

Exercise 04

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Question 1

In []:

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

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

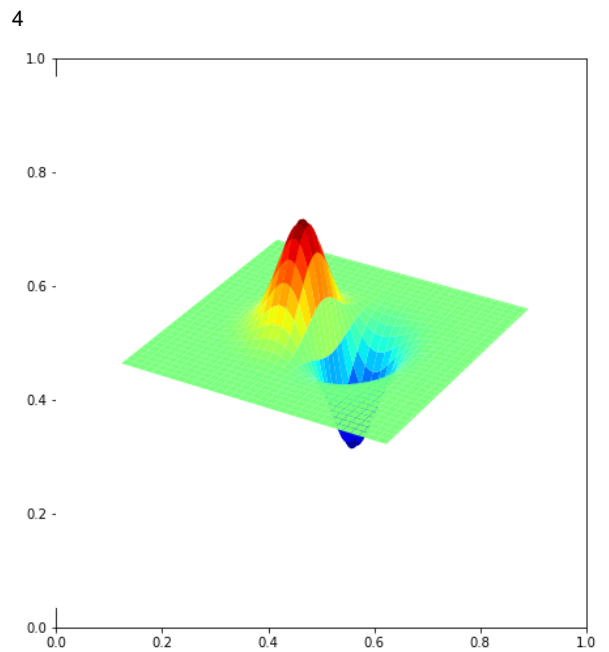
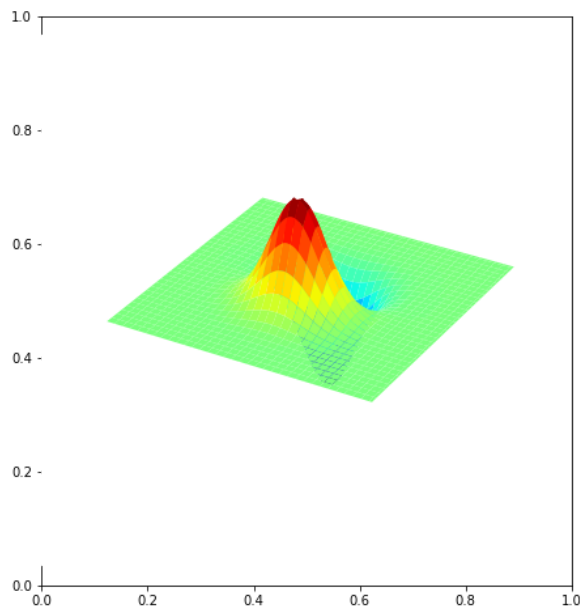
delta = 0.1
XX, YY = np.meshgrid(np.arange(-5, 5+delta, delta), np.arange(-5, 5+delta, delta))

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

g_y = cv.filter2D(g, -1, sobel_h)
g_x = cv.filter2D(g, -1, sobel_v)

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



Question 2

In []:

