Computer Vision HW10 Report

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Contents

1 Source Code

This part of the report will go through some important snippets of my source code. For source code file, please check out the `hw10.py` file in the directory submitted.

1.1 Principle Code Sneak Peek

First, we will take a look at the overall structure of my code. And furthermore we will have some brief explanation for the implementation of the operators with different masks.

1.1.1 Functions Overview

In this homework, we are asked to implement 5 different kinds of zero-crossing edge detection methods. And there are 4 functions that I've created for those methods.
The following snapshot includes the signature of those 4 functions.

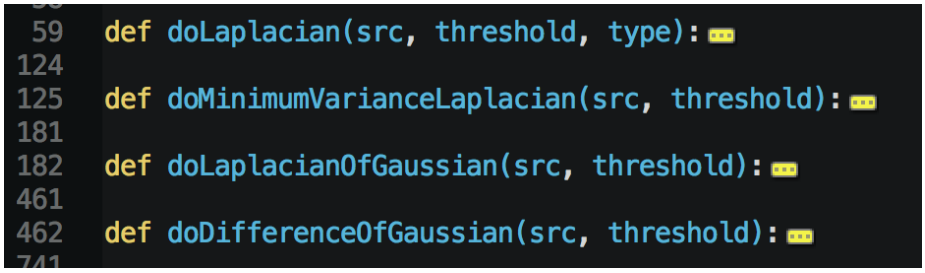

Figure 1: Essential Functions Overview

All of the functions above take these parameters: `src` and `threshold`, which respectively stands for source image (input image) and the threshold for this method. And all the functions, if no error occurs, return a new image which is properly processed image.
The function `doLaplacian();` takes an additional parameter: `type` due to the fact that we have 2 different masks for Laplacian method. And the `type` parameter should be either `1` or `2`; otherwise, the function returns the source image `src` without any processing.

1.1.2 Masks to be used

There are 5 different masks (kernels), and they result in 5 different images in the end.

The masks that I have utilized in my code (in `hw10.py`) are shown in the following figure.

```
DIGITAL_LAPLACIAN_MASK_1 = [
    0, 1, 0, 1, -4, 1, 0, 1, 0
]

DIGITAL_LAPLACIAN_MASK_2 = [
    1, 1, 1, 1, -8, 1, 1, 1, 1
]

DIGITAL_LAPLACIAN_MINIMUM_VARIANCE_MASK = [
    2, -1, 2, -1, -4, -1, 2, -1, 2
]

LAPLACIAN_OF_GAUSSIAN_KERNEL = [
    0, 0, 0, -1, -1, -2, -1, -1, 0, 0, 0,
    0, 0, -2, -4, -8, -9, -8, -4, -2, 0, 0,
    0, -2, -7, -15, -22, -23, -22, -15, -7, -2, 0,
    -1, -4, -15, -24, -14, -1, -14, -24, -15, -4, -1,
    -1, -8, -22, -14, 52, 103, 52, -14, -22, -8, -1,
    -2, -9, -23, -1, 103, 178, 103, -1, -23, -9, -2,
    -1, -8, -22, -14, 52, 103, 52, -14, -22, -8, -1,
    -1, -4, -15, -24, -14, -1, -14, -24, -15, -4, -1,
    0, -2, -7, -15, -22, -23, -22, -15, -7, -2, 0,
    0, 0, -2, -4, -8, -9, -8, -4, -2, 0, 0,
    0, 0, 0, -1, -1, -2, -1, -1, 0, 0, 0
]

DIFFERENCE_OF_GAUSSIAN_MASK = [
    -1, -3, -4, -6, -7, -8, -7, -6, -4, -3, -1,
    -3, -5, -8, -11, -13, -13, -13, -11, -8, -5, -3,
    -4, -8, -12, -16, -17, -17, -17, -16, -12, -8, -4,
    -6, -11, -16, -16, 0, 15, 0, -16, -16, -11, -6,
    -7, -13, -17, 0, 85, 160, 85, 0, -17, -13, -7,
    -8, -13, -17, 15, 160, 283, 160, 15, -17, -13, -8,
    -7, -13, -17, 0, 85, 160, 85, 0, -17, -13, -7,
    -6, -11, -16, -16, 0, 15, 0, -16, -16, -11, -6,
    -4, -8, -12, -16, -17, -17, -17, -16, -12, -8, -4,
    -3, -5, -8, -11, -13, -13, -13, -11, -8, -5, -3,
    -1, -3, -4, -6, -7, -8, -7, -6, -4, -3, -1
]
```

Figure 2: Masks to be used in this homework

DIGITAL_LAPLACIAN_MASK_1 the mask for Laplacian type 1.

DIGITAL_LAPLACIAN_MASK_2 the mask for Laplacian type 2.

DIGITAL_LAPLACIAN_MINIMUM_VARIANCE_MASK the mask for Minimum Variance Laplacian.

LAPLACIAN_OF_GAUSSIAN_KERNEL the kernel for Laplace of Gaussian.

DIFFERENCE_OF_GAUSSIAN_MASK the mask for Difference of Gaussian.

BBB mask for BBB.

1.2 Parameters (Threshold)

Here is the list of thresholds I used for each of the resulted image.

Laplacian Mask Type 1
my threshold = 15

Laplacian Mask Type 2
my threshold = 15

Minimum Variance Laplacian
my threshold = 20

Laplace of Gaussian
my threshold = 3000

Difference of Gaussian
my threshold = 1

2 Results

All the resulted images are properly saved and submitted along with this report document. You may go check them out if you'd like to.

2.1 Laplacian Mask Type 1

Figure 3: Laplacian type 1 with threshold=15

2.2 Laplacian Mask Type 2

Figure 4: Laplacian type 2 with threshold=15

2.3 Minimum Variance Laplacian

Figure 5: Minimum Variance Laplacian with threshold=20

2.4 Laplace of Gaussian

Figure 6: Laplace of Gaussian with threshold=3000

2.5 Difference of Gaussian

Figure 7: Difference of Gaussian with threshold=1