college-assignment (/github/sachi1406/college-assignment/tree/main)
/
IP_Expt_6_Sachi_Shah.ipynb (/github/sachi1406/college-assignment/tree/main/IP_Expt_6_Sachi_Shah.ipynb)

(https://colab.research.google.com/github/sachi1406/college-assignment/blob/main/IP_Expt_6_Sachi_Shah.ipynb)

IP-Experiment Number 6

Edge Detection using Sobel Mask

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Aim:

1. Apply Sobel's mask on the given test image to obtain component of gradient $|g_x|$,$|g_y|$and $|g_x + g_y|$.
2. Apply 5x5 averaging filter on the test image and then implement the sequence in step a.
3. Summarize your observations after comparing the results obtained in step a and b.

Import Libraries

In [ ]:

```
import cv2
from skimage import io
import matplotlib.pyplot as plt
import numpy as np
from scipy import signal
```

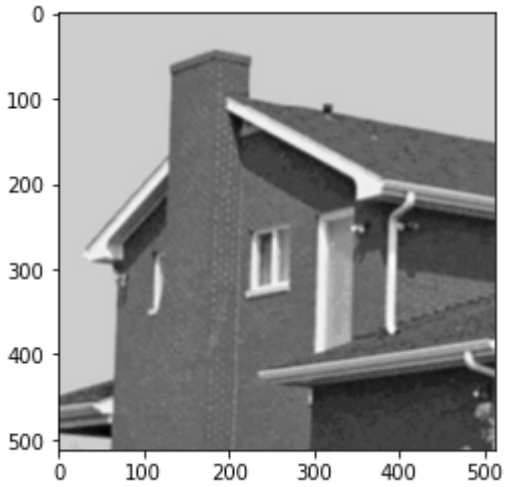
Theory:
The Sobel operator performs a 2-D spatial gradient measurement on an image and so emphasizes regions of high spatial frequency that correspond to edges.

In [ ]:

```
# load the image house.tiff and read the same
img = cv2.imread('house.tif', 0)
plt.imshow(img, cmap='gray')
```

Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa7160f3750>
```



Sobel operator for horizontal edges

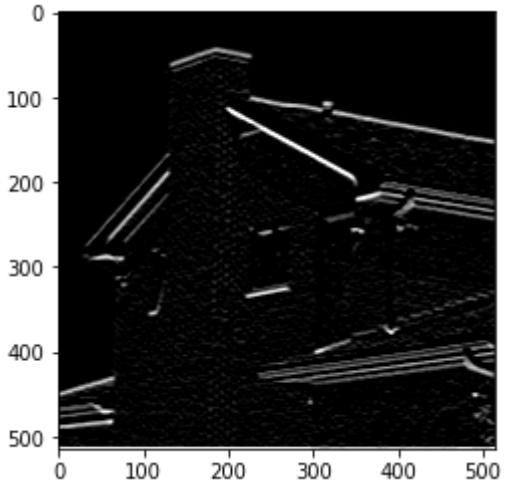
-1	-2	-1
0	0	0
1	2	1

In [ ]:

```
#Detect horizontal edges using in built convolution function
mask_hor = [[-1,-2,-1],[0,0,0],[1,2,1]]
hor = signal.convolve2d(img,mask_hor)
plt.imshow(hor,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa715b84c10>
```



Sobel operator for vertical edges

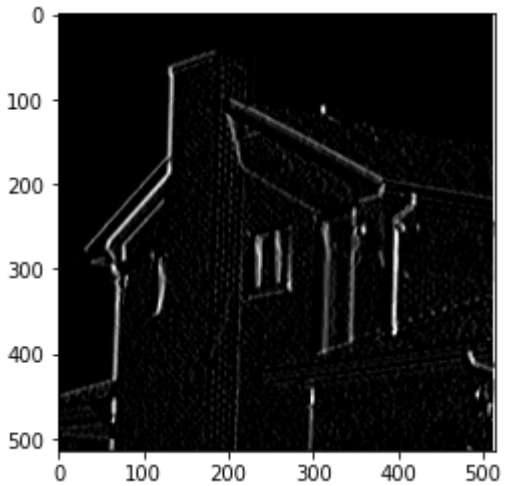
-1	0	1
-2	0	2
-1	0	1

In [ ]:

