**Technische Universität Berlin**

DIGITAL IMAGE PROCESSING

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# Exercise 2:

# Noise

**Group Z**

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# **Contents**

# Part 1: Discussion of the Solution

By this exercise we learned how to distinguish Shot noise and Gaussian noise and the methods to reduce these kinds of noise. According to the type of the noise, we use median filter to reduce Shot noise and average filter to reduce Gaussian noise. For our image we found 5x5 kernel is the most ideal kernel size. If we choose 3x3 kernel, there will be some small particles remaining in the image with Shot noise, the result of average filter is also not ideal. If we choose 7x7 kernel, the details of the image with Shot noise will be deleted, the edges of the image with Gaussian noise will be blurred.
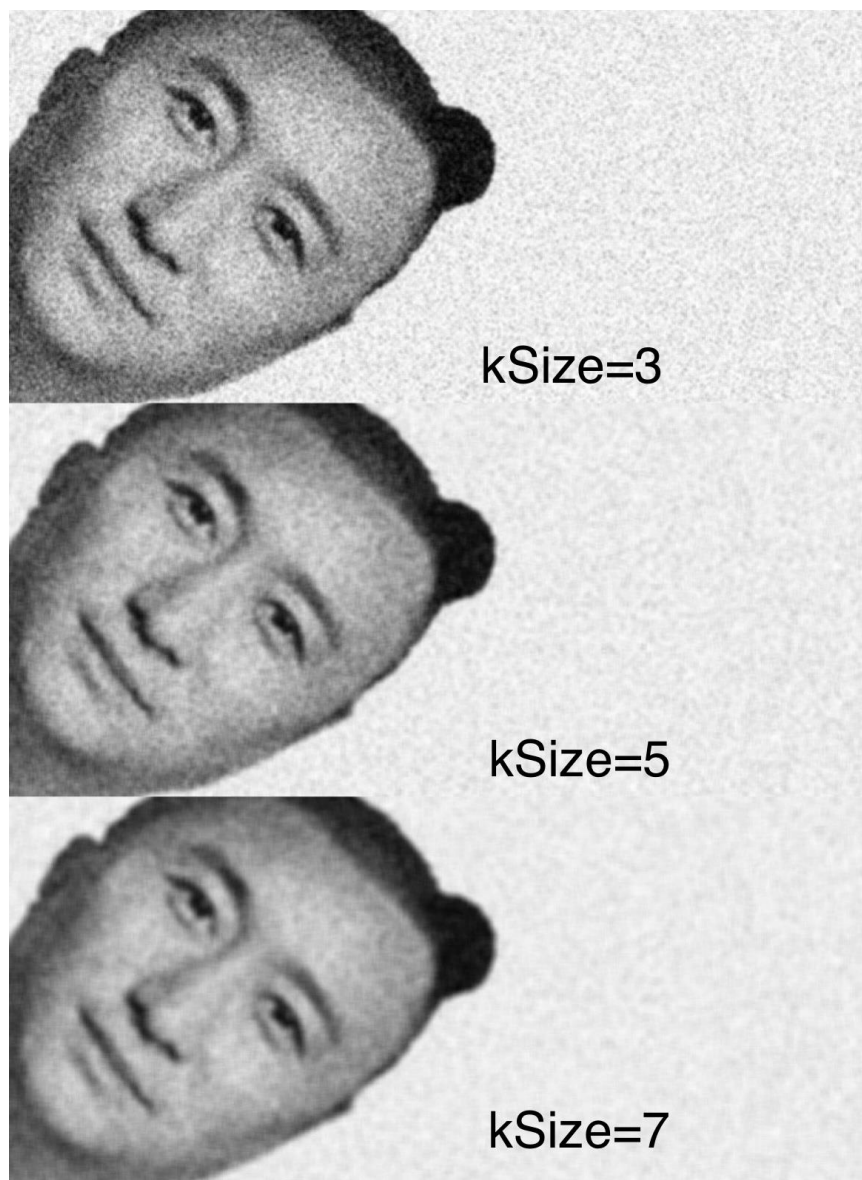


