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Semester: VI

Program: B.Tech

Branch: EXTC

Date of performance: 5th February

Date of Submission: 19th February

Experiment Number: 4

Aim:

a. To write a program in PYTHON to perform low pass averaging filtering in spatial domain on an image with Gaussian noise.

b. To write a program in PYTHON to perform median filtering in spatial domain on an image with salt and pepper noise.

c. To write a program in PYTHON to perform high pass filtering in spatial domain on a blur image.

Conclusion: Outcome:

From this experiment we learnt about neighborhood processing in spatial domain: Here, to modify one pixel, we consider values of the immediate neighboring pixels also. For this purpose, 3X3, 5X5, or 7X7 neighborhood mask can be considered.

Low Pass filtering: It is also known as the smoothing filter. It removes the high-frequency content from the image. It is also used to blur an image. A low pass averaging filter mask is as shown in the code.

High Pass Filtering: It eliminates low-frequency regions while retaining or enhancing the high-frequency components. A high pass filtering mask is as shown in the code.

Median Filtering: It is also known as nonlinear filtering. It is used to eliminate salt and pepper noise. Here the pixel value is replaced by the median value of the neighboring pixel.

Collab Link: https://colab.research.google.com/drive/1ZbxLdrMNQ30WGX-BsZpC5gka1TH0Gyv8?usp=sharing

```
# Low Pass Spatial Domain Filtering
# to observe the blurring effect


import cv2
import numpy as np
import matplotlib.pyplot as plt



# Read the image
img = cv2.imread('/content/Fig0333(a)(test_pattern_blurring_orig).tif', 0)

# Obtain number of rows and columns
# of the image
m, n = img.shape

# Develop Averaging filter(3, 3) mask
mask = np.ones([3, 3], dtype = int)
mask = mask / 9

print(mask)
```

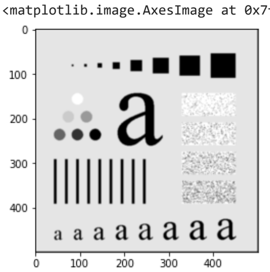
```
[[0.11111111 0.11111111 0.11111111]
 [0.11111111 0.11111111 0.11111111]
 [0.11111111 0.11111111 0.11111111]]
```

```
# Convolve the 3X3 mask over the image
img_new = np.zeros([m, n])

for i in range(1, m-1):
    for j in range(1, n-1):
        temp = img[i-1, j-1]*mask[0, 0]+img[i-1, j]*mask[0, 1]+img[i-1, j + 1]*mask[0, 2]+img[i, j-1]*mask[1, 0]+ img[i, j]*mask[1, 1]+img[i, j + 1]*mask[1, 2]+img[i

        img_new[i, j]= temp

img_new = img_new.astype(np.uint8)
cv2.imwrite('blurred.tif', img_new)
```

```
True
```

```
plt.imshow(img_new, cmap="gray", vmin=0, vmax=255)
```

```
<matplotlib.image.AxesImage at 0x7f43877a47b8>
```




```
#Spatial domain low pass filtering for a variable size image a more generalized approach
img_generalized = np.zeros([m,n], dtype=int)
x= int(input("Enter size of the mask: "))
y=x//2   #as we want both the values plus and minus 2 values
for i in range(1,m-1):
  for j in range(1,n-1):
    temp= img[i+(-x+2):i+(x-1),j+(-x+2):j+(x-1)]    #for the creation of the mask

    constant= np.sum(temp)   #adding the values we calculated
    img_generalized[i,j]= constant//y**2
```

```
Enter size of the mask: 15
```

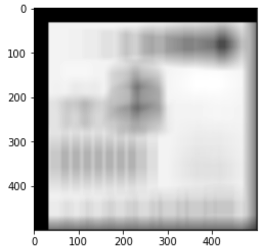
```
#Spatial domain low pass filtering for a variable size image a more generalized approach
img_generalized1 = np.zeros([m,n], dtype=int)
x= int(input("Enter size of the mask: "))
```

```
x= int(input("Enter size of the mask: "))
y=x//2   #as we want both the values plus and minus 2 values
for i in range(1,m-1):
  for j in range(1,n-1):
    temp= img[i+(-x+2):i+(x-1),j+(-x+2):j+(x-1)]    #for the creation of the mask

    constant= np.sum(temp)   #adding the values we calculated
    img_generalized1[i,j]= constant//y**2
```

```
Enter size of the mask: 35
```

