Digital Image Processing, 2024 Spring

Homework 1

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Due 23:59 (CST), Apr. 7, 2024

Problem 1:

(a) Figure 1 is the histogram image of grain.tif.

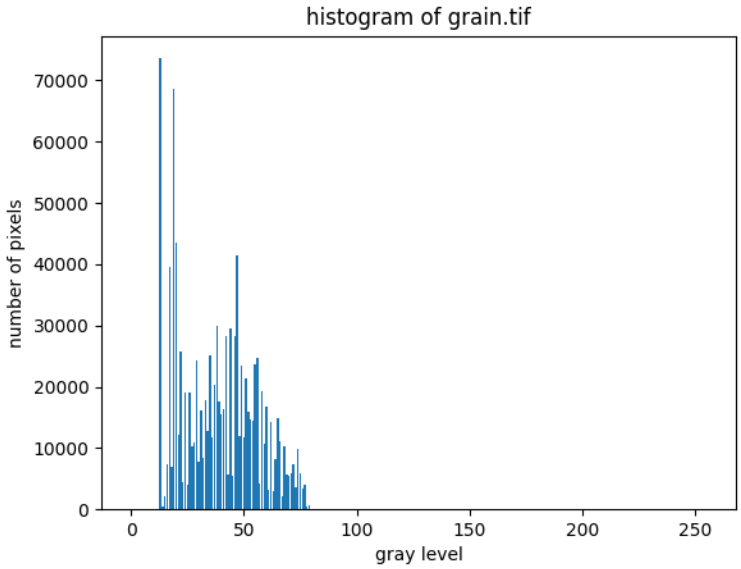

Figure 1. Histogram of grain.tif

(b) The left image of Figure 2 is the histogram equalized image, and the right one is the histogram of that histogram equalized image.

(c) The left image of Figure 3 is the CLAHE processed image, and the right one is the histogram of that CLAHE processed image.

