Homework 6

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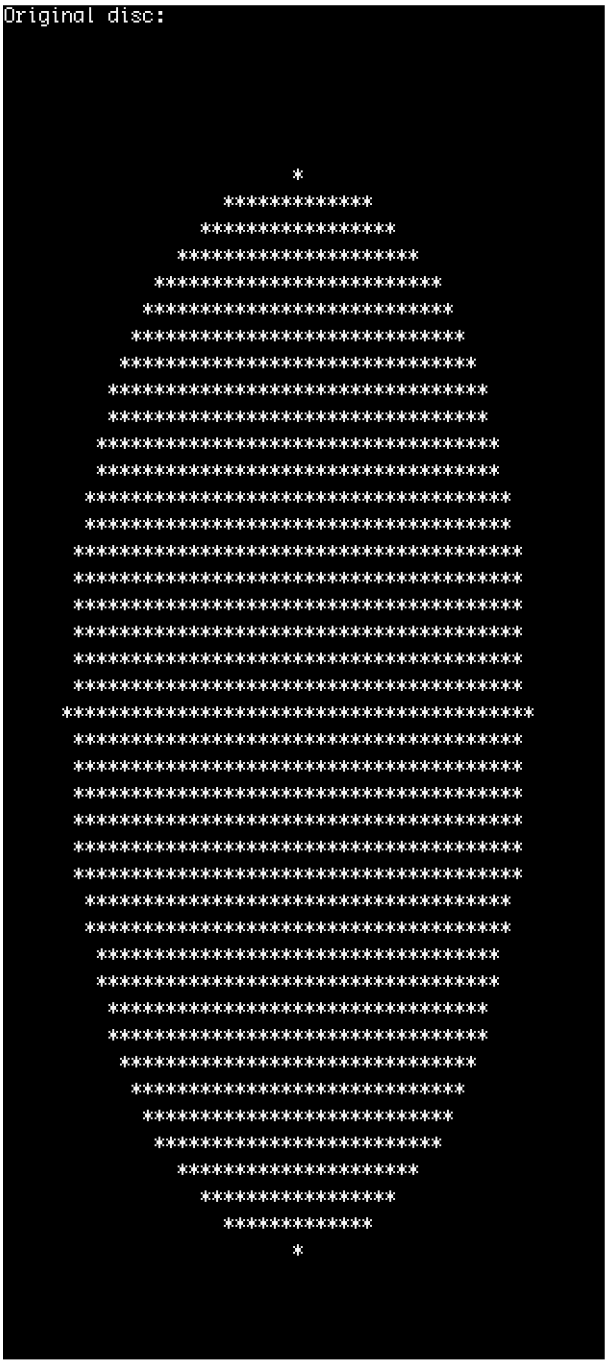
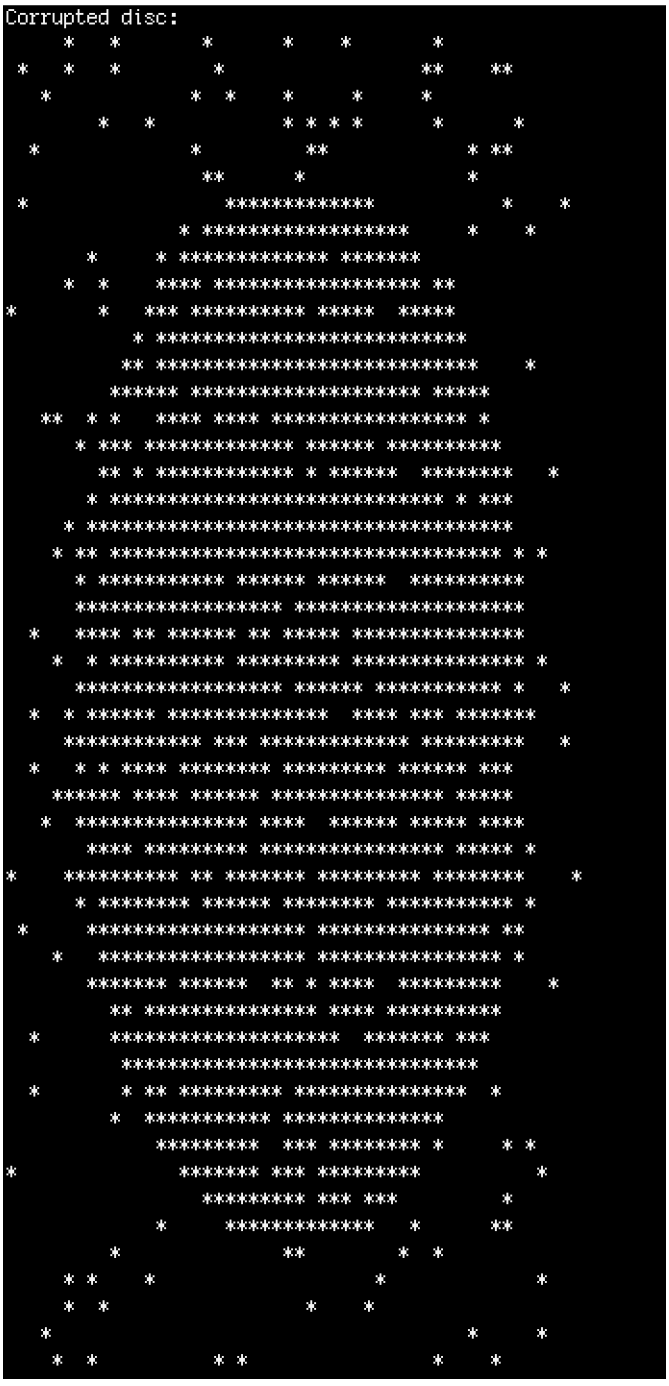
Example Images

