## **2. Algorithms**

### **2.1. 4 Sigma filter**

The 2-D 5 x 5 sigma filter takes 25 pixels as input. If we consider as the pixel of interest, the input pixels for the 5 x 5 sigma filter are

After sigma filter, the output

Here,

,

and

Overall, sigma filter averages values belonging to the same distribution as the interest input , while excluding noisy outliers in the input.

2.1. 6 mean and standard deviation of the interior of the large disk region

The matrix containing the large disk is isolated manually by taking the row 50 to row 181 and column 32 to column 150 out from the original image. The left panel of Figure 1

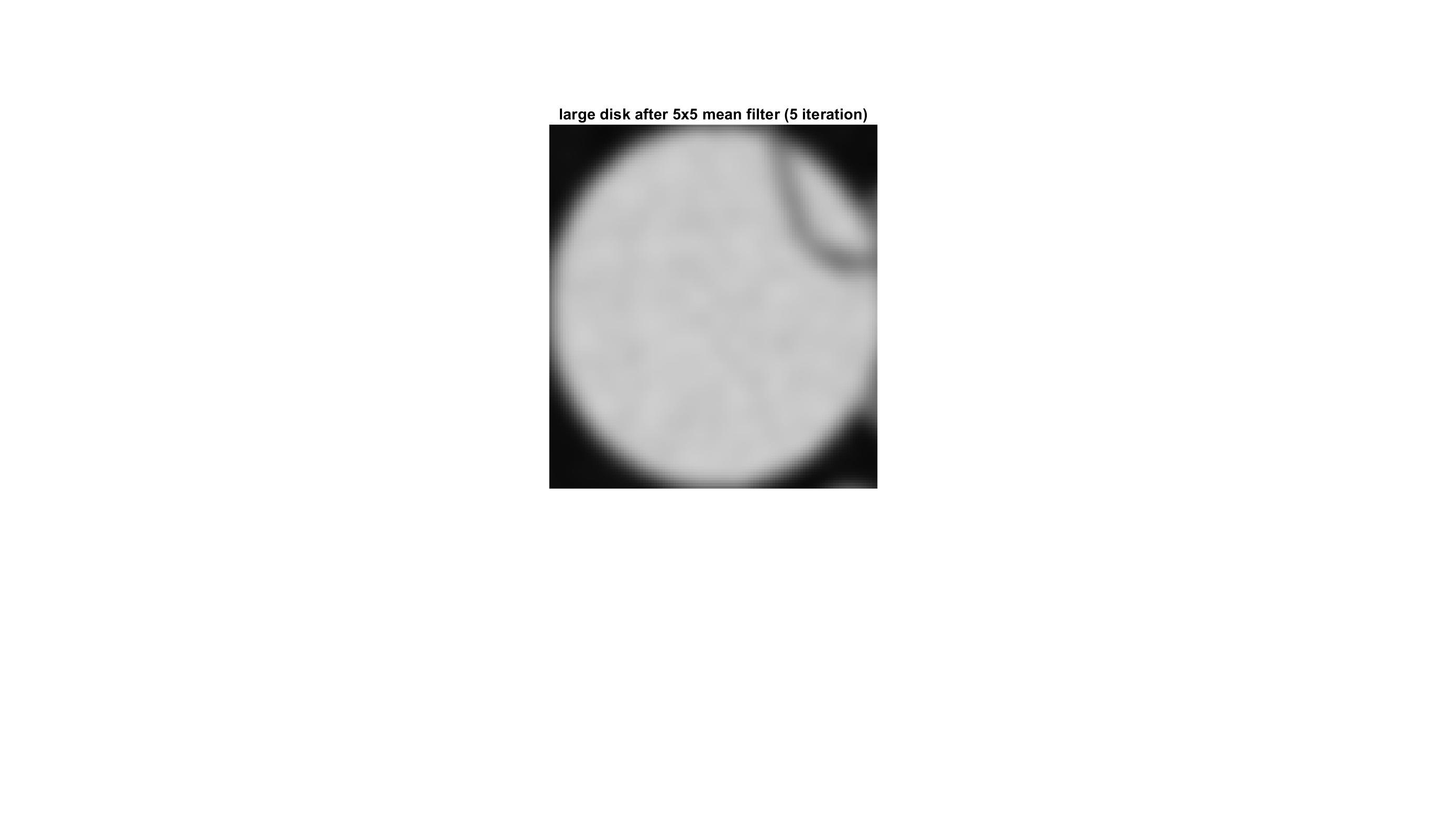
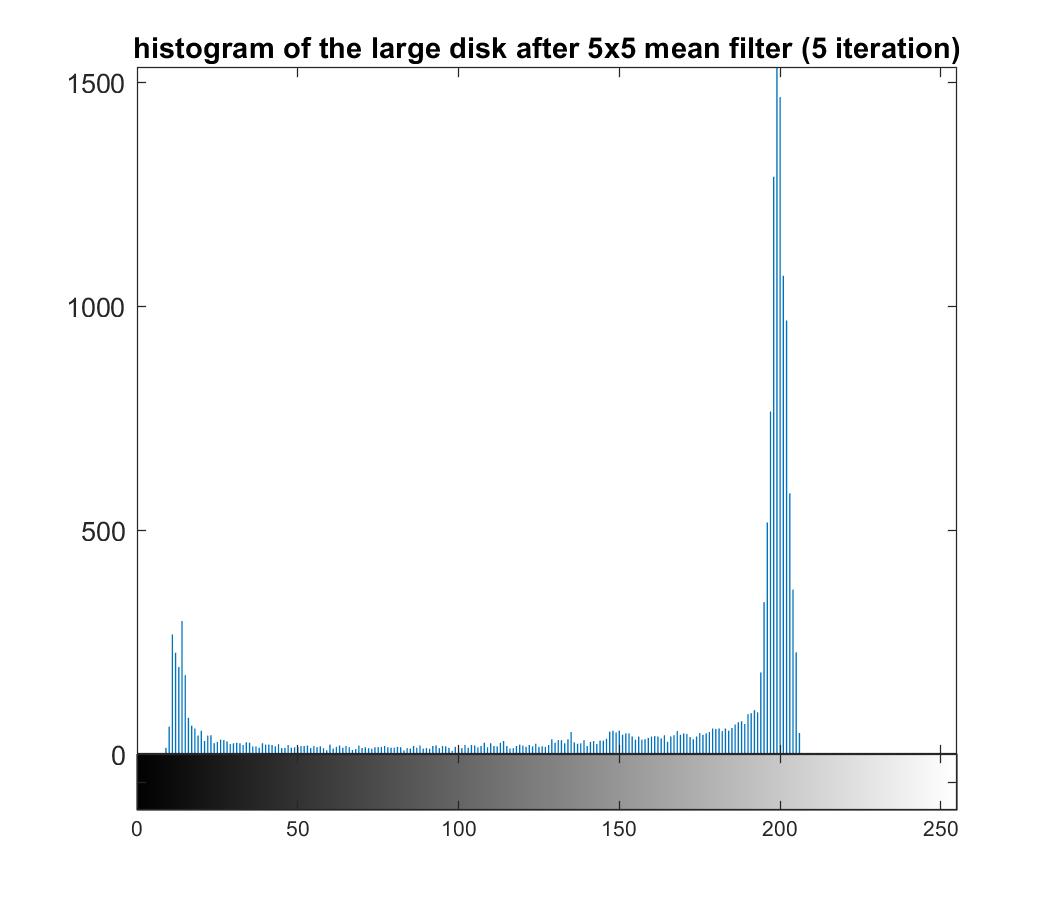
 

