Computer Vision HW10

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Homework 10

Zero Crossing Edge Detection

Step:

1. 依照 mask 大小 padding 後，跟 mask 相乘並相加，如圖所示(有 1/3 的話就將 temp0 /3)

```cpp
for(int i = 0 ; i < x ; i++){
    for(int j = 0 ; j < y ; j++){
        int temp0 = 0;
        for(int a = -5 ; a < 6 ; a++){
            for(int b = -5 ; b < 6 ; b++){
                temp0 += pic[i + 5 + a][j + 5 + b] * mask[a+5][b+5];
            }
        }
        if (temp0 >= threshold) temp[i+1][j+1] = 1;
        else if (temp0 <= -threshold) temp[i+1][j+1] = -1;
        else temp[i+1][j+1] = 0;
    }
}
```

2. 求出之結果進行 zero crossing edge detection，先將 step1 求出之 temp padding，然後進行計算如圖

```cpp
Mat lena_Difference_of_Gaussian(512, 512, CV_8UC1, Scalar(0));

for(int i = 0 ; i < x ; i++){
    for(int j = 0 ; j < y ; j++){
        bool flag = 0;
        if(temp[i+1][j+1] == 1){
            for(int a = -1 ; a < 2; a++){
                for(int b = -1 ; b < 2 ; b++){
                    if(temp[i+1+a][j+1+b] == -1){
                        lena_Difference_of_Gaussian.at<uchar>(i,j) = 0;
                        flag = 1;
                        break;
                    }
                }
                if(flag == 1) break;
                if(flag == 0) lena_Difference_of_Gaussian.at<uchar>(i,j) = 255;
            }
        }
        else lena_Difference_of_Gaussian.at<uchar>(i,j) = 255;
    }
}
```

Result:

(a) Laplace Mask1:   thresholds : 15
Mask:

```
int mask[3][3] = {0, 1, 0,
                  1,-4, 1,
                  0, 1, 0 };
```


(b) Laplace Mask2:   thresholds : 15
Mask:

```
int mask[3][3] = {1, 1, 1,
                  1,-8, 1,
                  1, 1, 1 };
```

(c) Minimum variance Laplacian: thresholds : 20
   Mask:

```
int mask[3][3] = { 2,-1, 2,
                  -1,-4,-1,
                   2,-1, 2 };
```


(d) Laplace of Gaussian: thresholds : 3000
   Mask:

```
int mask[11][11] = { 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};
```

(e) Difference of Gaussian: thresholds : 1

Mask:

```
int mask[11][11] = {-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};
```