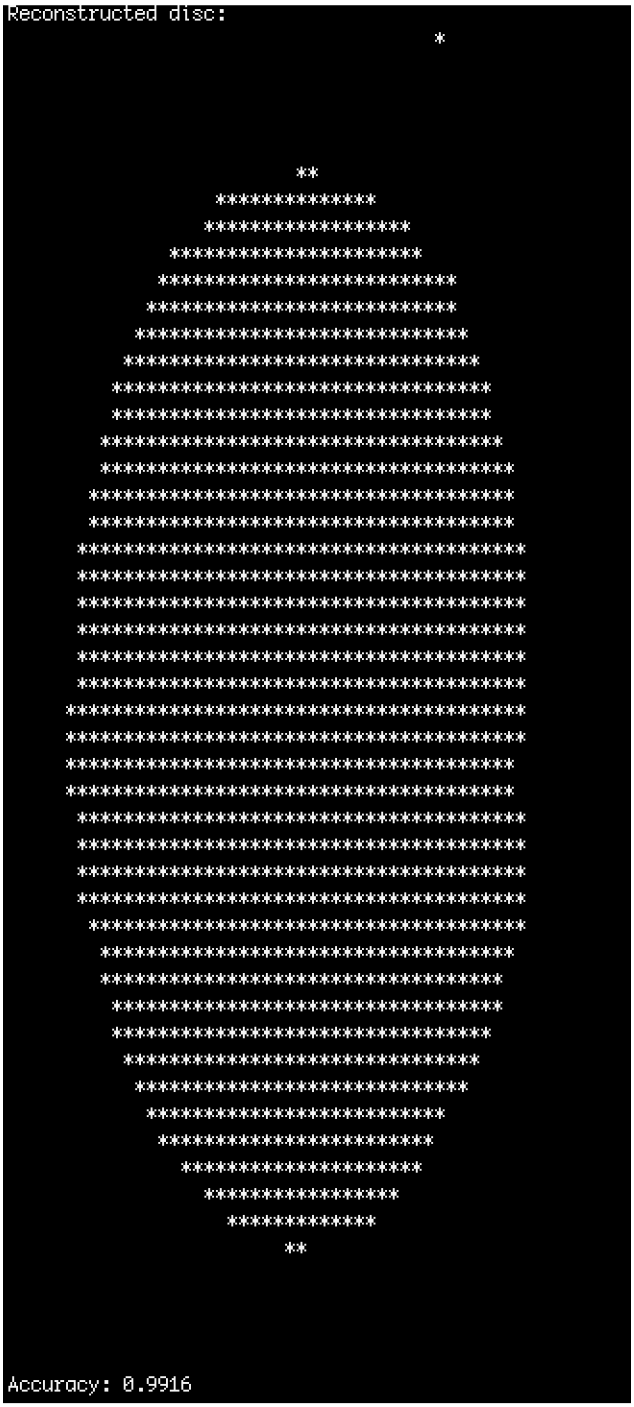
- **Original**



- **Corrupted ($\mu = 0.1$)**



- **Denoised ($\theta = 0.5$)**



The above images are a test of a small disc. The large disc, as specified in the project document, can be viewed by running the code as decribed in the README.

Parameter Testing

- **Data**

==========

Mu: 0.1

Theta: 0.1
Accuracy: 0.9014
Total iterations: 2
==========
Mu: 0.1
Theta: 0.2
Accuracy: 0.956
Total iterations: 2
==========
Mu: 0.1
Theta: 0.3
Accuracy: 0.9857
Total iterations: 4
==========
Mu: 0.1
Theta: 0.4
Accuracy: 0.9943
Total iterations: 4
==========
Mu: 0.1
Theta: 0.5
Accuracy: 0.9965
Total iterations: 7
==========
Mu: 0.1
Theta: 0.6
Accuracy: 0.9967
Total iterations: 8
==========
Mu: 0.1
Theta: 0.7
Accuracy: 0.9954
Total iterations: 10
==========
Mu: 0.1
Theta: 0.8
Accuracy: 0.9957
Total iterations: 11
==========
Mu: 0.1
Theta: 0.9
Accuracy: 0.9967
Total iterations: 31
==========
Mu: 0.2
Theta: 0.1
Accuracy: 0.7954
Total iterations: 2
==========
Mu: 0.2
Theta: 0.2
Accuracy: 0.8437
Total iterations: 2