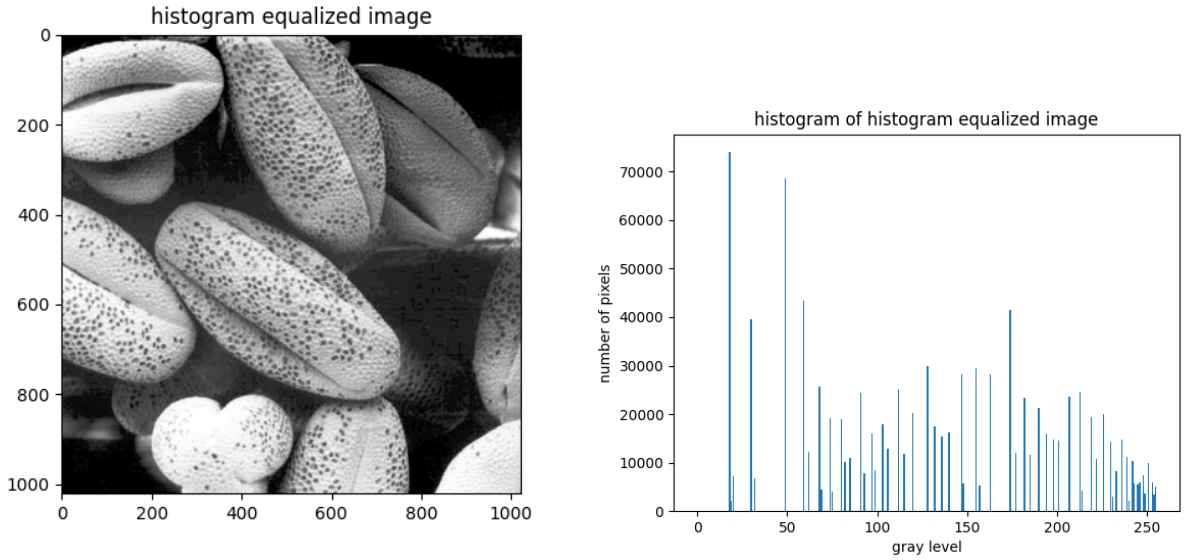

Figure 2. Histogram equalized image and its histogram

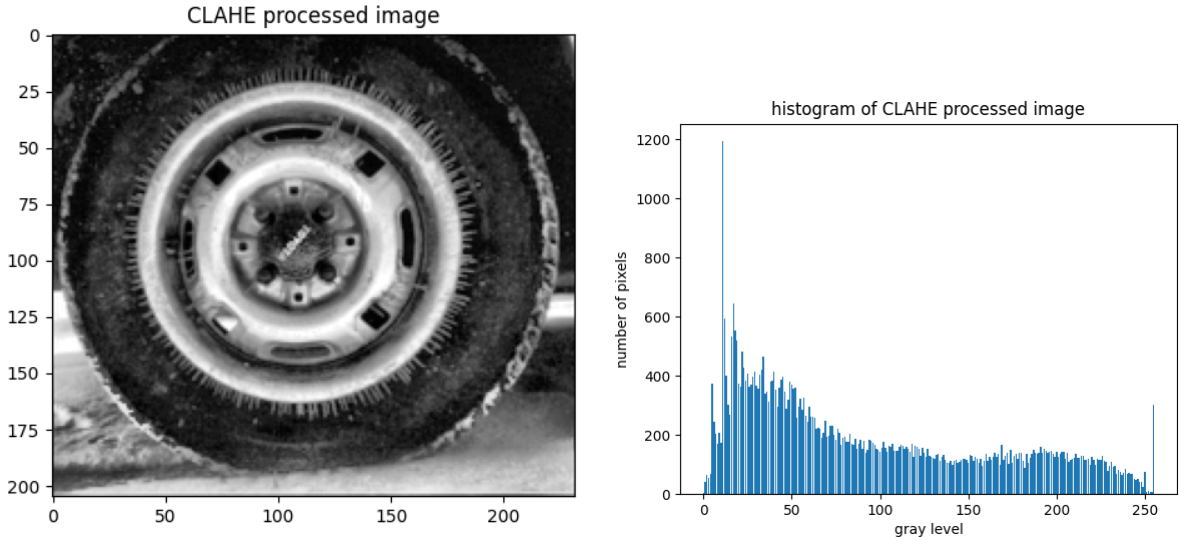

Figure 3. CLAHE processed image and its histogram

Problem 2:

(a) The Laplacian kernel is that:

$$\nabla^2 f = \begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

The kernel is separable, and the separated kernel is:

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & -2 & 0 \\ 0 & 1 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ 1 & -2 & 1 \\ 0 & 0 & 0 \end{bmatrix}$$

$$\begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} 1 & -2 & 1 \end{bmatrix}$$

The processed image is shown in Figure 4.

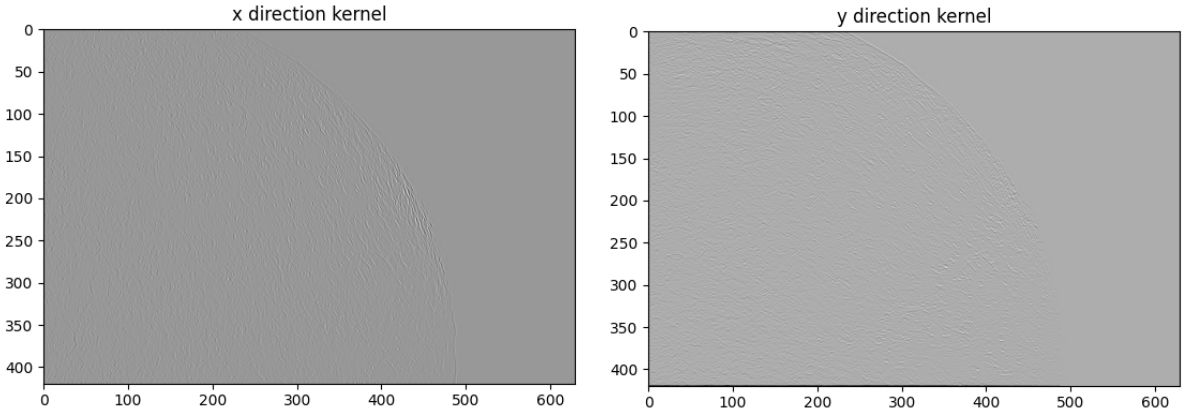

Figure 4. Separated Laplacian kernels processed image

(b) Sharpened image with unseparated Laplacian kernel

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The processed image is shown in Figure 5.

(c) Sharpened image with unsharpen mask

The processed image is shown in Figure 6.

