Name : Dilshan J.V.A.P

Index number : 190144D

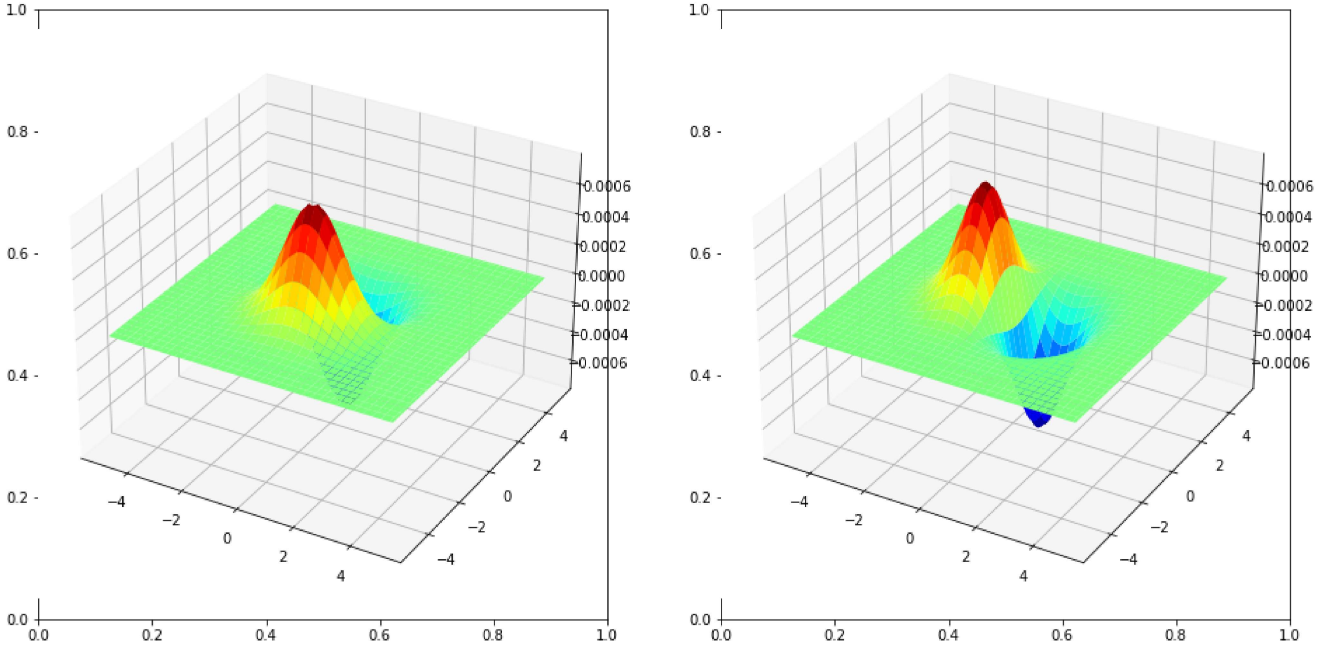
Exercise 4

In [ ]:

```
import numpy as np
import cv2 as cv
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm
```

