Machine Vision

Homework#5
Deadline: 2024/05/29 23:59:59

Robot Vision Lab (Room 1421)
TAs: 魏士涵 t112598058@ntut.edu.tw
賴靖嫻 t112598008@ntut.edu.tw

HW#5

- Image filtering

  1. Implement Mean Filter with 3*3 and 7*7 mask.

  2. Implement Median Filter with 3*3 and 7*7 mask.

  3. Implement Gaussian 2D Filter with 5*5 mask.

     - Define your σ and describe your Gaussian kernel.

  ※Don't forget the zero padding, check your image size result

Mean Filter

8	10	21	17	35
2	43	15	72	21
30	94	55	43	74
36	28	69	88	56
45	75	42	47	20

Mean Filter

0	0	0			
0	**8**	10	21	17	35
0	2	43	15	72	21
30	94	55	43	74	
36	28	69	88	56	
45	75	42	47	20	

$0 \times 1/9 + 0 \times 1/9 + 0 \times 1/9 +$
$0 \times 1/9 + 8 \times 1/9 + 10 \times 1/9 +$
$0 \times 1/9 + 2 \times 1/9 + 43 \times 1/9 = 7$

$\times$

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

$=$

7				

Median Filter

0	0	0			
0	**8**	10	21	17	35
0	2	43	15	72	21
	30	94	55	43	74
	36	28	69	88	56
	45	75	42	47	20

Neighborhood values: 0 0 0 0 8 10 0 2 43

↓

0 0 0 0 **0** 2 8 10 43

↓

0				

Gaussian 2D Filter

1. $G(x, y) = \dfrac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$

   If $\sigma = 1$,

(-1,-1)	(0,-1)	(1,-1)
(-1,0)	(0,0)	(1,0)
(-1,1)	(0,1)	(1,1)

$\longrightarrow$
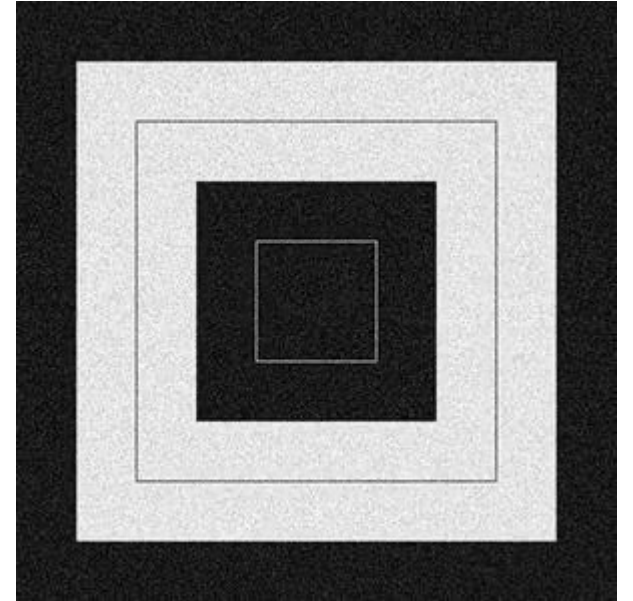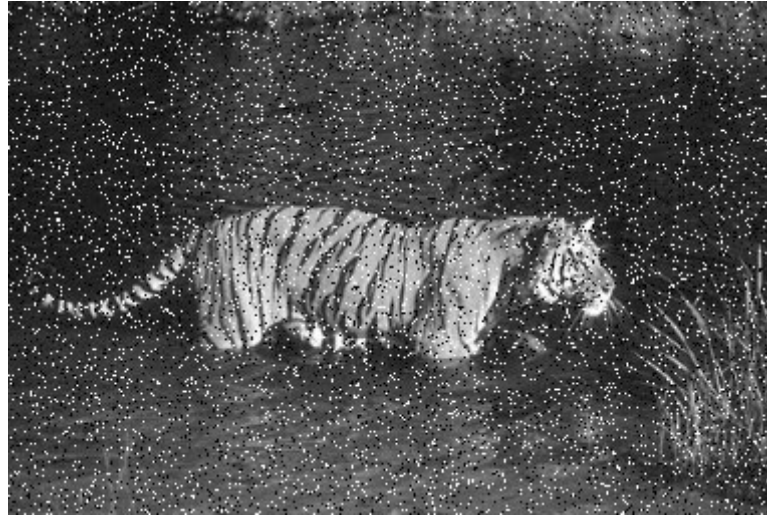
0.0585	0.0965	0.0585
0.0965	0.1591	0.0965
0.0585	0.0965	0.0585