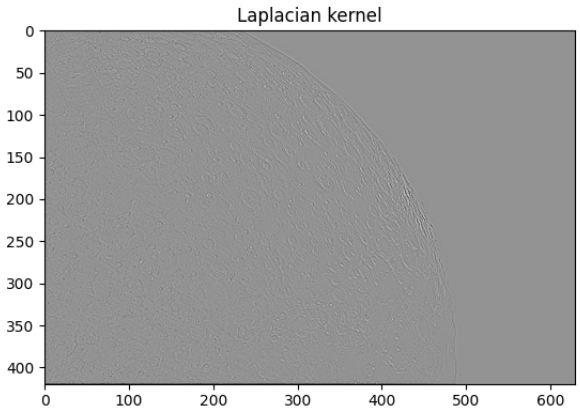

Figure 5. Unseparated Laplacian kernels processed image

Problem 3:

The processed image by the median filter is shown in Figure 7.

cause of the results:

The processed image by the and Gaussian filter is shown in Figure 8.

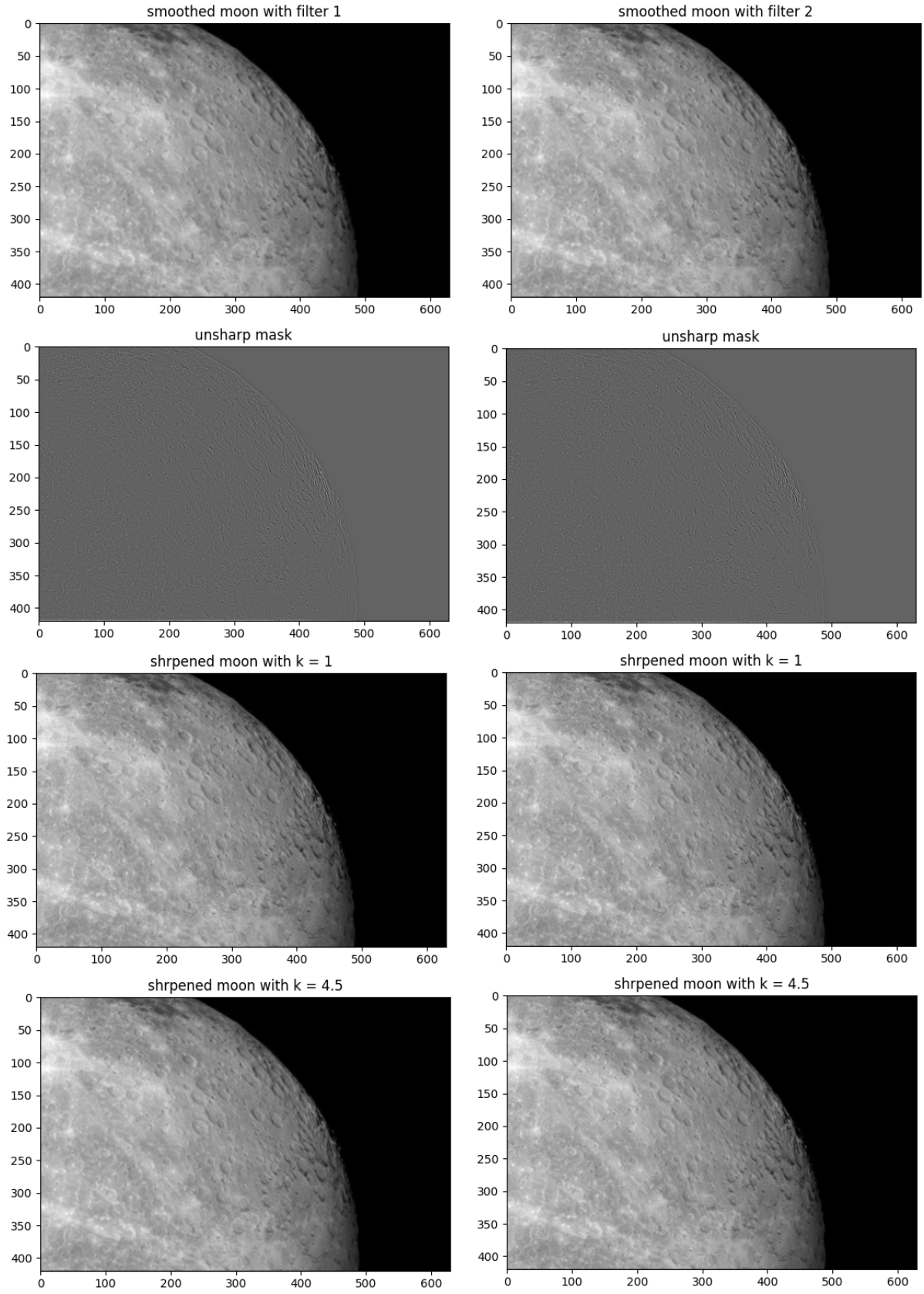

Figure 6. unsharpen mask processed image

