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```
addpath 'mrf';
addpath 'mrf_derivatives';
addpath '../../common/';
load('../data/assignmentImageDenoisingPhantom.mat');
```

Part (a)

The RRMSE between Noisy and Noiseless image

```
error = abs(rrmse(imageNoiseless, imageNoisy));
display(error);
```

```
error =

    0.3364
```

Part (b)

```
best_alpha = 0.89;
best_gamma = 0.5;
algorithm = 1;
[estimate_algorithm_1, e, e1, e2, e3, e4, series_1] = ...
    runGradientDescents(imageNoisy, imageNoiseless, ...
    algorithm, best_alpha, best_gamma);
errors_1 = [best_alpha, best_gamma, e, e1, e2, e3, e4];

% Errors for Quadratic MRF model
% a b RRMSE(a, b) RRMSE(1.2a, b) RRMSE(0.8a, b) RRMSE(a, 1.2b) RRMSE(a, 0.8b)
display(errors_1);

best_alpha = 0.032;
best_gamma = 0.0070;
algorithm = 2;
[estimate_algorithm_2, e, e1, e2, e3, e4, series_2] = ...
    runGradientDescents(imageNoisy, imageNoiseless, ...
    algorithm, best_alpha, best_gamma);
errors_2 = [best_alpha, best_gamma, e, e1, e2, e3, e4];
```

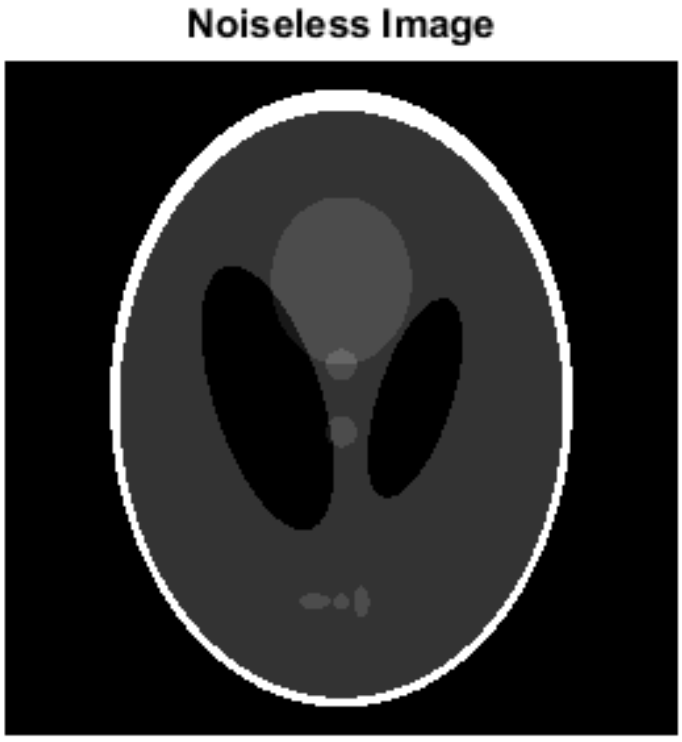
```
% Errors for Huber MRF model
% a b RRMSE(a, b) RRMSE(1.2a, b) RRMSE(0.8a, b) RRMSE(a, 1.2b) RRMSE(a, 0.8b)
display(errors_2);

best_alpha = 0.003;
best_gamma = 0.007;
algorithm = 3;
[estimate_algorithm_3, e, e1, e2, e3, e4, series_3] = ...
    runGradientDescents(imageNoisy, imageNoiseless, ...
    algorithm, best_alpha, best_gamma);
errors_3 = [best_alpha, best_gamma, e, e1, e2, e3, e4];