Figure The matrix containing the large disk and its histogram after applying 5 x 5 mean filter to the original disk image.

## **3. Structure of Code**

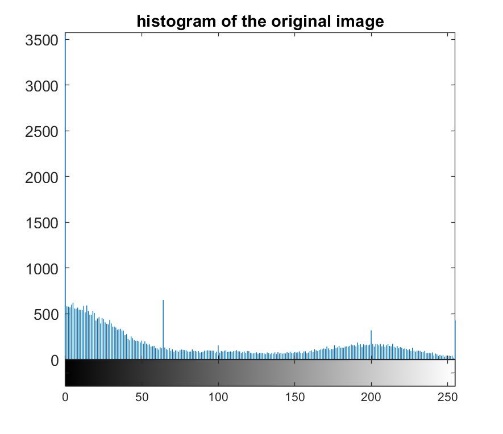
**sigma\_filter.m**

Function sigma\_filter.m takes an image as input, and applies sigma filter to it. The output image will be the image after sigma\_filter. This function does not call any other functions.

## **C. Results**

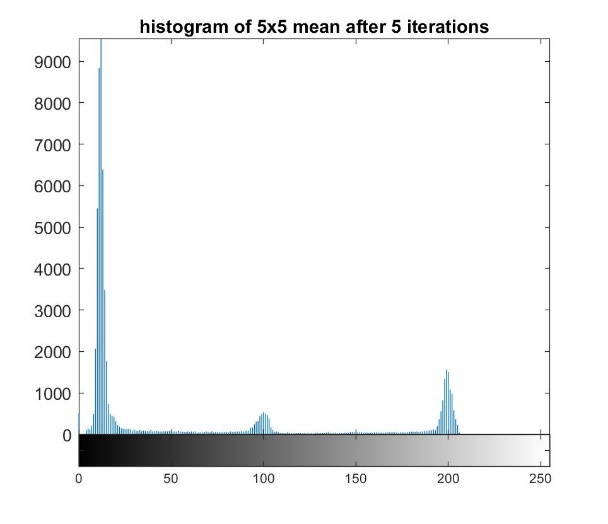
### **1. Nonlinear Filtering**

The first part of this project focuses on applying different types of nonlinear filters and understanding their effects.