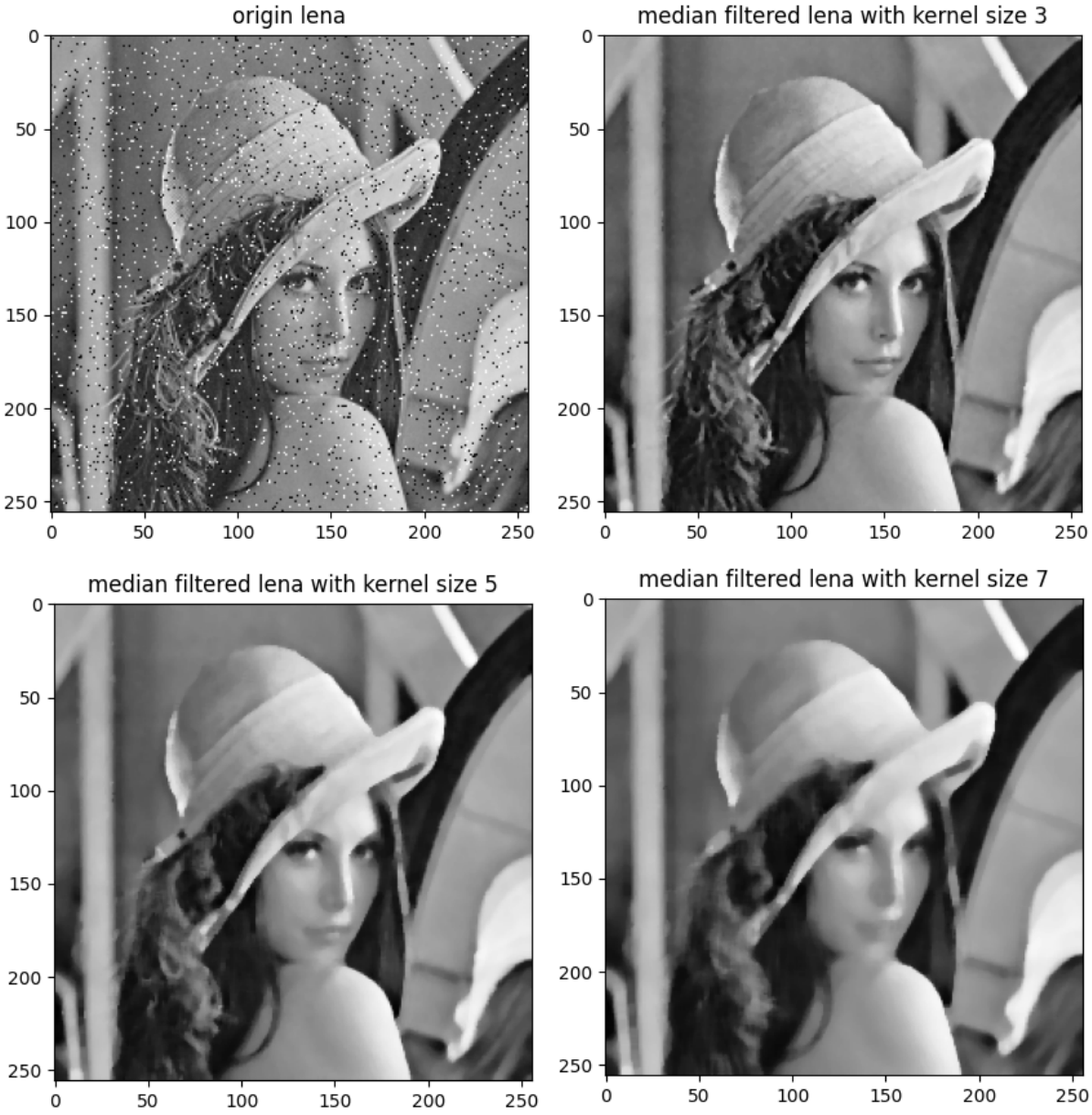

Figure 7. Median filter processed image

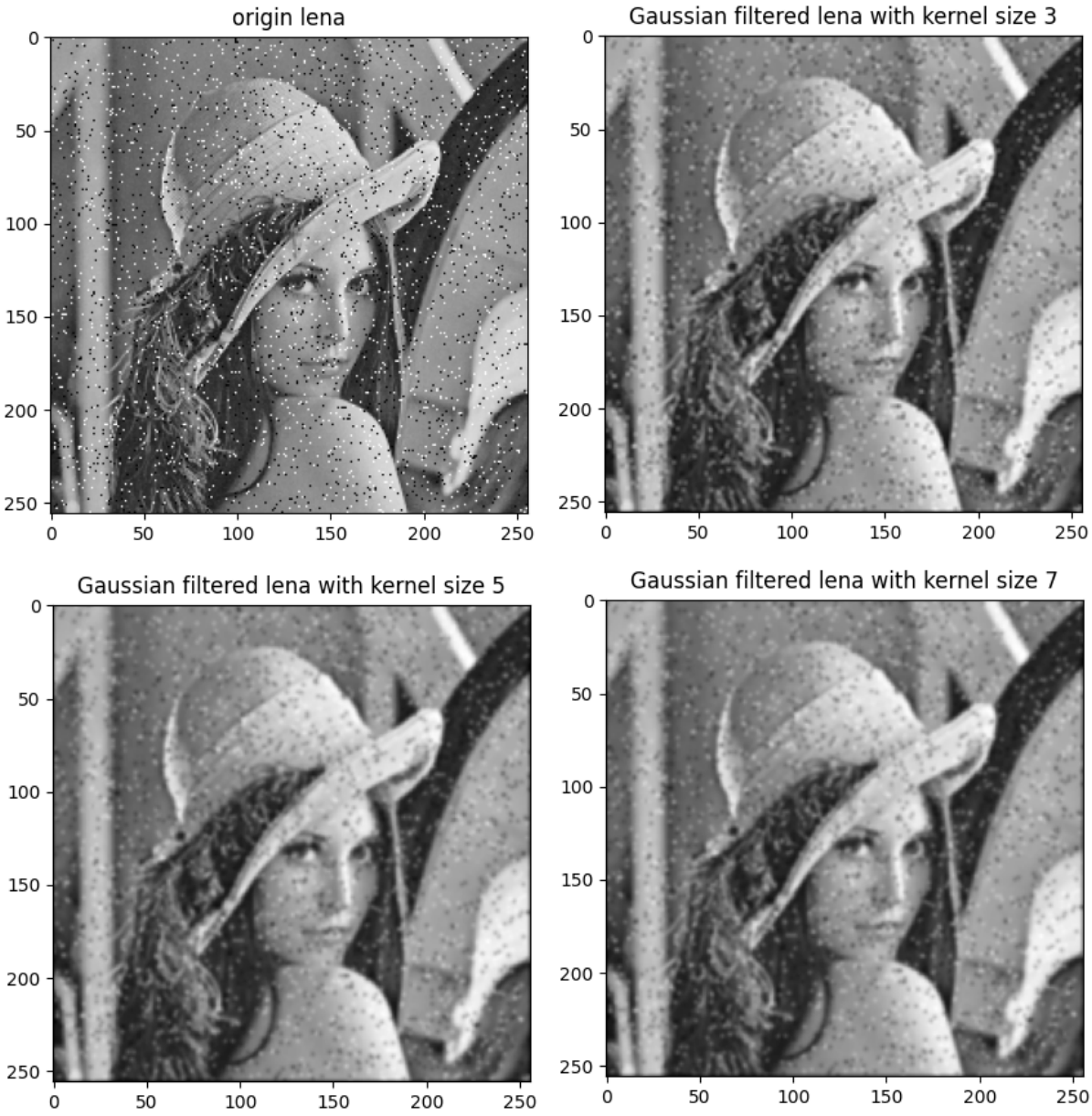

Figure 8. Gaussian filter processed image