```
#Detect vertical edges using inbuilt function for convolution
mask_ver = [[-1,0,1],[-2,0,2],[-1,0,1]]
ver = signal.convolve2d(img,mask_ver)
plt.imshow(ver,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa715af72d0>
```



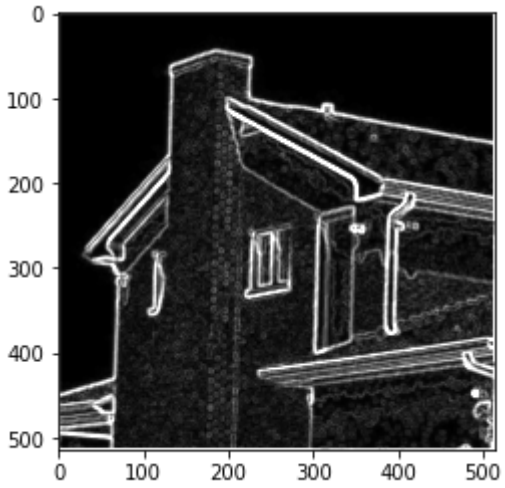
Detecting vertical and horizontal edges using |gx|+|gy|

In [ ]:

```
#Detecting vertical and horizontal edges
final = abs(hor) + abs(ver)
plt.imshow(final,cmap = 'gray',vmin = 0,vmax = 255)
```

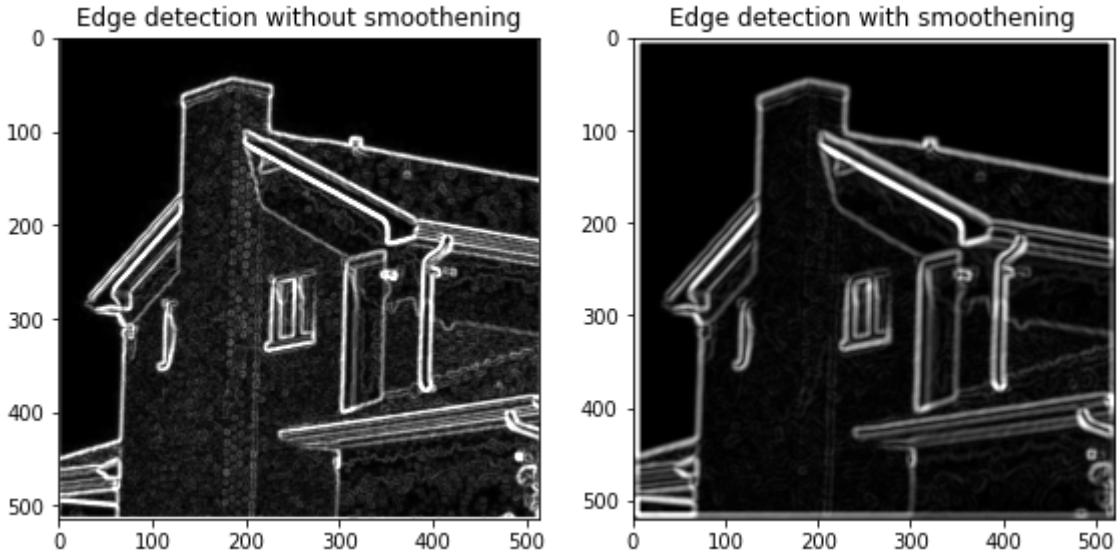
Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa714fc95d0>
```



In [ ]:

```
#remove fine details
#effect of smoothening and then performing edge detection
#smoothening

mask = np.ones((7,7),dtype = int)
mask_s = mask/49
smooth = signal.convolve2d(img,mask_s)

mask_hor = [[-1,-2,-1],[0,0,0],[1,2,1]]
hor_smoothened = signal.convolve2d(smooth,mask_hor)

mask_ver = [[-1,0,1],[-2,0,2],[-1,0,1]]
ver_smoothened = signal.convolve2d(smooth,mask_ver)

output_after_smoothening = abs(hor_smoothened) + abs(ver_smoothened)

plt.figure(figsize=(8,8))

plt.subplot(121)
plt.imshow(final,cmap='gray',vmin = 0,vmax = 255)
plt.title('Edge detection without smoothening')
plt.subplot(122)
plt.imshow(output_after_smoothening,cmap='gray',vmin = 0,vmax = 255)
plt.title('Edge detection with smoothening')

plt.tight_layout()
```