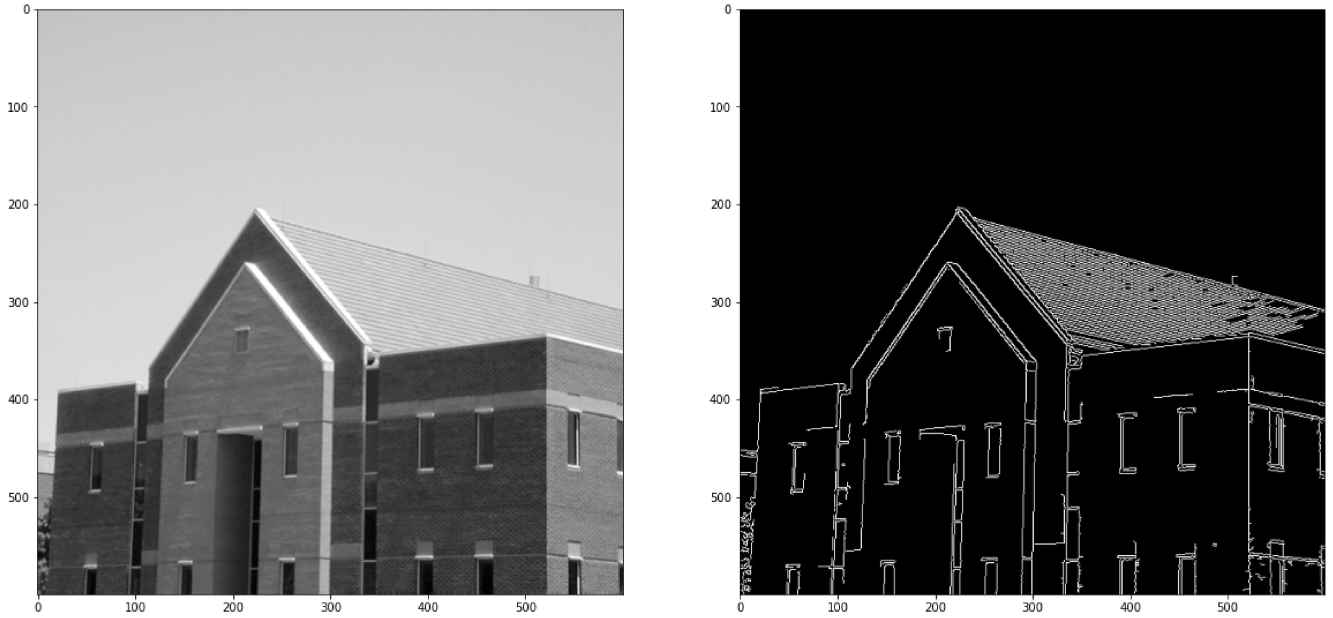
In [ ]:

```
#(1)
fig,ax = plt.subplots(1,2,figsize=(16,8))
ax1=fig.add_subplot(121,projection='3d')
ax2=fig.add_subplot(122,projection='3d')

delta=0.1
XX,YY=np.meshgrid(np.arange(-5,5+delta,delta),np.arange(-5,5+delta,delta))

sigma=1
g=np.exp(-(XX**2+YY**2)/(2*sigma**2))
g/=np.sum(g)
sobel_v=np.array([[-1,-2,-1],[0,0,0],[1,2,1]],dtype=np.float32)
g_x=cv.filter2D(g,-1,sobel_v)
sobel_h=np.array([[-1,0,1],[-2,0,2],[-1,0,1]],dtype=np.float32)
g_y=cv.filter2D(g,-1,sobel_h)

surf1=ax1.plot_surface(XX,YY,g_x,cmap=cm.jet,linewidth=0,antialiased=True)
surf2=ax2.plot_surface(XX,YY,g_y,cmap=cm.jet,linewidth=0,antialiased=True)
plt.show()
```



In [ ]:

```
#(4)
im = cv.imread (r'building.tif', cv.IMREAD_GRAYSCALE)
assert im is not None
edges = cv.Canny (im, 100, 200) # image, low threshold, high threshold
fig, ax = plt. subplots(1,2, figsize=(20, 20))
ax[0].imshow (im, cmap='gray')
ax[1].imshow (edges, cmap='gray')
plt.show()
```