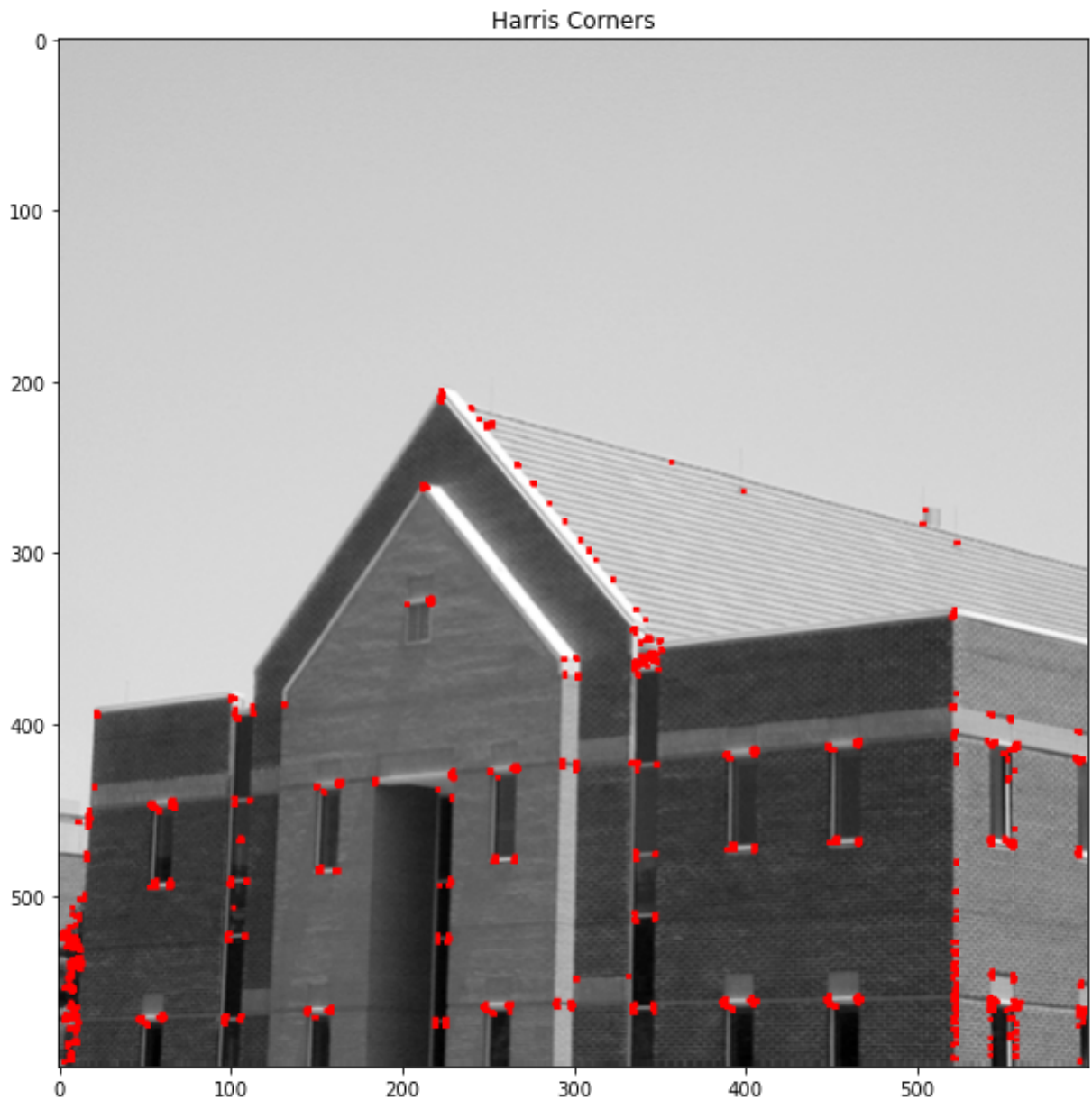
```
import cv2 as cv
import numpy as np
import matplotlib.pyplot as plt

img = cv.imread(r"C:\Users\HIRUNI\Desktop\EN2550\EN2550\4\building.tif")
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()] = [255,0,0]

fig, ax = plt.subplots(figsize=(10,10))
ax.imshow(img)
plt.title("Harris Corners")
plt.show()
```