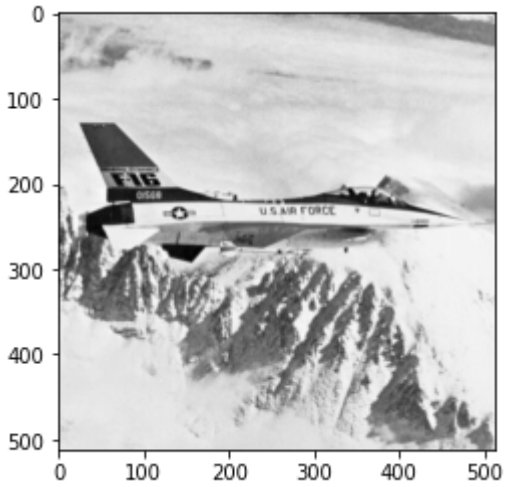
Students have to perform all the above steps for jetplane.tif image

In [ ]:

```
# load the jetplane.tif image and read the same
img_jet = cv2.imread('jetplane.tif', 0)
plt.imshow(img_jet, cmap='gray')
```

Out[ ]:

<matplotlib.image.AxesImage at 0x7fa711b44910>

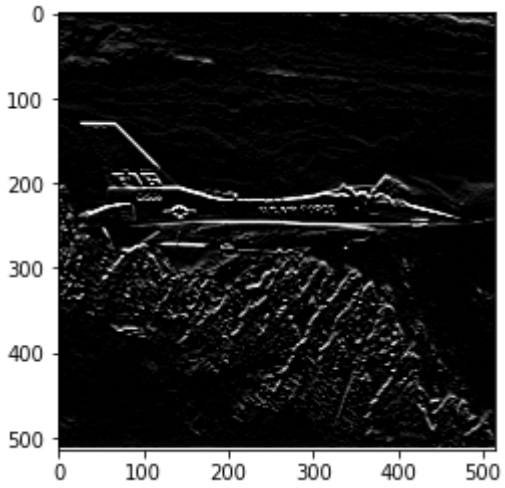


In [ ]:

```
#Detect horizontal edges using in built convolution function
mask_hor_jet = [[-1,-2,-1],[0,0,0],[1,2,1]]
hor_jet = signal.convolve2d(img_jet,mask_hor_jet)
plt.imshow(hor_jet,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

<matplotlib.image.AxesImage at 0x7fa711a96c50>

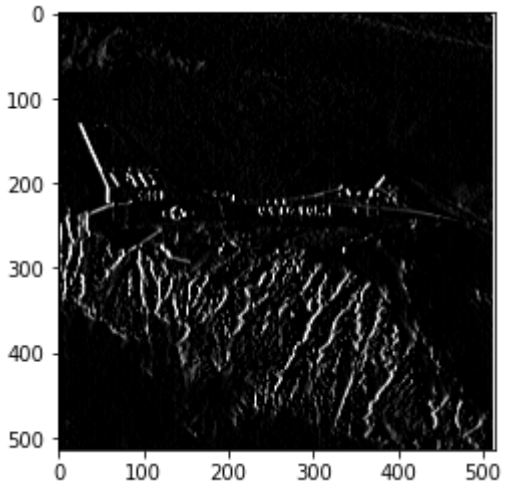


In [ ]:

```
#Detect vertical edges using inbuilt function for convolution
mask_ver_jet = [[-1,0,1],[-2,0,2],[-1,0,1]]
ver_jet = signal.convolve2d(img_jet,mask_ver_jet)
plt.imshow(ver_jet,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