2. Normalization

3. Convolution：I*G

Images

HW#5

- Report
  - Student ID
  - Name
  - Describe the main part of your method or explain your code
  - 15 result images
  - Compare the result images that were generated by three different filters and describe what you observe

HW#5

- Rules in using C/C++ OpenCV Lib

    ➢ Use [OpenCV-2.x](#) version

    ➢ Allow use:

    1. Read, save, show image (cvLoadImage, cvShowImage, …)

    2. Define image (Mat)

    3. Get image size (cvSize, cvGetSize)

    ➢ Not Allow use:

    1. Cannot use the function of Lib to do the main part of homework.

        Example: filter2D, medianBlur, GaussianBlur, blur

        Other libs also not allow use to do the main part of homework

HW#5

- Rules in using Python OpenCV Lib

  ➢Allow use:

  1. Read, save, show image (cv2.imread, cv2.imshow, …)

  2. Define image

  3. Get image size

  ➢Not Allow use:

  1. Cannot use the function of Lib to do the main part of homework.

     Example: cv.filter2D, cv.medianBlur, cv.GaussianBlur, cv.blur

     Other libs also not allow use to do the main part of homework
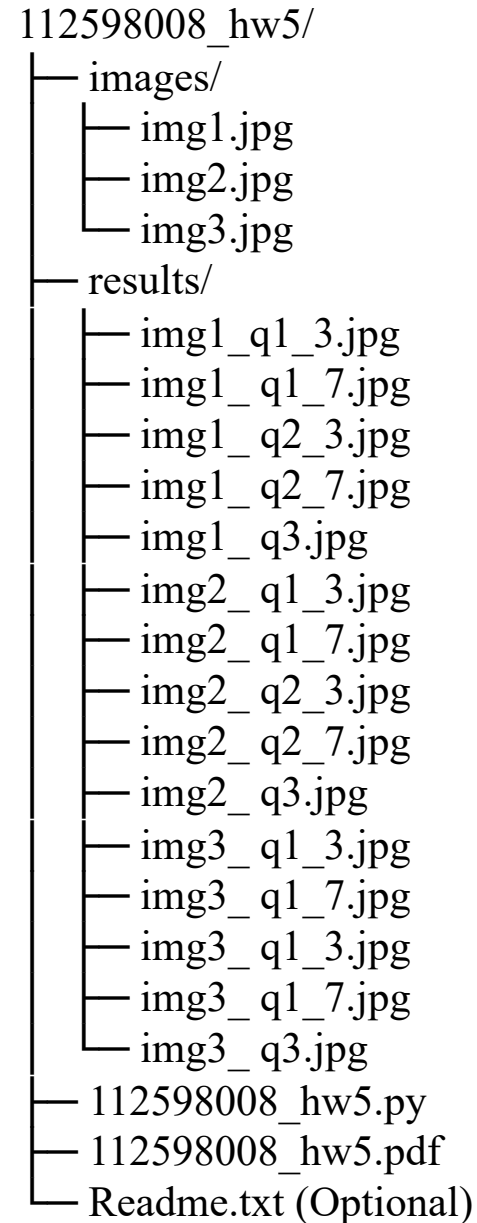
HW#5