% Errors for Adaptive MRF model
% a b RRMSE(a, b) RRMSE(1.2a, b) RRMSE(0.8a, b) RRMSE(a, 1.2b) RRMSE(a, 0.8b)
display(errors_3);
```

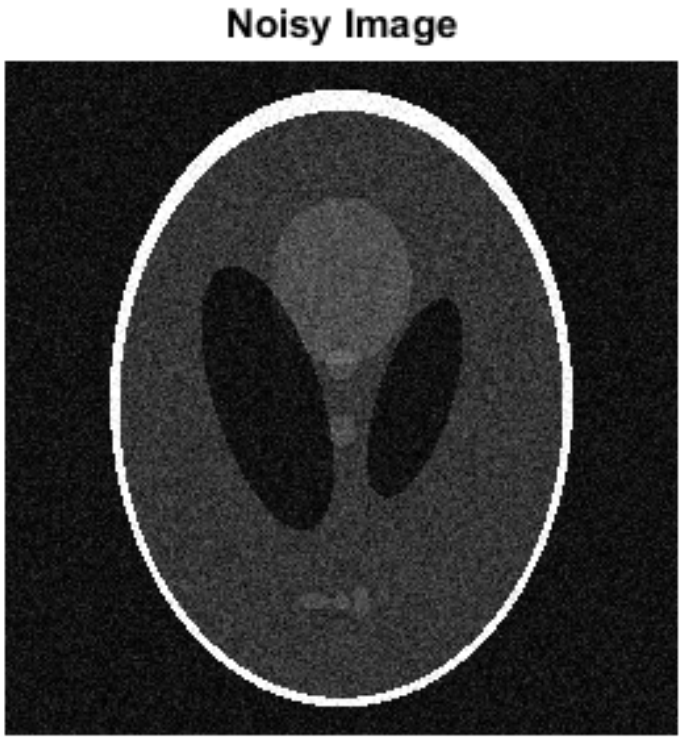
```
errors_1 =

    0.8900    0.5000    0.2285    5.3304    0.2485    0.2285    0.2285


errors_2 =

    0.0320    0.0070    0.0698    0.0700    0.0699    0.0705    0.0701


errors_3 =

    0.0030    0.0070    0.0722    0.0722    0.0722    0.0731    0.0727
```

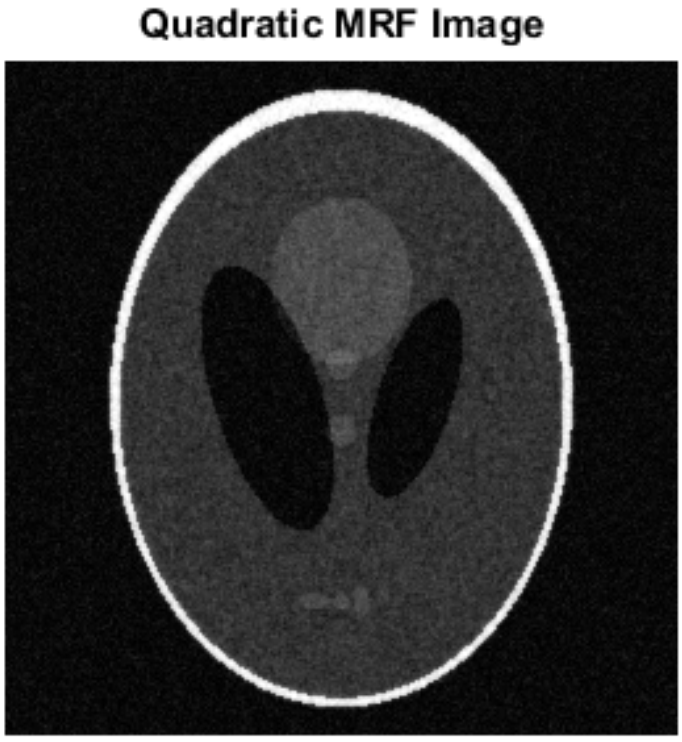
Part (c)

Noiseless