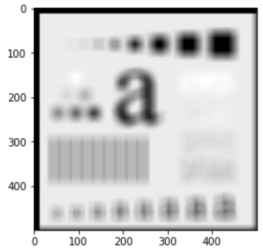
```
plt.imshow(img_generalized1, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7f43876d5fd0>
```



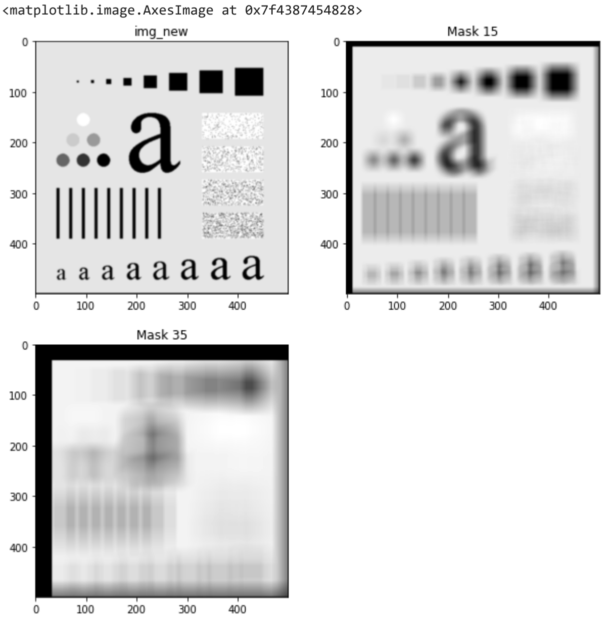
```
plt.imshow(img_generalized, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7f438777fb70>
```



```
fig = plt.figure(figsize=(10,10),facecolor='w')
plt.subplot(2,2,1)
plt.title("img_new")
plt.imshow(img_new, cmap="gray", vmin=0, vmax=255)
plt.subplot(2,2,2)
plt.title("Mask 15")
plt.imshow(img_generalized, cmap="gray")
plt.subplot(2,2,3)
plt.title("Mask 35")
plt.imshow(img_generalized1, cmap="gray")
```

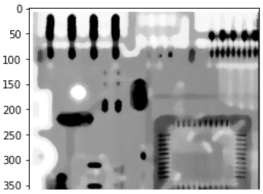
```
<matplotlib.image.AxesImage at 0x7f4387454828>
```




```
# Read the image method 1
img_salty = cv2.imread('/content/noisysaltpepper.tif', 0)
m1,n1 =img_salty.shape
```

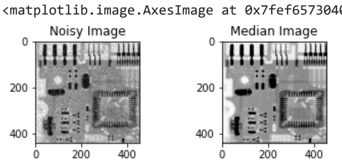
```
img_saltless = np.ones([m1, n1])

b1 = int(input("Enter the size of mask: "))
a1 = b1//2
for i in range(1, m1-1):
    for j in range(1, n1-1):
        temp1 = img_salty[i-a1:i+a1 ,j-a1:j+a1]

        constant= np.median(temp1)
        img_saltless[i,j]= constant

plt.imshow(img_saltless, cmap = 'gray')
```

```
Enter the size of mask: 15
/usr/local/lib/python3.6/dist-packages/numpy/core/fromnumeric.py:3373: RuntimeWarning: Mean of empty slice.
  out=out, **kwargs)
/usr/local/lib/python3.6/dist-packages/numpy/core/_methods.py:170: RuntimeWarning: invalid value encountered in double_scalars
  ret = ret.dtype.type(ret / rcount)
<matplotlib.image.AxesImage at 0x7fef64534710>
```



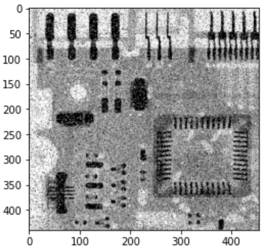
```
# Median Spatial Domain Filtering #Method 2(referred the net)


import cv2
import numpy as np


# Read the image
img_noisy1 = cv2.imread('/content/noisysaltpepper.tif', 0)

# Obtain the number of rows and columns
# of the image
m, n = img_noisy1.shape

# Traverse the image. For every 3X3 area,
# find the median of the pixels and
# replace the ceter pixel by the median
img_new1 = np.zeros([m, n])

for i in range(1, m-1):
    for j in range(1, n-1):
        temp = [img_noisy1[i-1, j-1],
               img_noisy1[i-1, j],
               img_noisy1[i-1, j + 1],
               img_noisy1[i, j-1],
               img_noisy1[i, j],
               img_noisy1[i, j + 1],
               img_noisy1[i + 1, j-1],
               img_noisy1[i + 1, j],
               img_noisy1[i + 1, j + 1]]

        temp = sorted(temp)
        img_new1[i, j]= temp[4]

img_new1 = img_new1.astype(np.uint8)
cv2.imwrite('new_median_filtered.png', img_new1)

plt.subplot(2,2,1)
plt.title("Noisy Image")
plt.imshow(img_noisy1, cmap="gray")
plt.subplot(2,2,2)
plt.title("Median Image")
plt.imshow(img_new1, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7fef65730400>
```