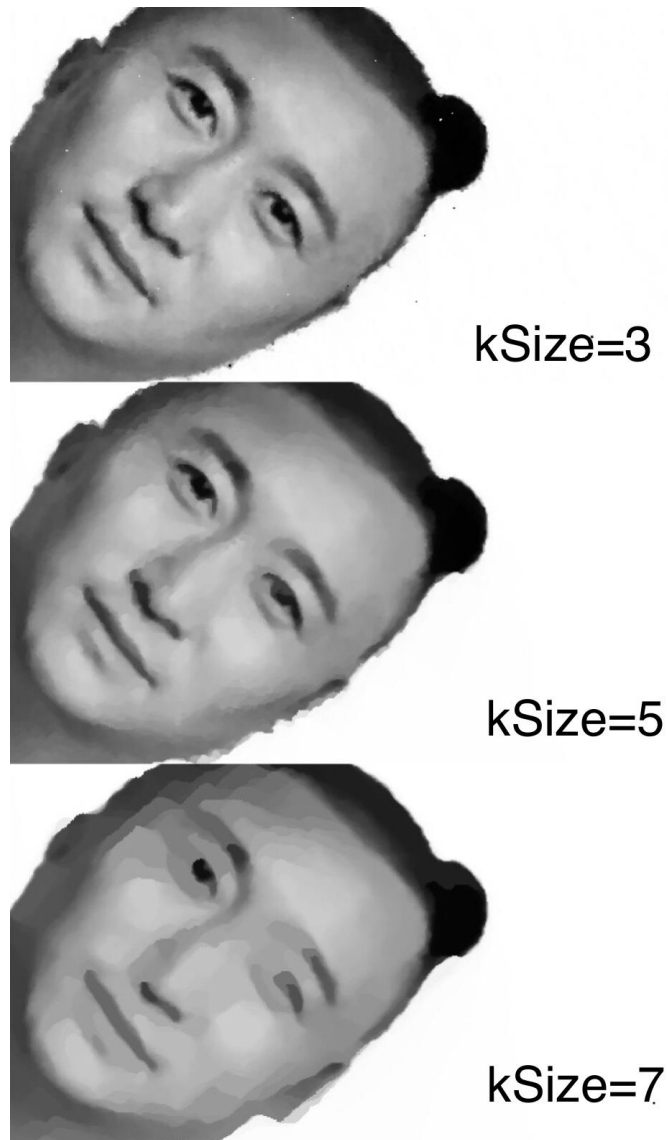Figure 1. Result of Gaussian Noise with different parameters

Figure 2. Result of Shot Noise with different parameters

# Part 2: Theoretical Questions

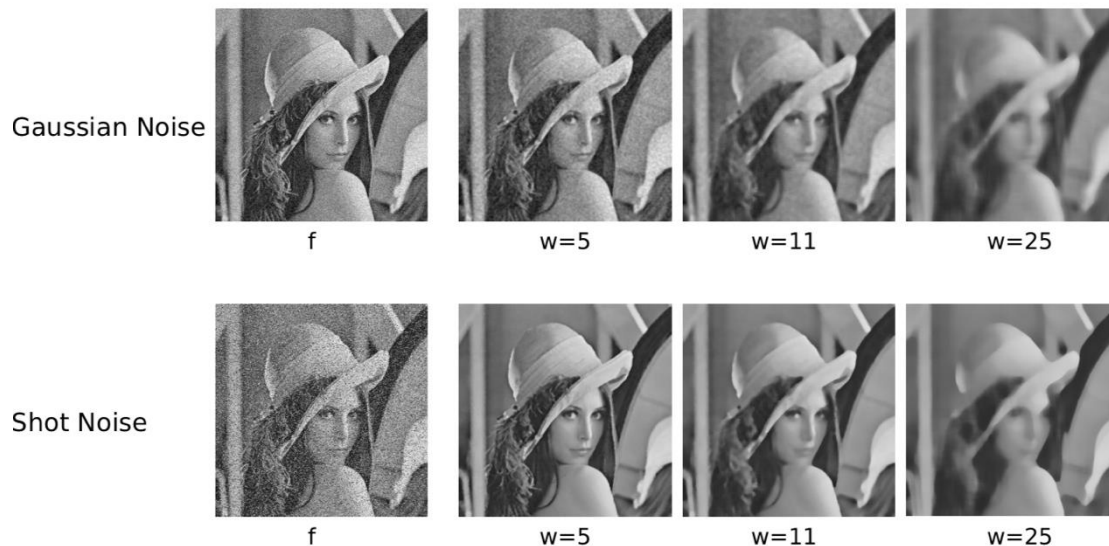## 1. When should the median filter be applied to an image and when the moving average filter?