```
figure; imshow(abs(imageNoiseless)); title('Noiseless Image');
% Noisy
figure; imshow(abs(imageNoisy)); title('Noisy Image');
% Quadratic MRF
figure; imshow(abs(estimate_algorithm_1)); title('Quadratic MRF Image');
% Huber MRF
figure; imshow(abs(estimate_algorithm_2)); title('Huber MRF Image');
% Adaptive MRF
figure; imshow(abs(estimate_algorithm_3)); title('Adaptive MRF Image');
```


Noiseless Image


Noisy Image

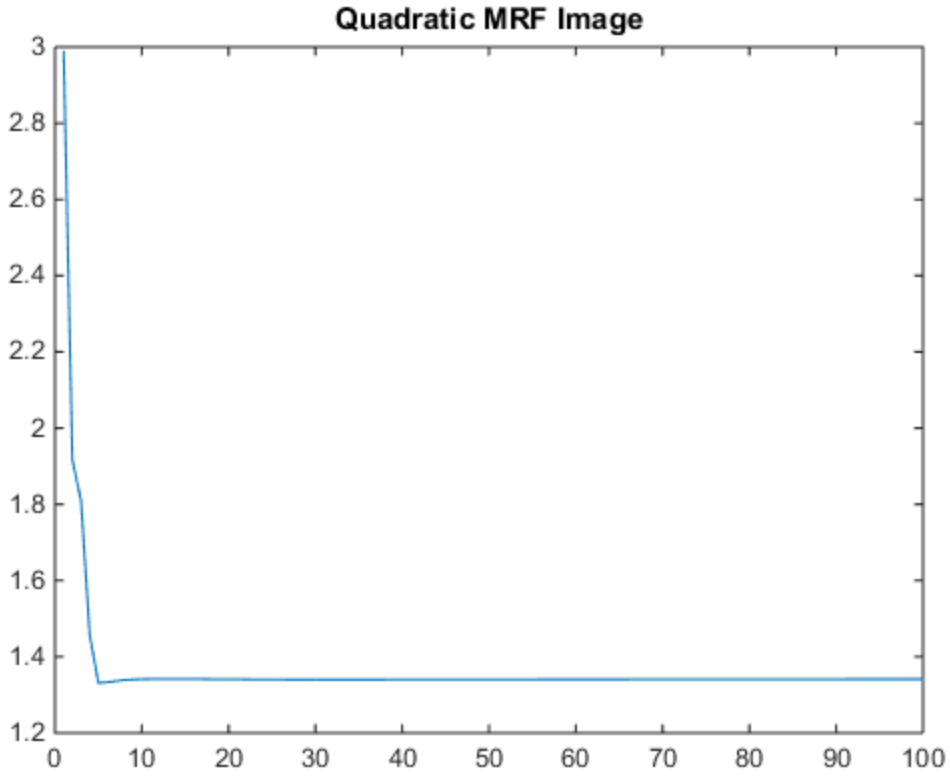

Quadratic MRF Image

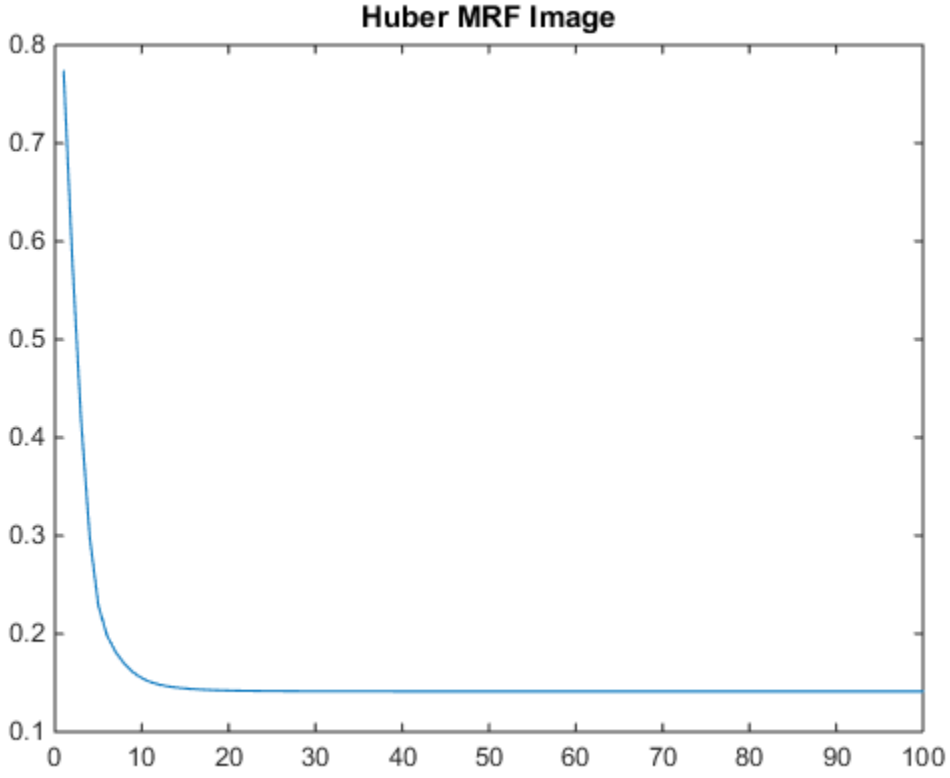

Huber MRF Image

