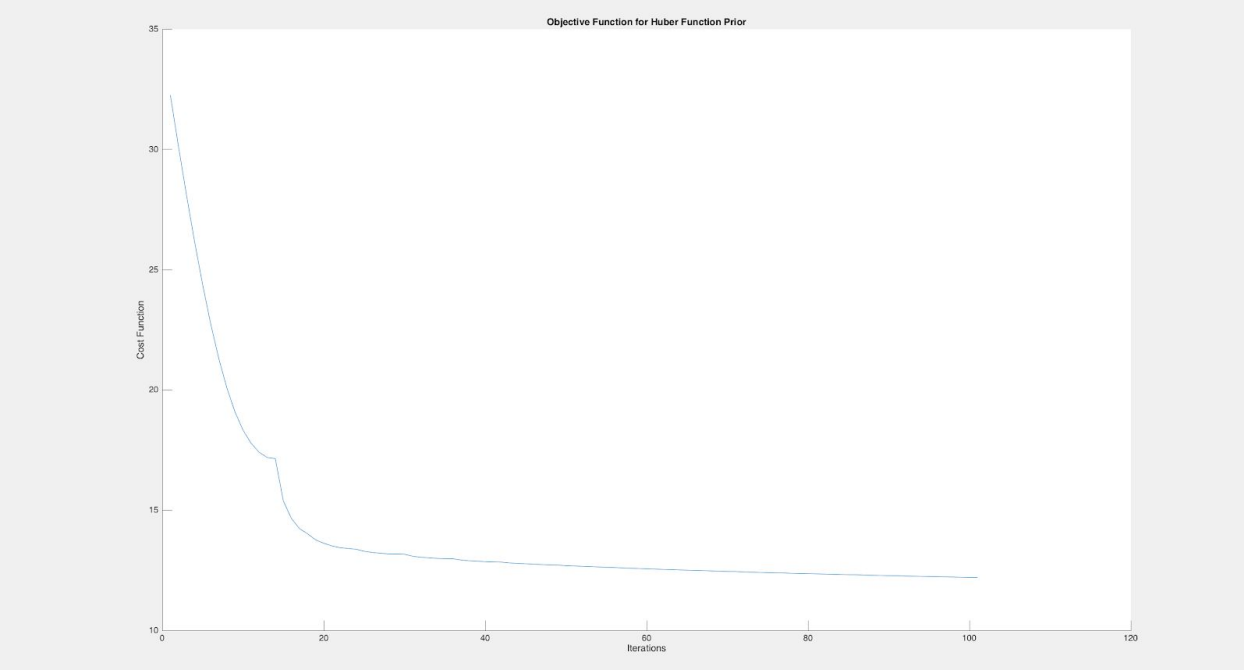
d) Denoised Image with Prior 3:

3) Objective Function Plots:

a) Cost Function with Quadratic Prior:



b) Cost Function with Huber Function Prior:



c) Cost Function with Prior 3: