Exercise 4

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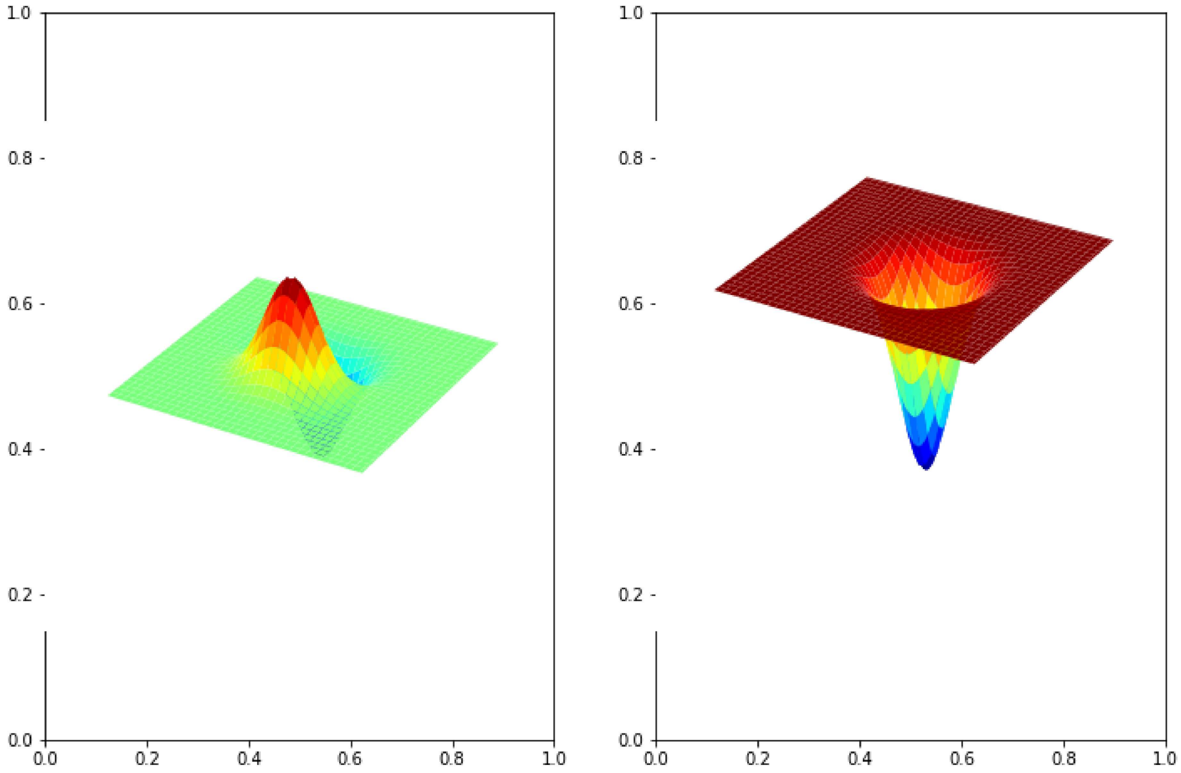
In [ ]:

```
#Importing Libraries
import numpy as np
import sympy as sy
import matplotlib.pyplot as plt
import cv2 as cv
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm
%matplotlib inline
```

Question 1

In [ ]:

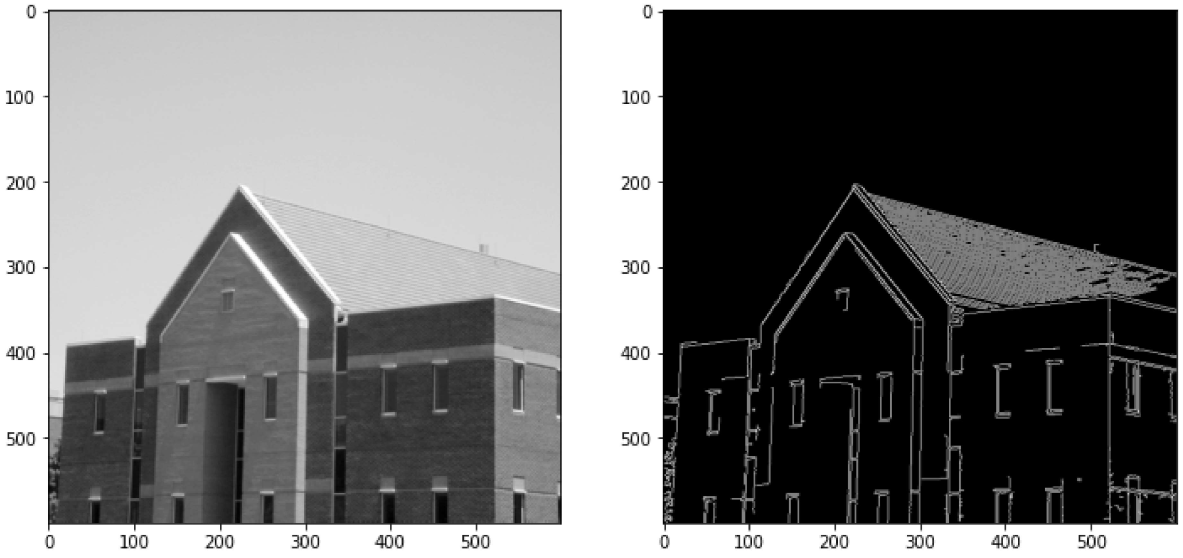
```
fig,ax=plt.subplots(1,2,figsize=(12,8))
ax1 = fig.add_subplot(121,projection='3d')
ax2 = fig.add_subplot(122,projection='3d')

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)
ax1.axis('off')
ax2.axis('off')
plt.show()
```



Detect Edges

In [ ]:

```
img = cv.imread("building.tif",cv.IMREAD_GRAYSCALE)
assert img is not None

edges=cv.Canny(img,100,200)

fig,ax=plt.subplots(1,2,figsize=(12,12))
ax[0].imshow(img,cmap='gray')
ax[1].imshow(edges,cmap='gray')
plt.show()
```



Detect Corners

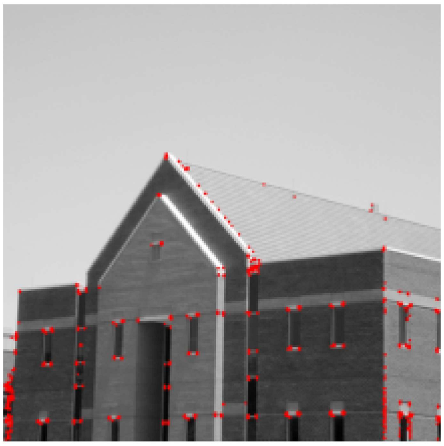
In [ ]:

```
img = cv.imread("building.tif",cv.IMREAD_COLOR)
assert img is not None
```

```
gray = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
gray = np.float32(gray)
dst = cv.cornerHarris(gray,2,3,0.04)

dst = cv.dilate(dst,None)
img[dst>0.01*dst.max()] = [0,0,255]

cv.imshow('dst',img)
cv.waitKey(0)
cv.destroyAllWindows()

fig,ax = plt.subplots()
img_ = cv.cvtColor(img,cv.COLOR_BGR2RGB)
ax.axis('off')
ax.imshow(img_)
```

Out[ ]:

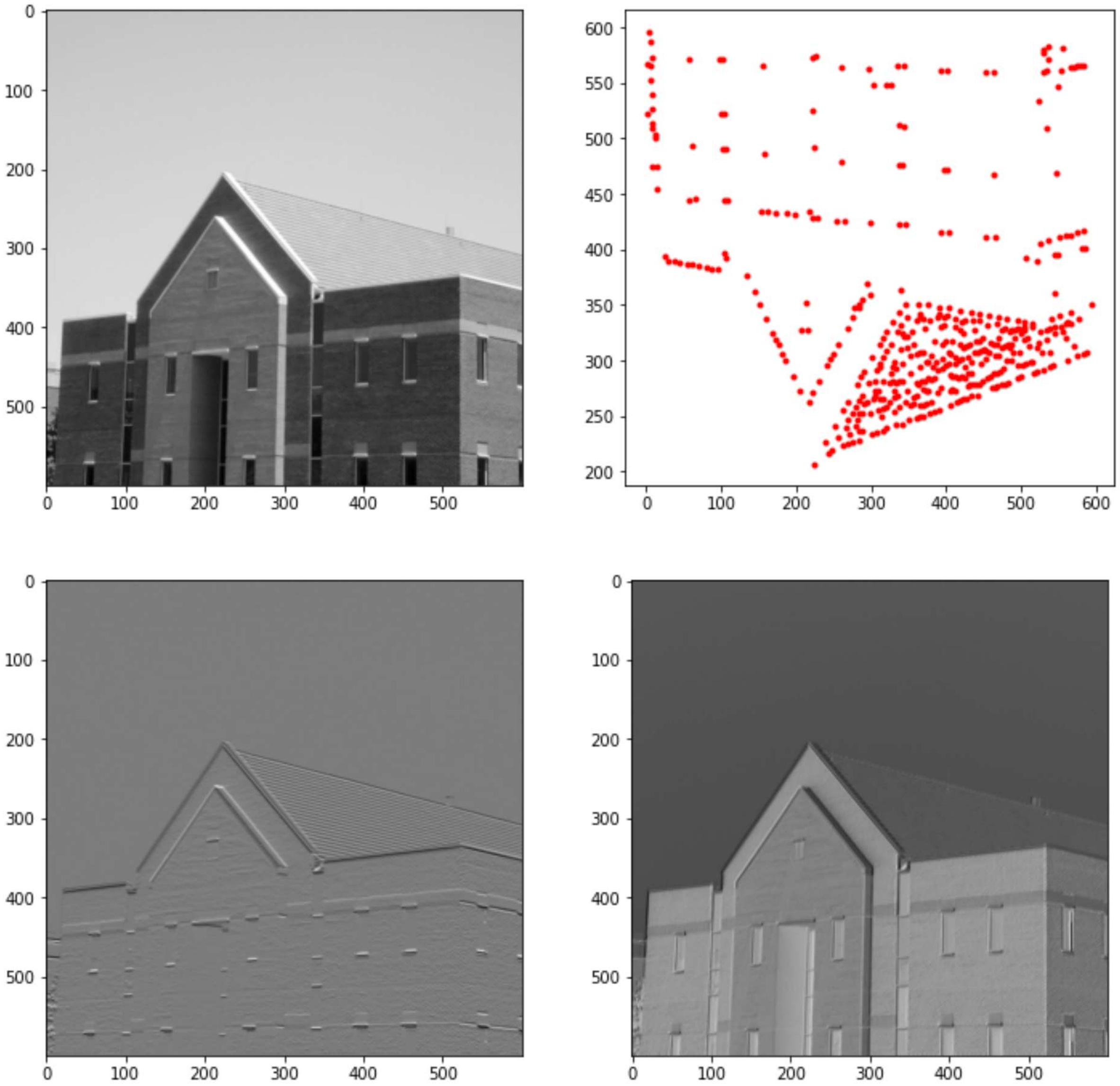
```
<matplotlib.image.AxesImage at 0x1bbab5a1ab0>
```



In [ ]:

```
from skimage.feature import peak_local_max

img = cv.imread("building.tif",cv.IMREAD_COLOR)
assert img is not None

I = cv.cvtColor(img,cv.COLOR_BGR2GRAY)
I = np.float32(I)

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
coordinates=peak_local_max(R,min_distance=2)

fig,ax=plt.subplots(2,2,figsize=(12,12))
ax[0,0].imshow(img,cmap='gray')
ax[0,1].plot(coordinates[:,1],coordinates[:,0],'r.')
ax[1,0].imshow(Ix + 127,cmap='gray')
```

```
ax[1,1].imshow(Iy + 127,cmap='gray')
plt.show()
```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