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Index No :- 190021A

In [ ]:

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# Question 01
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm

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)

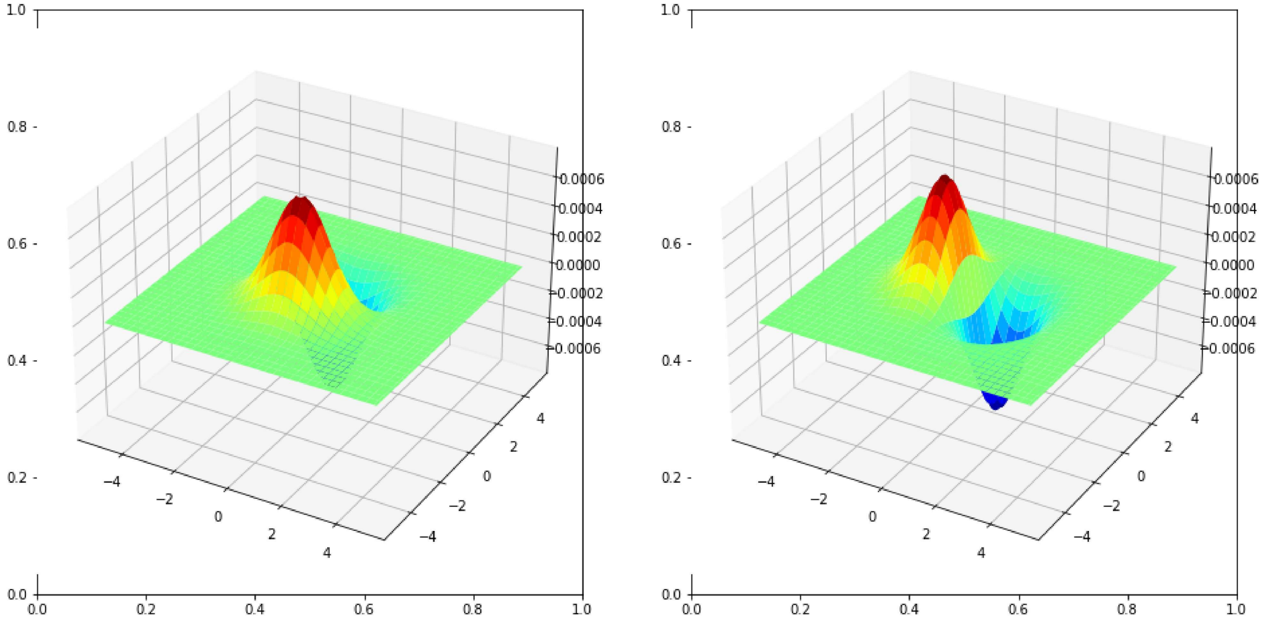
sobel_v = np.array([[-1,-2,-1],[0,0,0],[1,2,1]], dtype = np.float32)
g_x = cv.filter2D(g,  -1, sobel_v)

sobel_h = np.array([[-1,0,1],[-2,0,2],[-1,0,1]], dtype = np.float32)
g_y = cv.filter2D(g,  -1, sobel_h)


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

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 [ ]:

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# Question 02
```
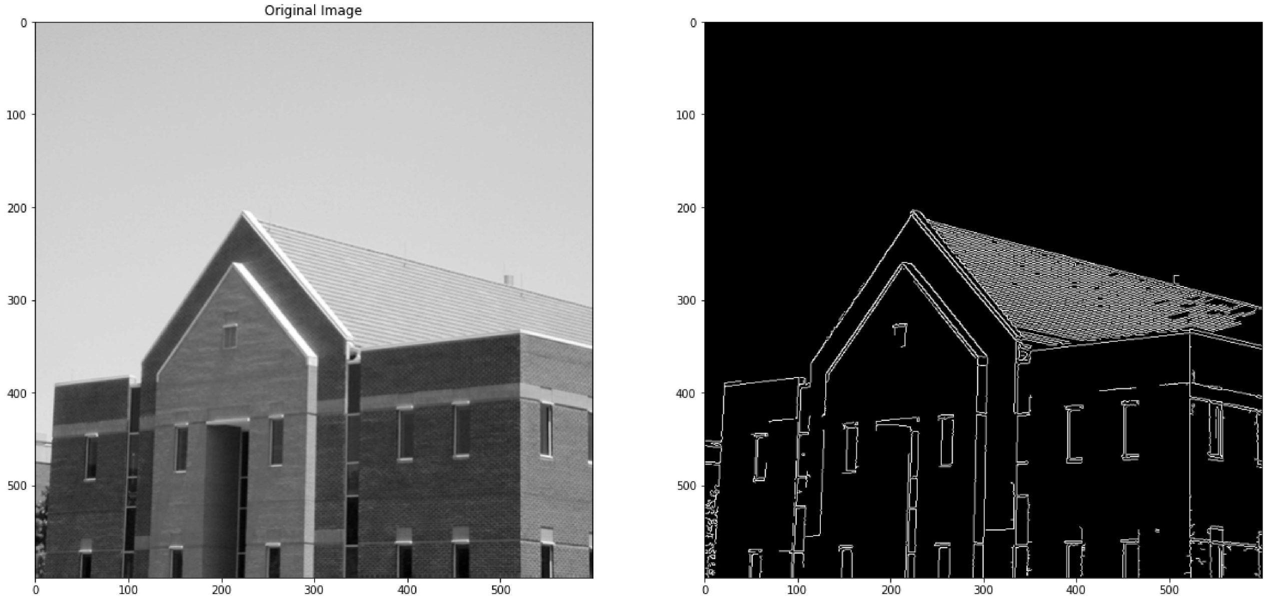
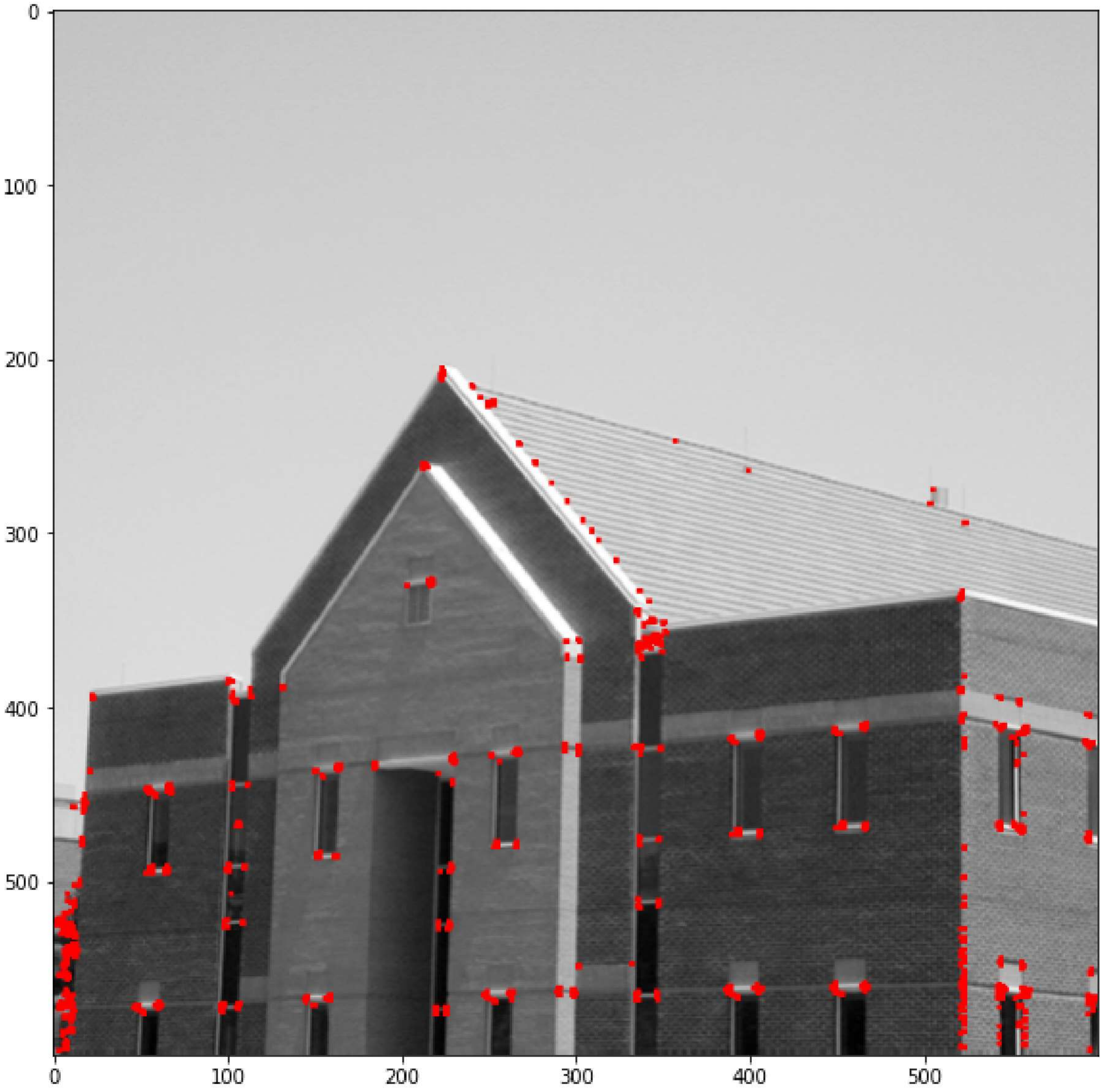