Median filter:

When the c of the noise is shot noise and the edges of the image need to be reserved, the median filter is more suitable.
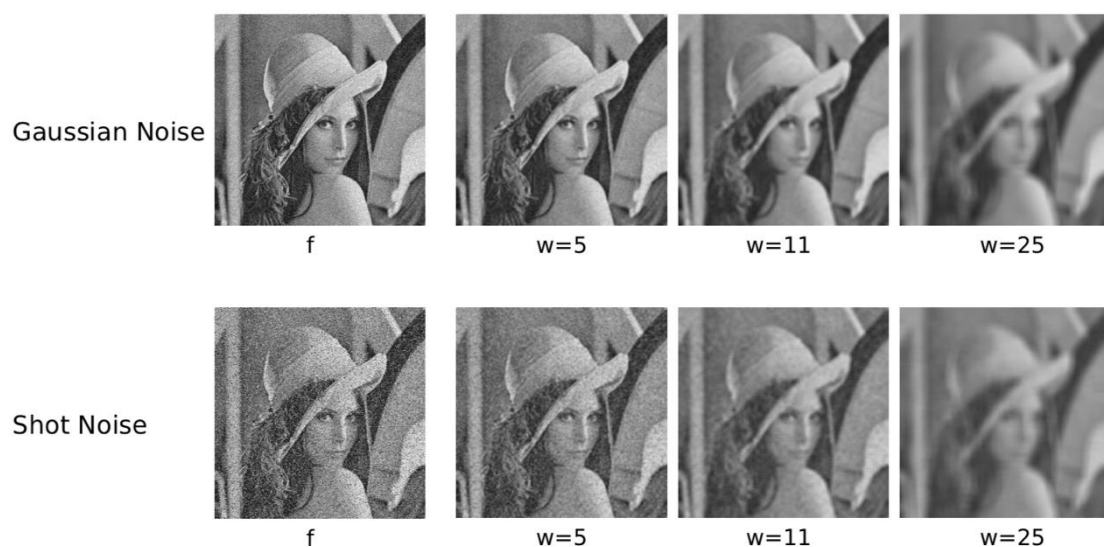
Moving average filter:
    Moving average filter is more effective for gaussian noise

## 2. Explain your answer to question 1.



    As the above picture shows, median filter is more effective when coping with shot noise. The shot noise points are similar but randomly distributed. The main idea of median filter is to choose a suitable point in the neighborhood (moving window) to replace the noise point. Since noise points are always with extremely higher or lower values, so using median value to replace them gives a good result.



    As the above picture shows, moving average filter is more effective for Gaussian noise. Gaussian noise is statistical noise having a probability density function equal to

that of the Gaussian distribution. Noise points are identically distributed, but the values are random. Moving average filter can effectively reduce the Gaussian noise by using the mean value of the window to replace the value of the central pixel.

## 3. Is there a general better choice than the moving average filter?

Yes, bilateral filtering.

## 4. Explain your answer to question 3.

A big disadvantage of moving average filter is that the details of the image will also be reduced, the edges will be blurred, because the gray value changes rapidly in the area of the edge. Therefore we introduce bilateral filtering which can preserve the edges of the image. In the area with high standard deviation (edge), the value remains the same, in the area with low standard deviation (noise), the value is replaced by average value.