<matplotlib.image.AxesImage at 0x7fa711a0a410>

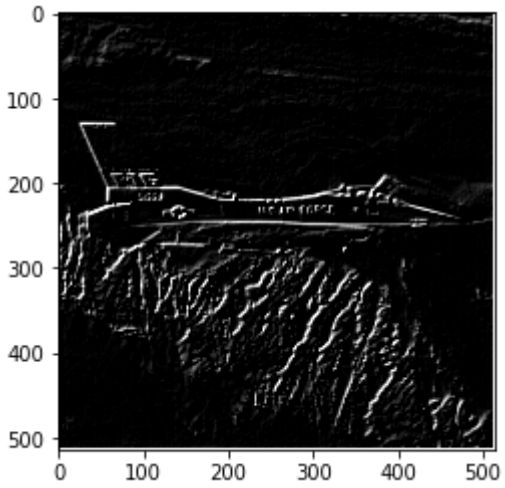


In [ ]:

```
# Detecting Diagonal with inbuilt convolve (forward Diagonal)

mask_diag_forward = [[-2,-1,0],[-1,0,1],[0,1,2]]
diag_forward = signal.convolve2d(img_jet,mask_diag_forward)
plt.imshow(diag_forward,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

<matplotlib.image.AxesImage at 0x7fa711915e90>



Backward diagonal edges

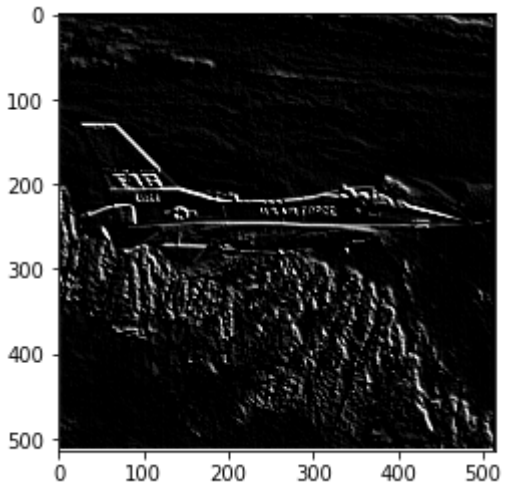
0	-1	-2
1	0	-1
2	1	0

In [ ]:

```
# Detecting Diagonal with inbuilt convolve (Backward Diagonal)

mask_diag_backward = [[0,-1,-2],[1,0,-1],[2,1,0]]
diag_backward = signal.convolve2d(img_jet,mask_diag_backward)
plt.imshow(diag_backward,cmap = 'gray',vmin = 0,vmax = 255)
```

Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa711882950>
```



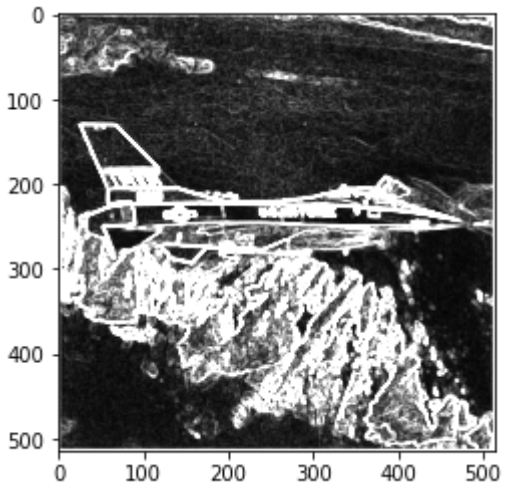
Edge in all four directions

In [ ]:

```
#Horizontal, vertical and diagonal edges

final_jet = abs(hor_jet) + abs(ver_jet) + abs(diag_forward) + abs(diag_backward)
plt.imshow(final_jet,cmap = 'gray',vmin = 0,vmax = 255)
```

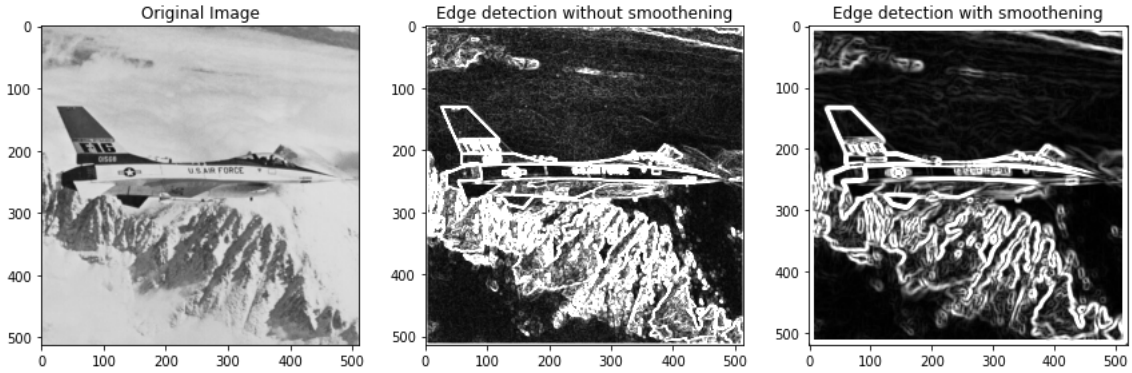
Out[ ]:

```
<matplotlib.image.AxesImage at 0x7fa709b99310>
```



