5 Exercises

Exercise 1: Write a program to apply the mean filtering over a noised image From the obtained images after applying the mean filtering, then PSNR and MSE are used to measure the difference of two images (original image and smoothing image).

> **Note:** Opencv provides *cv2.blur* to apply the mask filter on an image.

Exercise 2: Write a program to apply median filtering over a noised image. From the obtained images after applying the median filtering, then PSNR and MSE are used to measure the difference of two images (original image and smoothing image).

> **Note:** Opencv provides *cv2.medianBlur* to apply the median filter on an image.

Exercise 3: Write a programe to compute input image in which is convolved with each of the masks (1) to (6), respectively.

1. $\begin{bmatrix} -1 & -1 & 0 \\ -1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix}$
2. $\begin{bmatrix} 0 & -1 & -1 \\ 1 & 0 & -1 \\ 1 & 1 & 0 \end{bmatrix}$
3. $\begin{bmatrix} -1 & -1 & -1 \\ 2 & 2 & 2 \\ -1 & -1 & -1 \end{bmatrix}$
4. $\begin{bmatrix} -1 & 2 & -1 \\ -1 & 2 & -1 \\ -1 & 2 & -1 \end{bmatrix}$
5. $\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$
6. $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix}$

Exercise 4: Write a function to blur an input image f according to the filters following.

- Min filtering $g(x, y) = min_{f_w}$
- Max filtering $g(x, y) = max_{f_w}$

where f_w is the matrix belong to sub-window w of the input image, and g denotes the image result. After that calculate the gradient image between the image after applying the max filtering and the image after applying the min filtering.

Exercise 5: Write a function to blur an input image according to the midpoint filter.

$$g(x, y) = \frac{(min_{f_w} + max_{f_w})}{2}$$

Exercise 6: Write a program to apply Gaussian filtering over a noised image. where w' kernel could be calculated as following

$$w = \frac{e^{-(X^2+Y^2)}}{2\sigma^2}$$

$$w' = \frac{w}{\sum w(:)}$$

From the obtained images after applying the Gaussian filtering, then PSNR and MSE are used to measure the difference of two cases.

> **Note:** Opencv provides *cv2.GaussianBlur* to apply the Gaussian filter on given image.

6 References

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. New Jersey, Prentice Hall, 2002.
2. T. Acharya. Image Processing Principles and Applications. New York, Wiley & Son, 2005
3. I.T. Young, J.J. Gerbrands, L.J. van Vliet. Fundamentals of Image Processing, Delft University of Technology, 1998.