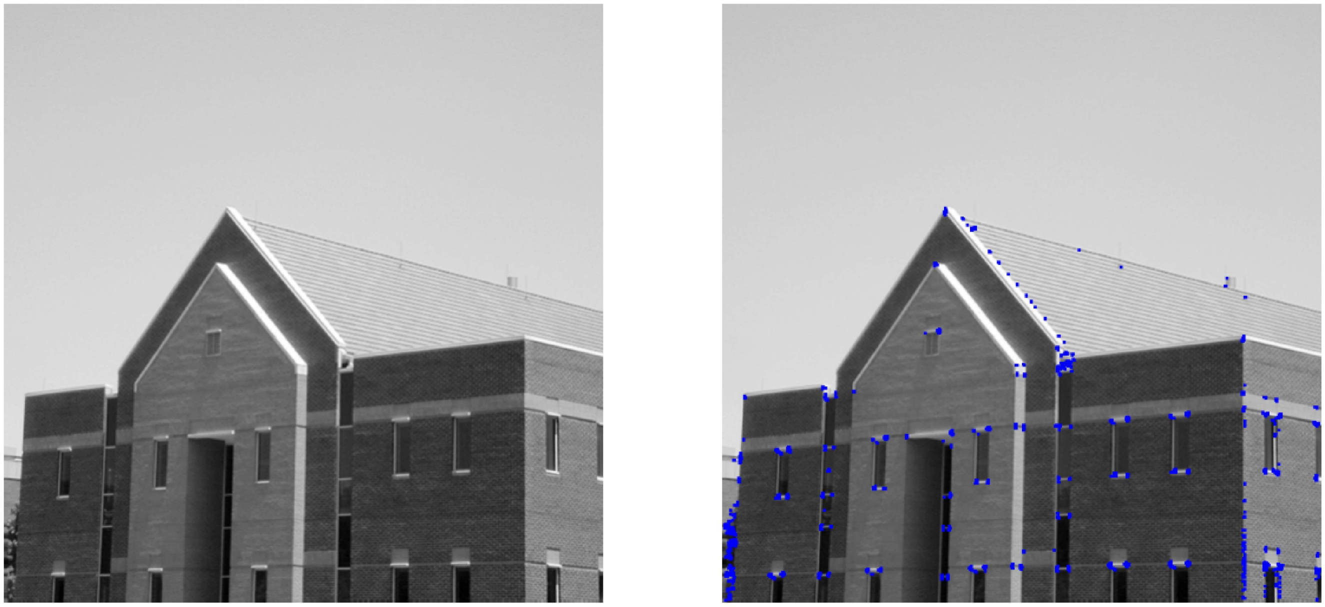


In [ ]:

```python
#(2)
im = cv.imread (r'building.tif', cv.IMREAD_COLOR)
assert im is not None
gray = cv.cvtColor(im, cv.COLOR_BGR2GRAY)
gray= np. float32 (gray)
dst = cv.cornerHarris(gray, 2, 3, 0.04)
dst = cv.dilate(dst, None)
im[dst > 0.01*dst.max()] = [0, 0, 255]
fig, ax = plt. subplots(1,2, figsize=(20, 20))
ax[0].imshow (gray, cmap='gray')
ax[0].axis('off')
ax[1].imshow (im, cmap='gray')
ax[1].axis('off')
```

Out[ ]:

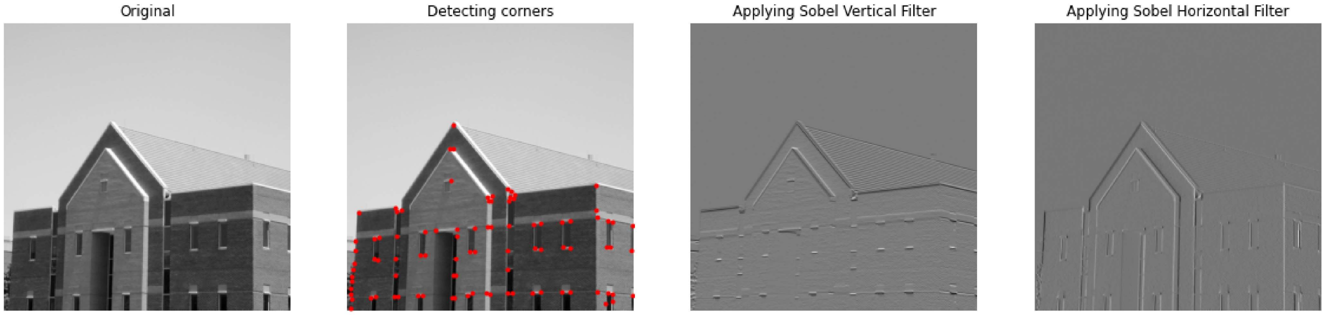
```
(-0.5, 599.5, 599.5, -0.5)
```



In [ ]:

```python
#(3)
from skimage.feature import peak_local_max
im = cv.imread (r'building.tif', cv.IMREAD_COLOR)
assert im is not None
fig, ax = plt. subplots(1,4, figsize=(20, 20))
ax[0].imshow (im, cmap='gray')
ax[0].set_title('Original')
I=cv.cvtColor(im,cv.COLOR_BGR2GRAY)
I=np.float32(I)

sobel_v=np.array([[-1,-2,-1],[0,0,0],[1,2,1]],dtype=np.float32)
sobel_h=np.array([[-1,0,1],[-2,0,2],[-1,0,1]],dtype=np.float32)
```

```
Ix=cv.filter2D(I,-1,sobel_v)
Iy=cv.filter2D(I,-1,sobel_h)

sigma=3
ksize=7
m11=cv.GaussianBlur(Ix*Ix,(ksize,ksize),sigma)
m12=cv.GaussianBlur(Ix*Iy,(ksize,ksize),sigma)
m21=m12
m22=cv.GaussianBlur(Iy*Iy,(ksize,ksize),sigma)

det=m11*m22-m12*m21
trace=m11+m22
alpha=0.04
R=det-alpha*trace**2
R[R<1e8]=0
cordinates=peak_local_max(R,min_distance=2)

ax[1].imshow (im, cmap='gray')
ax[1].plot(cordinates[:,1],cordinates[:,0],'r.')
ax[1].set_title('Detecting corners')
ax[2].imshow (Ix+127, cmap='gray')
ax[2].set_title('Applying Sobel Vertical Filter')
ax[3].imshow (Iy+127, cmap='gray')
ax[3].set_title('Applying Sobel Horizontal Filter')

for i in range(4):
    ax[i].axis('off')
```



Original

Detecting corners

Applying Sobel Vertical Filter

Applying Sobel Horizontal Filter