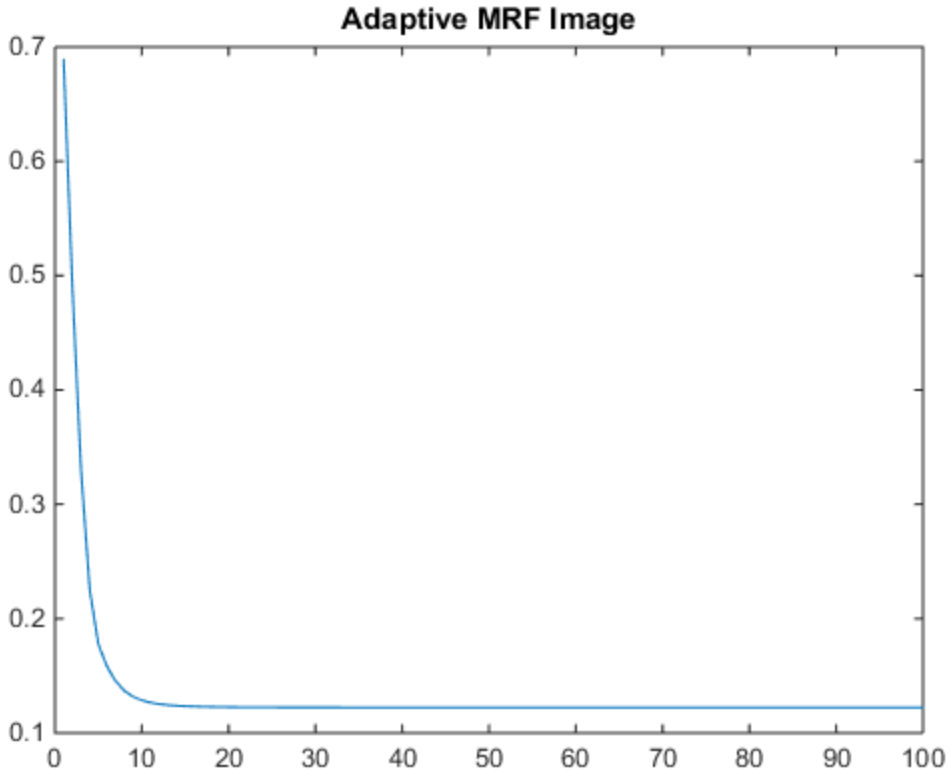
Part (d)

Quadratic MRF

```
figure; plot(1:100, series_1); title('Quadratic MRF Image');
% Huber MRF
figure; plot(1:100, series_2); title('Huber MRF Image');
% Adaptive MRF
figure; plot(1:100, series_3); title('Adaptive MRF Image');
```


Quadratic MRF Image
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
0
10
20
30
40
50
60
70
80
90
100


Huber MRF Image
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
10
20
30
40
50
60
70
80
90
100



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