- Grade
  - Program(80%)
    - Mean Filter (25%)
    - Median Filter(25%)
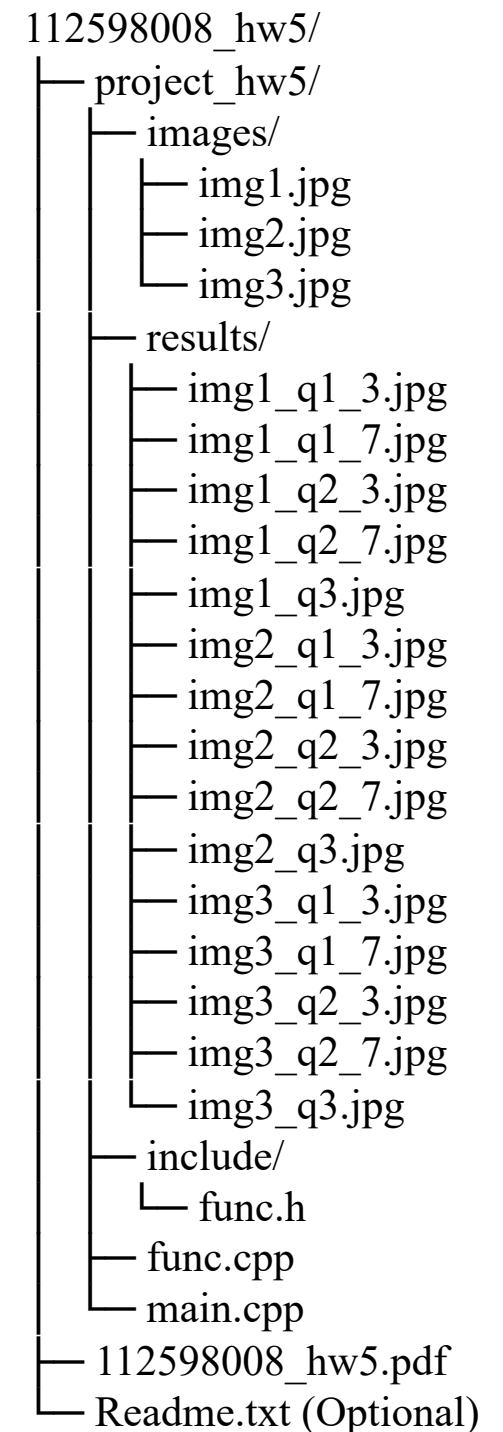   - Gaussian 2D Filter(30%)
  - Report(20%)

HW#5

- Folder Structure

  ➢ There are 15 images in
     the results folder.

  ➢ Write homework on the
     one program.

Python

```
112598008_hw5/
├── images/
│   ├── img1.jpg
│   ├── img2.jpg
│   └── img3.jpg
├── results/
│   ├── img1_q1_3.jpg
│   ├── img1_ q1_7.jpg
│   ├── img1_ q2_3.jpg
│   ├── img1_ q2_7.jpg
│   ├── img1_ q3.jpg
│   ├── img2_ q1_3.jpg
│   ├── img2_ q1_7.jpg
│   ├── img2_ q2_3.jpg
│   ├── img2_ q2_7.jpg
│   ├── img2_ q3.jpg
│   ├── img3_ q1_3.jpg
│   ├── img3_ q1_7.jpg
│   ├── img3_ q1_3.jpg
│   ├── img3_ q1_7.jpg
│   └── img3_ q3.jpg
├── 112598008_hw5.py
├── 112598008_hw5.pdf
└── Readme.txt (Optional)
```

C/C++

```
112598008_hw5/
├── project_hw5/
│   ├── images/
│   │   ├── img1.jpg
│   │   ├── img2.jpg
│   │   └── img3.jpg
│   ├── results/
│   │   ├── img1_q1_3.jpg
│   │   ├── img1_q1_7.jpg
│   │   ├── img1_q2_3.jpg
│   │   ├── img1_q2_7.jpg
│   │   ├── img1_q3.jpg
│   │   ├── img2_q1_3.jpg
│   │   ├── img2_q1_7.jpg
│   │   ├── img2_q2_3.jpg
│   │   ├── img2_q2_7.jpg
│   │   ├── img2_q3.jpg
│   │   ├── img3_q1_3.jpg
│   │   ├── img3_q1_7.jpg
│   │   ├── img3_q2_3.jpg
│   │   ├── img3_q2_7.jpg
│   │   └── img3_q3.jpg
│   ├── include/
│   │   └── func.h
│   ├── func.cpp
│   └── main.cpp
├── 112598008_hw5.pdf
└── Readme.txt (Optional)
```

HW#5

- Please compress your files.

  ➢ Example: 112598008_hw5.zip

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  ➢ For each hour late, 10% of the total score will be deducted.

- Don't share your code and your report with other students.

  Do it by yourself.