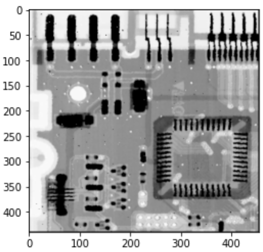

```
plt.imshow(img_noisy1, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7fef65698c88>
```



```
plt.imshow(img_new1, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7fef673aff60>
```



High pass filter

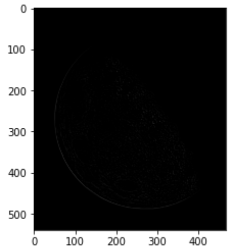
```
#import cv2, numpy, matplotlib
import cv2
import numpy as np
import matplotlib.pyplot as plt


img= cv2.imread('/content/blurry.tif',0) #Read the image
```

```
m,n=img.shape #Obtain number of rows and columns of the image


#Laplacian mask
mask= np.array([[0,1,0],[1,-4,1],[0,1,0]])


#Convolve the 3X3 mask over the image

img_new=np.zeros([m,n])
for i in range(1,m-1):
    for j in range(1,n-1):
        temp= img[i-1,j-1]*mask[0,0]+img[i-1,j]*mask[0,1]+img[i-1,j+1]*mask[0,2]+img[i,j-1]*mask[1,0]+img[i,j]*mask[1,1]+img[i,j+1]*mask[1,2]+img[i+1,j-1]*mask[2,0]+i

        img_new[i,j]=temp
#img_new=img_new.astype(np.uint8)
cv2.imwrite('laplacian1.png',img_new)
```

```
True
```

```
plt.imshow(img_new,cmap="gray", vmin=0, vmax= 255)
```

```
<matplotlib.image.AxesImage at 0x7f4389874550>
```

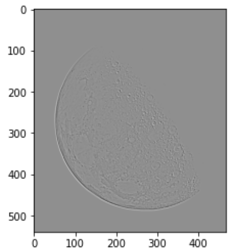



```
fmin=np.min(img_new)
print(fmin)
fmax=np.max(img_new)
print(fmax)
```

```
-106.0
83.0
```

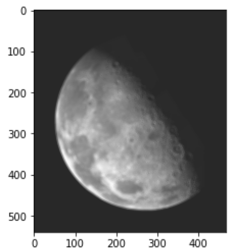
```
#scaling
#fm=f-min(f)
#fs=K[fm/max(fm ) , for 8 bit image, K=255
fm= img_new- fmin
img_sca= 255*fm/np.max(fm)
plt.imshow(img_sca, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7f43893bd860>
```



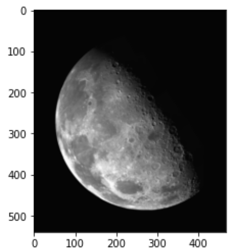

```
img_back= img+img_sca
plt.imshow(img_back,cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7f43893235c0>
```




```
#g(x,y)= 5f(x,y)- [f(x+1,y)+f(x-1,y)+f(x,y+1)+f(x,y-1)]
g=np.zeros([m,n])
for i in range(1,m-1):
    for j in range(1,n-1):
        g[i,j]=9*img[i,j]-img[i-1,j]-img[i+1,j]- img[i,j+1]-img[i,j-1]
plt.imshow(g, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7f438928a160>
```




```
fig = plt.figure(figsize=(20,20),facecolor='w')
plt.subplot(3,2,1)
plt.imshow(img, cmap="gray")
plt.title("Original")
plt.subplot(3,2,2)
```

```
plt.imshow(img_new, cmap="gray", vmax=255,vmin=0)
plt.title("Laplacian filtered image")
plt.subplot(3,2,3)
plt.imshow(img_sca, cmap="gray")
plt.title("Scaled Laplacian filtered image")
plt.subplot(3,2,4)
plt.imshow(img_back, cmap="gray")
plt.title("Recovering the background by adding original to Laplacian filtered image")
plt.subplot(3,2,5)
plt.imshow(g, cmap="gray")
plt.title("Laplacian filtered image with back ground preserved")
```

```
Text(0.5, 1.0, 'Laplacian filtered image with back ground preserved')
```