Hong Trinh_438443
Embedded Vision

Assignment 2

In image filtering, the two basic filters are Low Pass Filter (LPF) and High Pass Filter (HPF). LPF is used to remove noise, blur, smoothen an image. HPF is used to detect edges in an image. Both use kernel which is an odd size matrix contains weights to filter an image. In case of LPF, all values in kernel sum up to 1. If the kernel contains both negative and positive weights, it's probably used to sharpen or smoothen an image.

Import the needed library named as OpenCV for image processing and NumPy for array. Reading the image and changing it into the gray image. Creating 3x3 kernel in range -9,9:

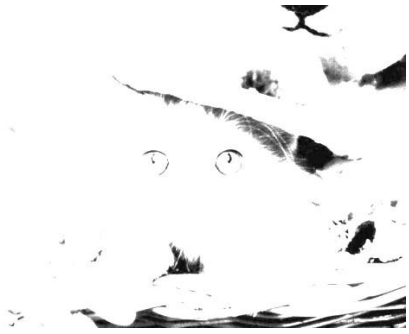
```
import cv2 as cv
import numpy as np

#read image
img = cv.imread('image.jpg')
img_gray = cv.cvtColor(img, cv.COLOR_BGR2GRAY)
#create a kernel 3x3
kernel1 = np.array([[-1, -1,  -1],
                    [-1,  9, -1],
                    [-1, -1,  -1]])
#mean filter
mean = np.array([[1, 1, 1],
                 [1, 1, 1],
                 [1, 1, 1]])
```

Using filter2D function to make a mask with kernel:

```
img_k = cv.filter2D(src=img_gray, ddepth=-1, kernel=kernel1)
img_m = cv.filter2D(src=img_gray, ddepth=-1, kernel=mean)
cv.imwrite('image_k.jpg', img_k)
cv.imwrite('image_mean.jpg', img_m)
```

The original image and the results are:





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The Laplacian edge detector uses only one kernel. It calculates second order derivatives in a single pass. Using Laplacian function with the k size is 7

```
img_noise = cv.imread('noise.jpg')
# Laplacian High Pass Filter
lap_filter = cv.Laplacian(img_noise, ddepth=-1, ksize=7, scale=1, borderType=cv.BORDER_DEFAULT)
cv.imwrite('laplacian.jpg', lap_filter)
```

Results:

Two filter to smooth the image: Gaussian Blur and median filter

```
# Apply Gaussian Blur
gau_blur = cv.GaussianBlur(img_noise,(3,3),0)
cv.imwrite('GaussianBlur.jpg', gau_blur)
#median filter
img2 = cv.medianBlur(img, 5)
cv.imwrite('image_blur.jpg', img2)
```

Result Gaussian Blur:

Result Median Filter:

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