

Computer Vision Homework #2

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Robot Vision Lab (Room 1421)



Homework Assignment

- 2023/10/03 – Homework 1 assigned, due 10/17
- **2023/11/07 – Homework 2 assigned, due 11/21**
- 2023/11/28 – Homework 3 assigned, due 12/12
- 2023/12/19 – Homework 4 assigned, due 01/02

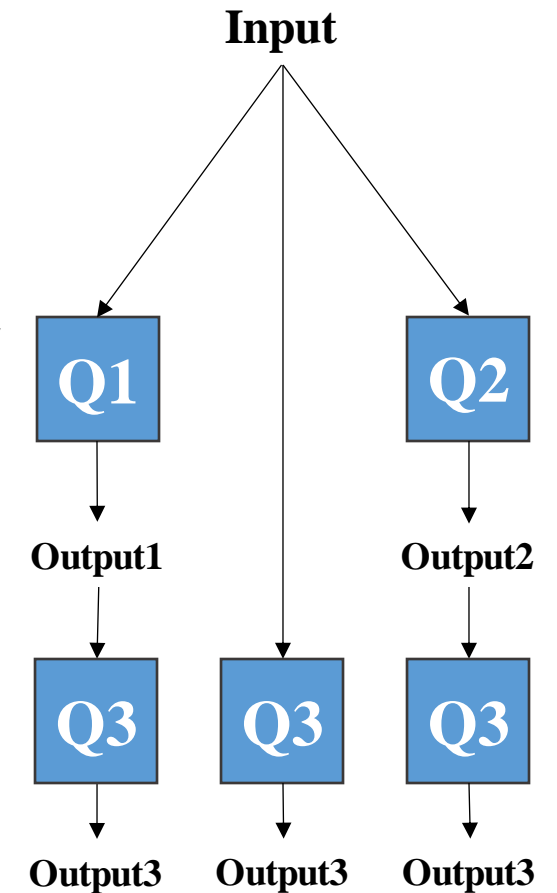
Note

- What is considered to be “main part of the homework”
- Do the homework according to the instructions. If you have another method, you can show it in the report, but don't ignore/replace the original instructions.
- Don't forget the zero padding, check your image size result
- Please check again your zip files content before submit
- Don't forget to use the correct input image
- Please follow the rule to name your file
- Introduce “Coding Style” score for next HW
 - More “original” code will have more score
 - Less function from library used will have more score
- Don't copy other code and/or report

Homework 2

Given 2 images with **noise** (noise1.png and noise2.png) for testing as follow:

1. **Mean Filter** : decide the kernel size, stride, and zero-padding size by yourself. Use the same setting for all the noise images.
(save as noise1_q1.png and noise2_q1.png)
2. **Median Filter** : decide the kernel size, stride, and zero-padding size by yourself. Use the same setting for all the noise images.
(save as noise1_q2.png and noise2_q2.png)
3. **Image Histogram** : accumulate the number of each pixel value, then draw a histogram for each image, and explain the histogram result in your report
(save as : noise1_his.png, noise1_q1 _his.png, noise1_q2 _his.png, noise2_his.png, noise2_q1 _his.png, noise2_q2 _his.png)



※ There will be totally 2 test images and 10 result images in your report.

Example for the rules in using OpenCV or other Lib

❑ Allow use Opencv for C/C++

Read, load, save, show : cvLoadImage, cvShowImage ...

Define size of image: cvSize, cvGetSize

Define image : Mat

❑ Not Allow use

Cannot use the function of OpenCV Lib to do the main part of homework, only allowed to use if I said it/agree with it.

Not limited to the OpenCV library only

Example:

- ✓ cvtColor(image, gray, CV_RGB2GRAY); // convert RGB to Gray
- ✓ cv2.filter2D //directly use convolution
- ✓ np.Convolve2D //directly use convolution

Mean Filter and Median Filter



Noisy image



Filtered by Mean Filter



Filtered by Median Filter

Example : 3*3 Mean Filter

As the kernel size increases, the image will become more blurry.

image

152	124	252	163	32	67
128	40	220	190	142	216
68	157	24	30	140	36
81	7	25	149	155	41
22	33	100	131	75	67
69	44	44	167	231	161

*

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

=

129			

※ Please implement the mean algorithm by yourself.

$$\left\lfloor \frac{1}{9} (152 + 124 + 252 + 128 + 40 + 220 + 68 + 157 + 24) \right\rfloor = 129$$

Example : 3*3 Median Filter

It's a nonlinear filter.

152	124	252	163	32	67
128	40	220	190	142	216
68	157	24	30	140	36
81	7	25	149	155	41
22	33	100	131	75	67
69	44	44	167	231	161

