

Computer Vision Hw9

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Code

```
import cv2
import numpy as np
from scipy import signal
import math

def crossCorrelation(img, msk):
    pad_width = int(msk.shape[0] / 2)
    return signal.fftconvolve(np.pad(img, (pad_width, pad_width), "edge"), np.flip(msk),
mode = "valid").round(0).astype(int)

def zeroCross(img, msk, threshold):
    mat = crossCorrelation(img, msk)
    res = np.full(img.shape, 255)
    for r, c in np.ndindex(img.shape):
        if mat[r, c] < threshold:
            continue
        for dr in range(-1, 2):
            for dc in range(-1, 2):
                if 0 <= r + dr < img.shape[0] and 0 <= c + dc < img.shape[1] \
and mat[r + dr, c + dc] <= -threshold:
                    res[r, c] = 0
    return res

laplacian1 = np.array([[0, 1, 0], [1, -4, 1], [0, 1, 0]])
laplacian2 = np.array([[1, 1, 1], [1, -8, 1], [1, 1, 1]]) / 3
min_laplacian = np.array([[2, -1, 2], [-1, -4, -1], [2, -1, 2]]) / 3
log = np.array([[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]])
dog = np.array([[-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], \
```

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[-4, -8, -12, -16, -17, -17, -17, -16, -12, -8, -4],\n[-3, -5, -8, -11, -13, -13, -13, -11, -8, -5, -3],\n[-1, -3, -4, -6, -7, -8, -7, -6, -4, -3, -1]])
```

```
image = cv2.imread("lena.bmp", cv2.IMREAD_GRAYSCALE)\ncv2.imwrite("1_laplacian.bmp", zeroCross(image, laplacian1, 15))\ncv2.imwrite("2_laplacian.bmp", zeroCross(image, laplacian2, 15))\ncv2.imwrite("3_min_laplacian.bmp", zeroCross(image, min_laplacian, 20))\ncv2.imwrite("4_log.bmp", zeroCross(image, log, 3000))\ncv2.imwrite("5_dog.bmp", zeroCross(image, dog, 1))
```

Result

Laplacian 1 with thresholds 15



Laplacian 2 with thresholds 15



Minimum-variance Laplacian with thresholds 20



Laplacian of Gaussian thresholds 3000



Difference of Gaussian with thresholds 1