==========
Mu: 0.2
Theta: 0.3
Accuracy: 0.9381
Total iterations: 3
==========
Mu: 0.2
Theta: 0.4
Accuracy: 0.9765
Total iterations: 5
==========
Mu: 0.2
Theta: 0.5
Accuracy: 0.9829
Total iterations: 7
==========
Mu: 0.2
Theta: 0.6
Accuracy: 0.9867
Total iterations: 9
==========
Mu: 0.2
Theta: 0.7
Accuracy: 0.9867
Total iterations: 14
==========
Mu: 0.2
Theta: 0.8
Accuracy: 0.9854
Total iterations: 23
==========
Mu: 0.2
Theta: 0.9
Accuracy: 0.9887
Total iterations: 31
==========
Mu: 0.3
Theta: 0.1
Accuracy: 0.6907
Total iterations: 2
==========
Mu: 0.3
Theta: 0.2
Accuracy: 0.7337
Total iterations: 2
==========
Mu: 0.3
Theta: 0.3
Accuracy: 0.8277
Total iterations: 3
==========
Mu: 0.3
Theta: 0.4

Accuracy: 0.8965
Total iterations: 5
==========
Mu: 0.3
Theta: 0.5
Accuracy: 0.9318
Total iterations: 7
==========
Mu: 0.3
Theta: 0.6
Accuracy: 0.9407
Total iterations: 10
==========
Mu: 0.3
Theta: 0.7
Accuracy: 0.9443
Total iterations: 31
==========
Mu: 0.3
Theta: 0.8
Accuracy: 0.9574
Total iterations: 31
==========
Mu: 0.3
Theta: 0.9
Accuracy: 0.9479
Total iterations: 31
==========
Mu: 0.4
Theta: 0.1
Accuracy: 0.5979
Total iterations: 2
==========
Mu: 0.4
Theta: 0.2
Accuracy: 0.6241
Total iterations: 2
==========
Mu: 0.4
Theta: 0.3
Accuracy: 0.6934
Total iterations: 3
==========
Mu: 0.4
Theta: 0.4
Accuracy: 0.7394
Total iterations: 4
==========
Mu: 0.4
Theta: 0.5
Accuracy: 0.757
Total iterations: 6
==========

Mu: 0.4
Theta: 0.6
Accuracy: 0.8112
Total iterations: 12
==========
Mu: 0.4
Theta: 0.7
Accuracy: 0.8178
Total iterations: 31
==========
Mu: 0.4
Theta: 0.8
Accuracy: 0.7888
Total iterations: 31
==========
Mu: 0.4
Theta: 0.9
Accuracy: 0.8122
Total iterations: 31
==========
Mu: 0.5
Theta: 0.1
Accuracy: 0.4955
Total iterations: 2
==========
Mu: 0.5
Theta: 0.2
Accuracy: 0.4986
Total iterations: 2
==========
Mu: 0.5
Theta: 0.3
Accuracy: 0.5041
Total iterations: 3
==========
Mu: 0.5
Theta: 0.4
Accuracy: 0.5031
Total iterations: 4
==========
Mu: 0.5
Theta: 0.5
Accuracy: 0.4706
Total iterations: 6
==========
Mu: 0.5
Theta: 0.6
Accuracy: 0.4868
Total iterations: 11
==========
Mu: 0.5
Theta: 0.7
Accuracy: 0.4937

Total iterations: 31
==========
Mu: 0.5
Theta: 0.8
Accuracy: 0.4968
Total iterations: 31
==========
Mu: 0.5
Theta: 0.9
Accuracy: 0.5281
Total iterations: 31

Optimal Theta

$\mu = 0.1, \theta = 0.6, 0.9$
$\mu = 0.2, \theta = 0.6, 0.9$
$\mu = 0.3, \theta = 0.8$
$\mu = 0.4, \theta = 0.7$
$\mu = 0.5, \theta = 0.3, 0.9$

For all instances of $\theta = 0.9$, the accuracy was the best, but the number of iterations was significantly higher than the next best result. The next best result was usually very similar in accuracy. It appears that, with a low μ and a high μ, a low θ is better, but for μ somewhere in the middle, a larger θ (meaning a much finer ϕ) is more successful.

Maximum Noise

For μ up to 0.4, filtering always results in over 75% accuracy, and usually close to 80%. However, at $\mu = 0.5$, accuracy barely reaches 50% with good values of θ. Therefore, the maximum filterable μ is 0.4.