image

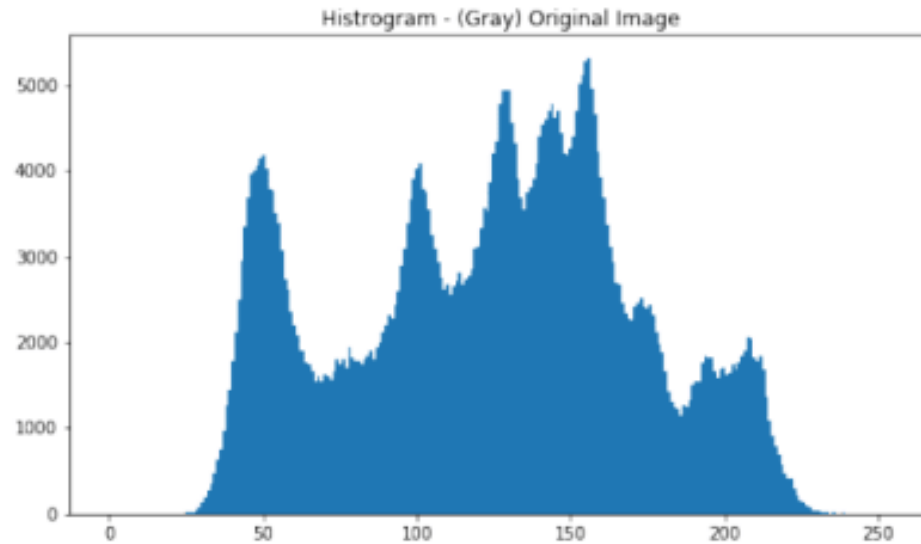
Sorting : 24, 40, 68, 124, 128, 152, 157, 220, 252

128			

※ Please implement the sorting algorithm by yourself.

Image Histogram

Count the number of each pixel's intensity (0~255)



Create a table to record the number of each pixel's intensity.

You can draw the histogram by using the library of matplotlib or others. (exception)

Example : Image Histogram

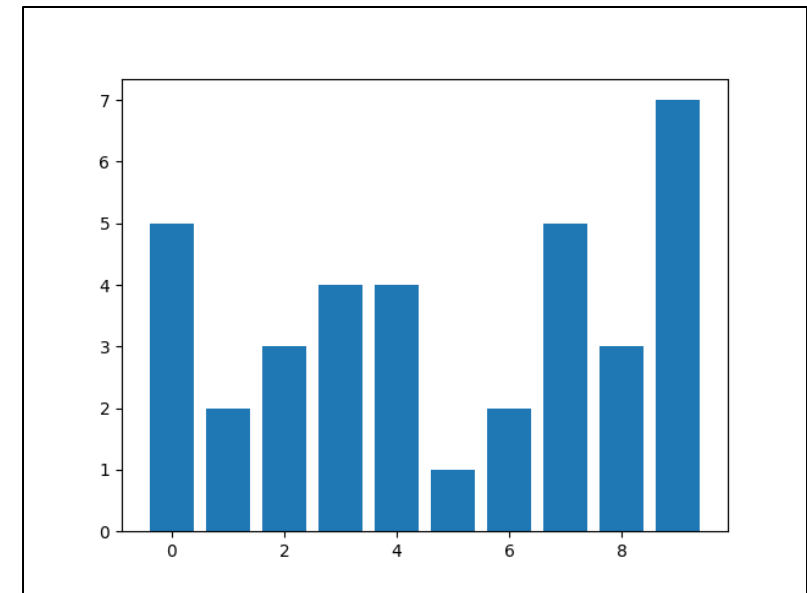
1	3	7	3	0	7
5	2	3	9	1	4
4	9	4	7	7	6
2	7	8	5	6	0
1	9	0	4	2	1
0	3	8	9	8	9

image

statistics

value	0	1	2	3	4	5	6	7	8	9
#num	5	2	3	4	4	1	2	5	3	7

draw histogram



※ The sum of #num must be equal to width of image * height of image

Grading

- Program (75%)
 - Mean Filter (25%)
 - Median Filter (25%)
 - Image Histogram (15%)
 - Coding Style (10%)
- Report (25%)
 - Please explain your code.
 - For each test image, compare the result images that were generated by two different filters and describe what you observe.
 - For each test image, please describe the difference between three histograms (original, mean filter output, and median filter output), and explain the reason.
 - Please paste 10 output images in your report.

Folder Structure

Python

```
111999406_hw2/
├── test_img/
│   ├── noise1.png
│   ├── noise2.png
│   └── result_img/
│       ├── noise1_q1.png
│       ├── noise1_q2.png
│       ├── noise1_his.png
│       ├── noise1_q1_his.png
│       ├── noise1_q2_his.png
│       ├── noise2_q1.png
│       ├── noise2_q2.png
│       ├── noise2_his.png
│       ├── noise2_q1_his.png
│       └── noise2_q2_his.png
├── 111999406_hw2.py
├── 111999406_hw2.pdf
└── Readme.txt
```

Write your report in

English (PDF)

Explaining how your
main function
working, shown the
results on your report,
and explain the image
result.

C/C++

```
111999406_hw2/
├── project_hw2/
│   ├── test_img/
│   │   ├── noise1.png
│   │   └── noise2.png
│   ├── result_img/
│   │   ├── noise1_q1.png
│   │   ├── noise1_q2.png
│   │   ├── noise1_his.png
│   │   ├── noise1_q1_his.png
│   │   ├── noise1_q2_his.png
│   │   ├── noise2_q1.png
│   │   ├── noise2_q2.png
│   │   ├── noise2_his.png
│   │   ├── noise2_q1_his.png
│   │   └── noise2_q2_his.png
│   ├── include/
│   │   └── func.h
│   ├── func.cpp
│   └── main.cpp
├── 111999406_hw2.pdf
└── Readme.txt
```

Homework #2

- Please compress your files (program and report)
 - StudentID_hw2(for example: 111999406_hw2.zip)
- Please submit to iStudy, in Homework 2 Assignment.
- Deadline: **2023/11/21 23:59:59**
- 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.

Thanks for your attention