```python
import cv2 as cv
import matplotlib.pyplot as plt
import math

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 = (20, 20))
ax[0].imshow(img, cmap='gray')
ax[0].set_title('Original Image')
ax[1].imshow(edges, cmap='gray')
plt.show()
```



In [ ]:

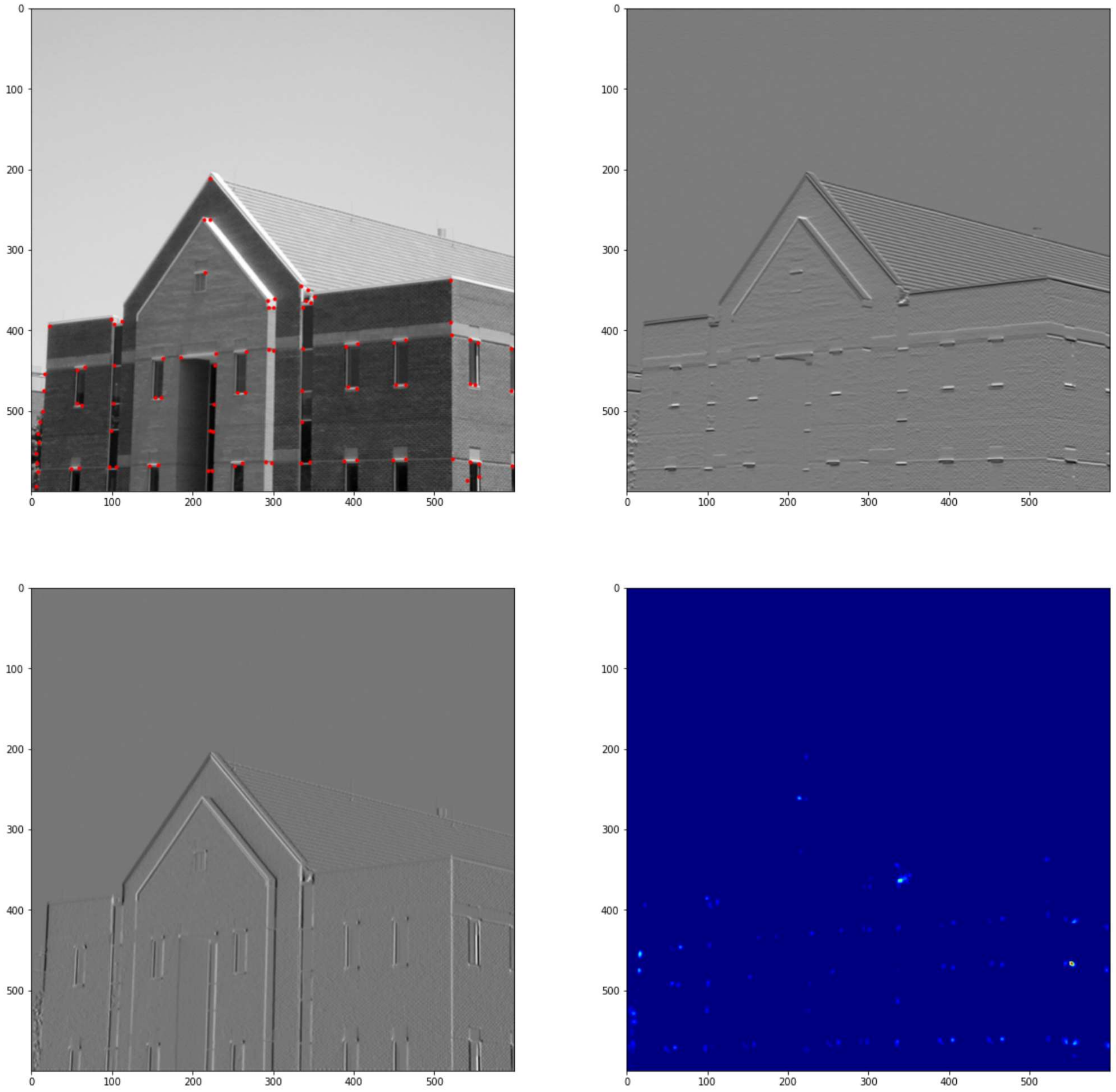
```python
# Question 03
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np

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]
img = cv.cvtColor(img, cv.COLOR_BGR2RGB)

fig, ax = plt.subplots(figsize = (15, 10))
ax.imshow(img)

plt.show()
```



In [ ]:

```
# Question 04
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from skimage.feature import peak_local_max
from matplotlib import cm

img = cv.imread("building.tif", cv.IMREAD_COLOR)
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()
```


0
100
200
300
400
500
0
100
200
300
400
500