Homework 6

Jacob Sachs

23 May 2013

Example Images

■ Original

```
Original disc:
                                      ako ko k
                                  *****
                              ******
                      ******
                    ****
                  *****
                 skaje akalenkaje akalenkaje akalenkaje akalenkaje akalenkaje akalenkaje akalenkaje akalenkaje akalenkaje akal
                ****
              *******
              *****
            skolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodokolodok
           ********
            skaleska kaleska kalesk
           **********
            ******
             **********
            **********
                *****
                ****
                 ********
                 ******
                        ajenje ajenjenje ajenje ajenjenje ajenje ajenjenje ajenje ajenje ajenje ajenje ajenje ajenje ajenje
                          \label{eq:controlled} \text{special controlled controlled
                              ******
                                      *****
```

■ Corrupted (*µ* = 0.1)

```
Corrupted disc:
                                                                     skoleskoleskoleskoleskoleskolesko
                                                     * *****
                                              ak akokokokokokokokokokokokokok
                                             *** ******** **** ****
                                      ** *********
                               *****
                                             academic alementa academicalemente alementa alem
                   * *** *********** ***** *****
                          skoje się skoleokokokokokokokok się skoleokokok się skoleokokokok
                       w waterbeide kalende k
               * **********
                   a acceptational acceptant acceptance
                   **** ** ***** ** ***** ********
             * * ********* ******* *******
                   ***********
             w waterstan with a contract to the contract to
                ********
                 * * **** ****** ****** ****
           skolekolek skolek skolekolek skolekolekolekolekolekolek skolekolek
       * *************** **** ***** ****
                       **** ******** *************
                ********
                   ***********
                       *****
                              * ** ******** **********
                                       ANDROPERATE STATES
                                              skolodolokokok skolode skolodolokokokok
                                                            *****
                                                                    piepiepiepiepiepiepiepiepiepiepiepie
                                                                                       **
```

■ Denoised (θ = 0.5)

```
Reconstructed disc:
                               skokokokokokokokokokokokok
                              sk skalesk skalesk skalesk skalesk skalesk skalesk
                        *****
                     ****
                   ****
                 ****
            **********
          *****
           ******
          *****
          *****
         ********
         ********
          ****
              siculario la ficial de la final de la fina
               ******
                  ******
                             ****
                                 akonkonkonkonkonkonkonkonk
                                         **
Accuracy: 0.9916
```

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

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

Accuracy: 0.8965 Total iterations: 5

Mu: 0.3

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 μ = 0.5, accuracy barely reaches 50% with good values of θ . Therefore, the maximum filterable μ is 0.4.