Question 3

```
In [ ]: import cv2 as cv
import numpy as np
import matplotlib.pyplot as plt
from skimage.feature import peak_local_max

img = cv.imread(r"C:\Users\HIRUNI\Desktop\EN2550\EN2550\4\building.tif")
assert img is not None

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

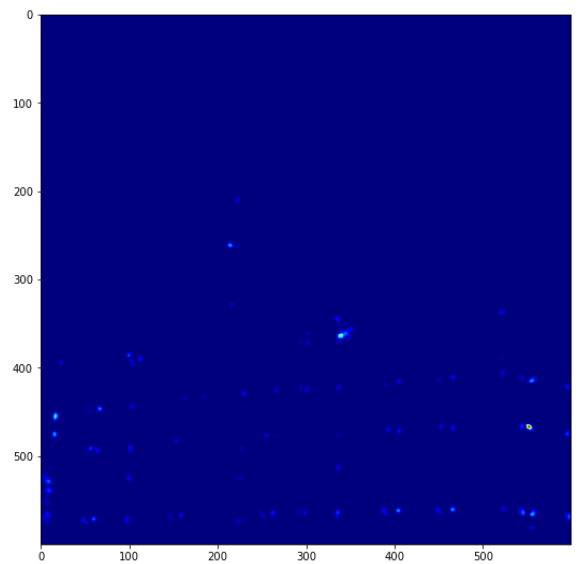
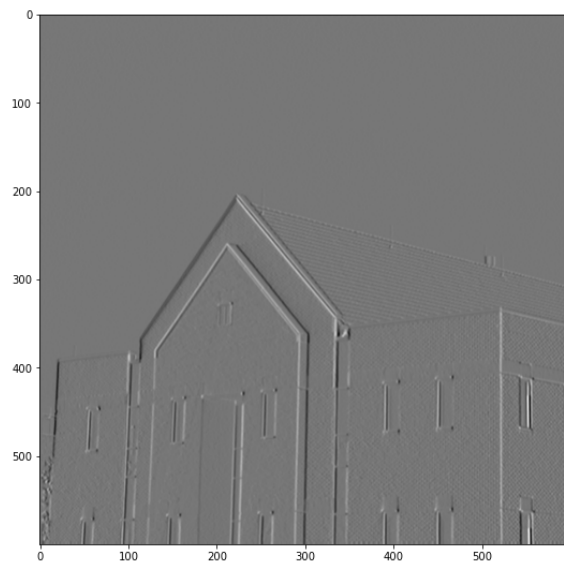
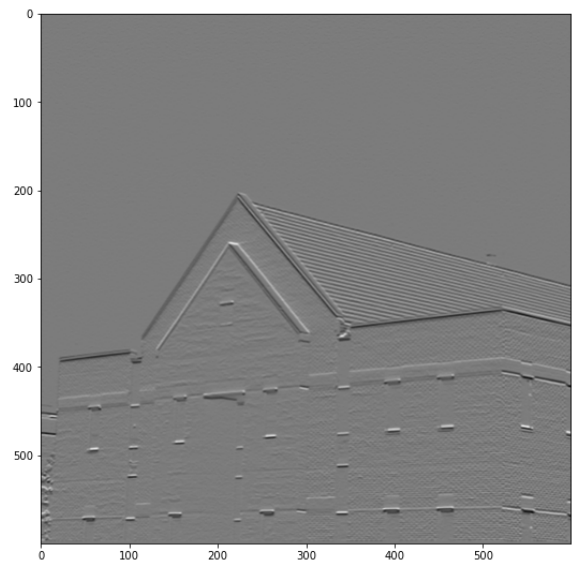
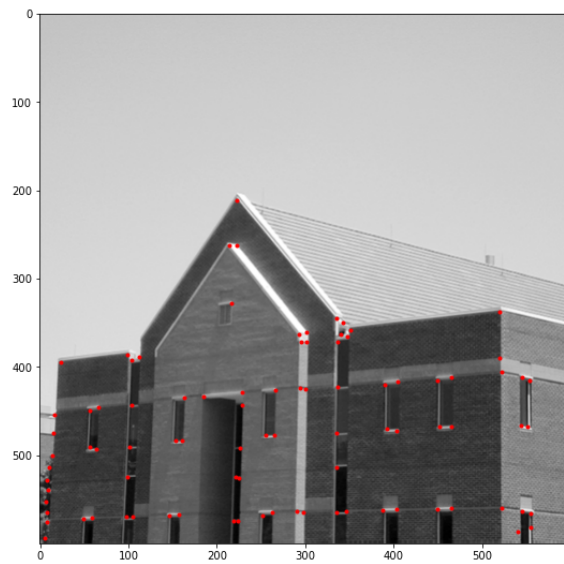
sobel_v= np.array([[[-1,-2,-1],[0,0,0],[1,2,1]], dtype=np.float32)
sobel_h = np.array([[[-1,0,1],[-2,0,2],[-1,0,1]], dtype=np.float32)
```

```
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
coordinates = peak_local_max(R, min_distance=2)

fig,ax =plt.subplots(2,2,figsize=(20, 20))
ax[0,0].imshow(img, cmap="gray")
ax[0,0].plot(coordinates[:,1],coordinates[:,0], 'r.')
ax[0,1].imshow(Ix+127, cmap="gray")
ax[1,0].imshow(Iy+127, cmap="gray")
ax[1,1].imshow(R+127, cmap=cm.jet)
plt.show()
```



Question 4

In []:

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

img = cv.imread(r"C:\Users\HIRUNI\Desktop\EN2550\EN2550\4\building.tif")
assert img is not None

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

fig, ax = plt.subplots(1, 2, figsize=(20, 20))
ax[0].imshow(img, cmap='gray')
ax[1].imshow(edges, cmap='gray')
plt.show()
```