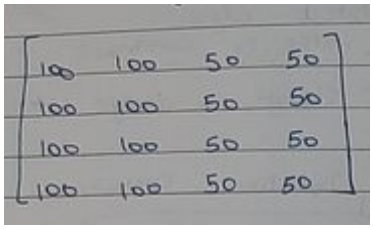
In [ ]:

```
#remove fine details
#effect of smoothening and then performing edge detection
#smoothening

mask = np.ones((7,7),dtype = int)
mask_s = mask/49
smooth_jet = signal.convolve2d(img_jet,mask_s)

jet_mask_hor = [[-1,-2,-1],[0,0,0],[1,2,1]]
jet_hor_smoothened = signal.convolve2d(smooth_jet,jet_mask_hor)

jet_mask_ver = [[-1,0,1],[-2,0,2],[-1,0,1]]
jet_ver_smoothened = signal.convolve2d(smooth_jet,jet_mask_ver)

jet_mask_diag_backward = [[0,-1,-2],[1,0,-1],[2,1,0]]
jet_diag_backward_smoothened = signal.convolve2d(smooth_jet,jet_mask_diag_backward)

jet_mask_diag_forward = [[-2,-1,0],[-1,0,1],[0,1,2]]
jet_diag_forward_smoothened = signal.convolve2d(smooth_jet,jet_mask_diag_forward)

output_after_smoothening_jet = abs(jet_hor_smoothened) + abs(jet_ver_smoothened) + abs

plt.figure(figsize=(12,12))

plt.subplot(131)
plt.imshow(img_jet,cmap='gray',vmin = 0,vmax = 255)
plt.title('Original Image')
plt.subplot(132)
plt.imshow(final_jet,cmap='gray',vmin = 0,vmax = 255)
plt.title('Edge detection without smoothening')
plt.subplot(133)
plt.imshow(output_after_smoothening_jet,cmap='gray',vmin = 0,vmax = 255)
plt.title('Edge detection with smoothening')

plt.tight_layout()
```



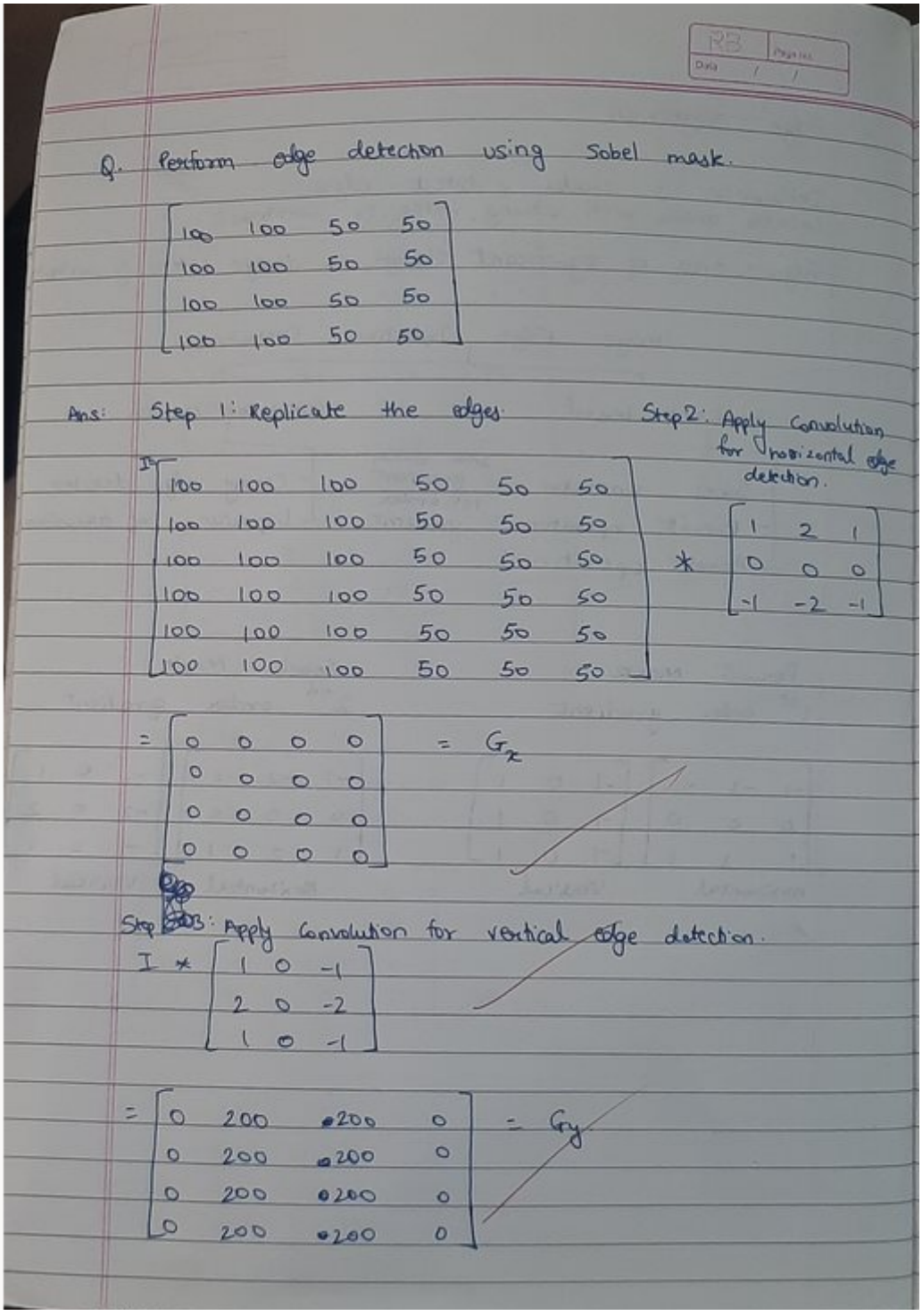
The following question has to be solved by students. Scan and copy-paste the answer here.