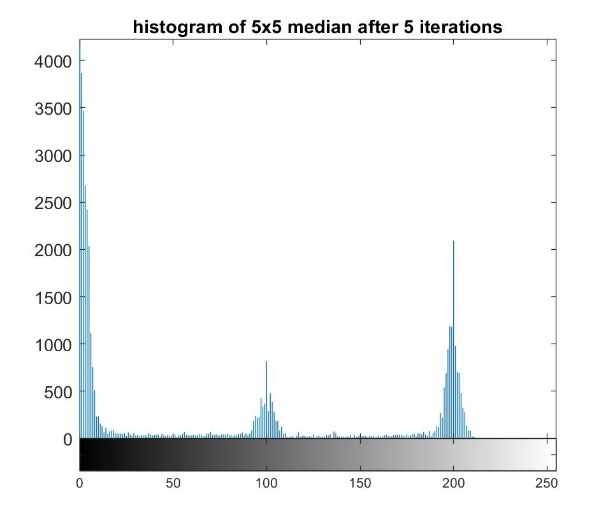
Original Image

A



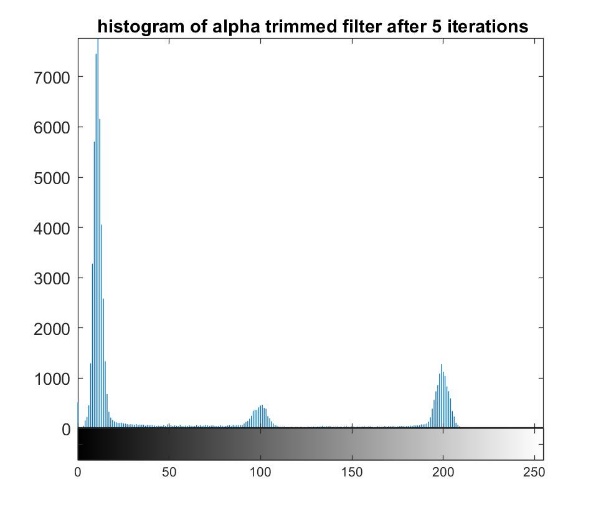
B

Mean Filter



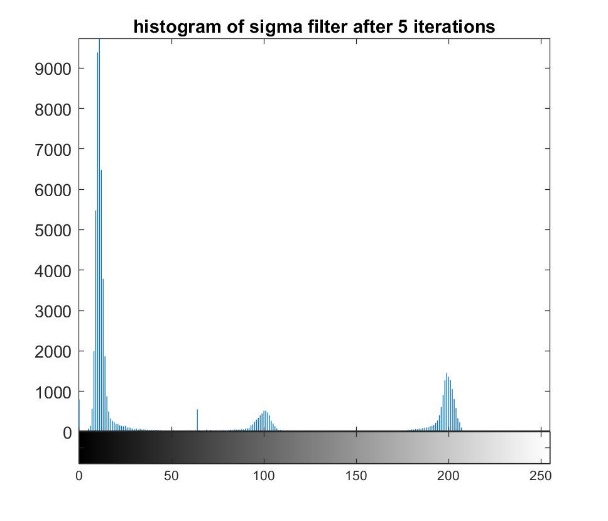
C

Median Filter



D

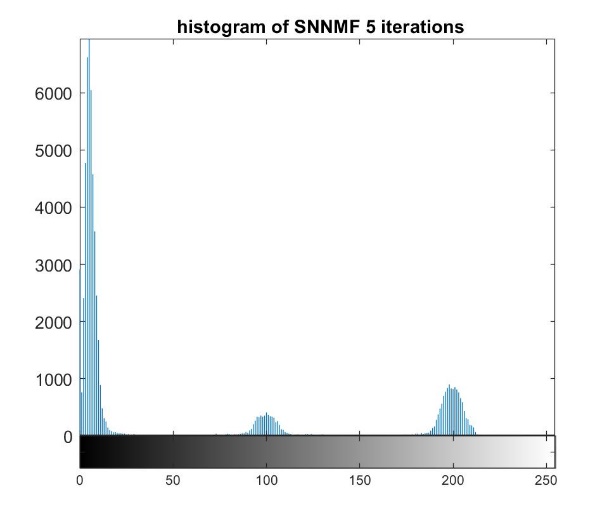
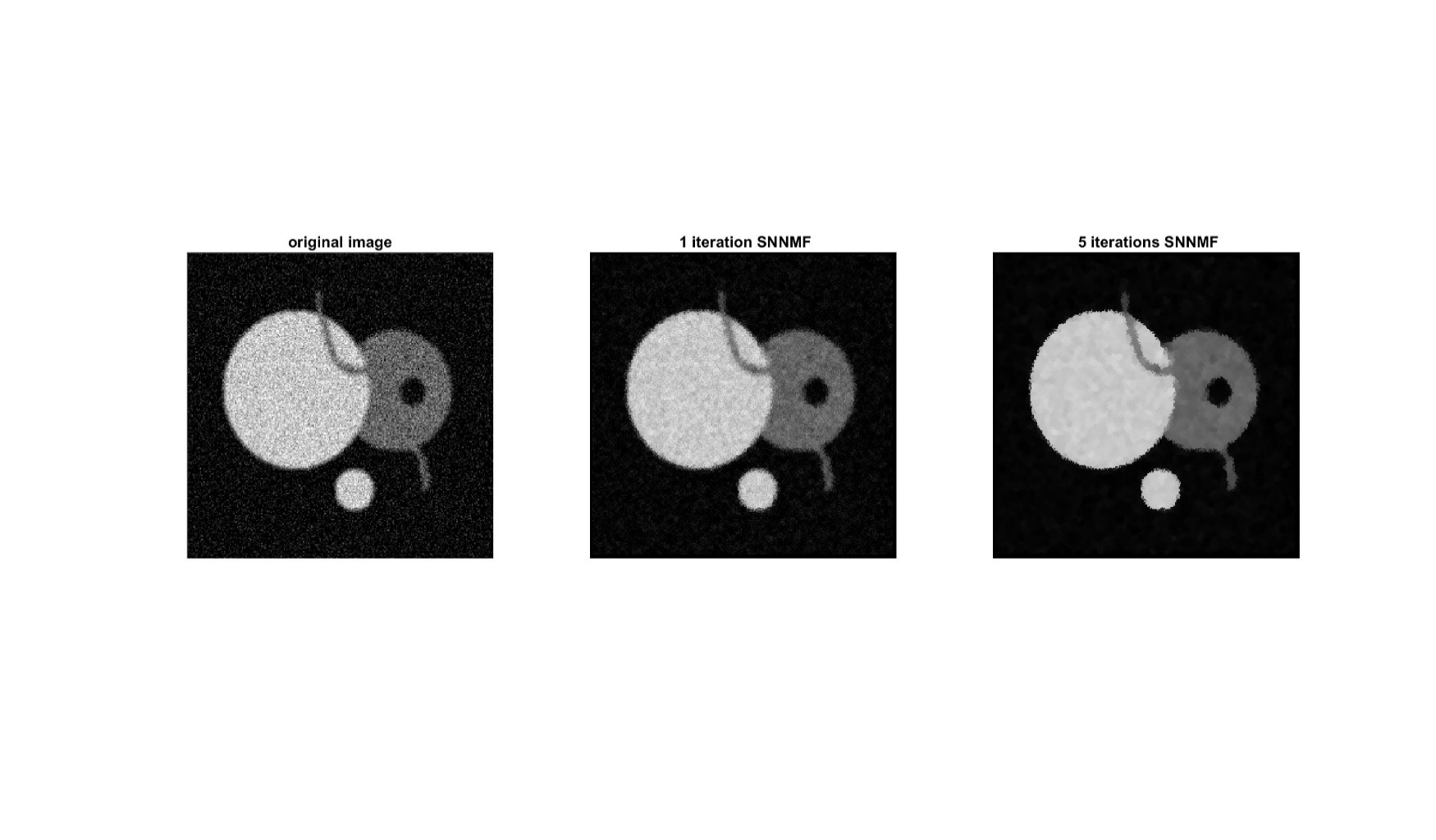
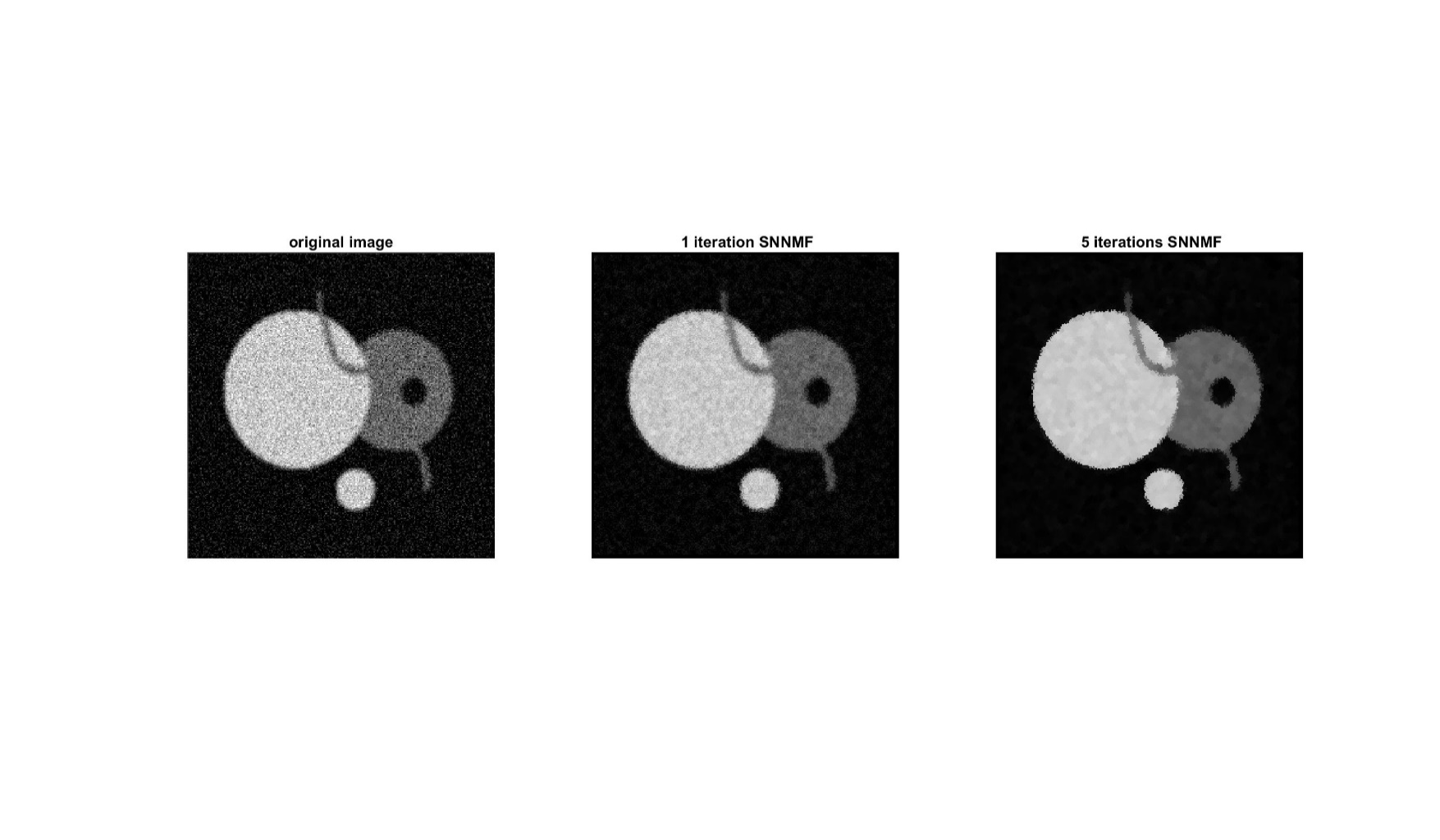
Alpha-Trimmed Mean Filter



SNNMF

Sigma Filter

E



F

Figure The image output and histogram of the original image (A), and images after applying mean filter (B), median filter (C), alpha-trimmed mean filter (D), sigma filter (E), and symmetric nearest-neighbor mean filter (F) for 1 time and 5 times.

|  |  |  |
| --- | --- | --- |
|  | Mean | Std |
| 5x5 mean filter | 188.69792 | 22.589779 |
| 5x5 median filter | 191.80400 | 21.022482 |
| 5x5 alpha-trimmed mean filter | 190.12857 | 22.155251 |
| 5x5 sigma filter | 192.49910 | 21.504250 |
| 5x5 symmetric nearest-neighbor mean filter | 190.12857 | 22.155251 |

Table mean and standard deviation of the interior of the large disk region for each filter after 5 iterations.