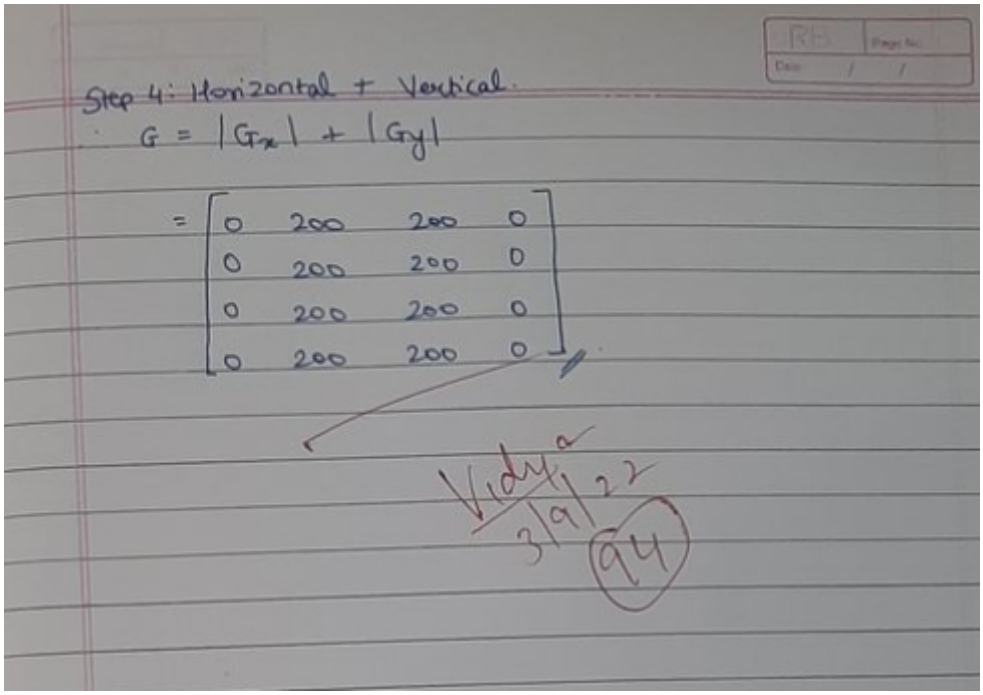
Q. consider the given image matrix



Replicate the edges and apply sobel mask to detect the gradient in :
(i) horizontal firection (ii) vertical direction (iii) horizonatla and vertical direction

Answer





Conclusion :

1. We implemented the code for edge detection using Sobel Mask. Sobel mask is based on second order derivative.
2. We detected the horizontal, vertical and diagonal edges of the given image however the sobel mask also detects the minute details that are sometimes unrequired.
3. These can be removed by first smoothening the image using the average filter and then doing edge detection.