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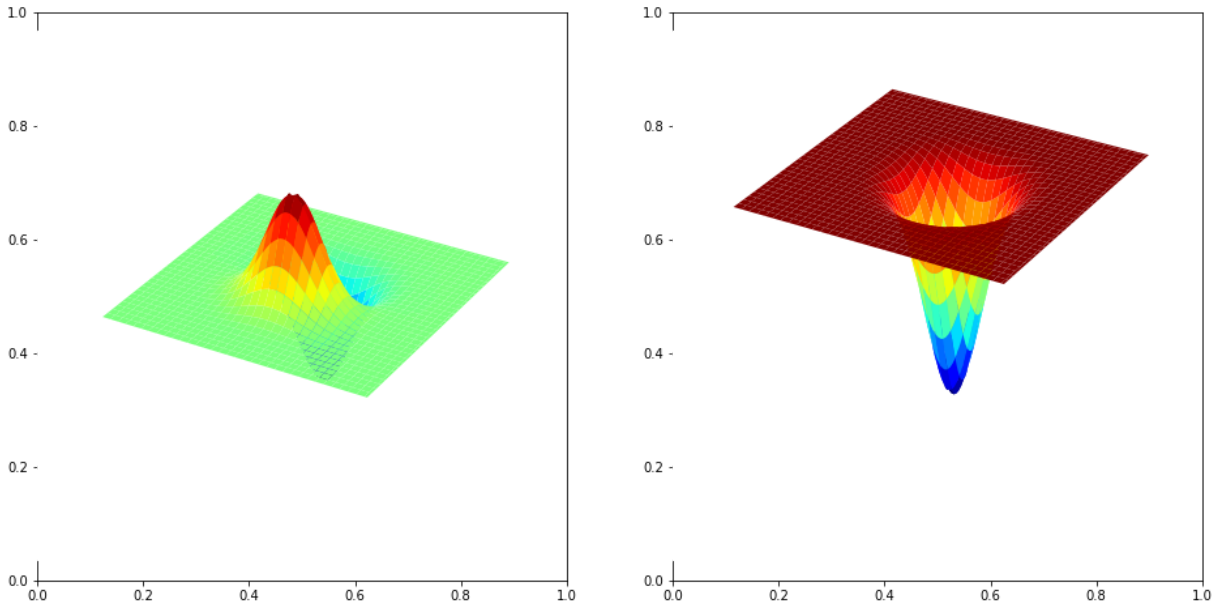
In [ ]:
```
import cv2 as cv
from cv2 import cornerHarris
import matplotlib.pyplot as plt
import numpy as np
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import cm

%matplotlib inline
```

In [ ]:
```
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 = Tr
surf2 = ax2.plot_surface(XX, YY, g_y, cmap = cm.jet, linewidth = 0, antialiased = Tr

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




In [ ]:
```
im = cv.imread('Images/building.tif', cv.IMREAD_GRAYSCALE)
```

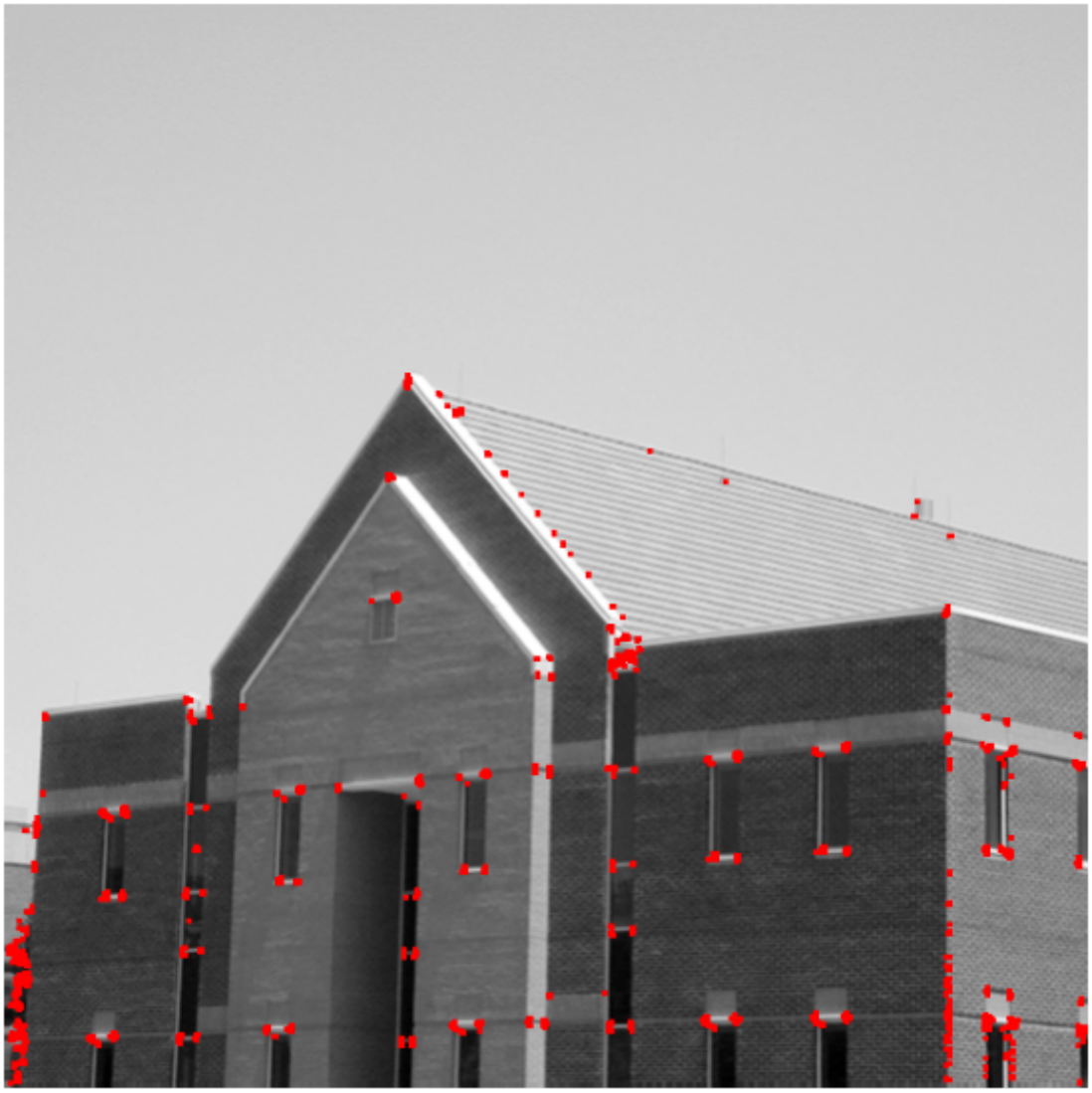
```
assert im is not None

edges = cv.Canny(im,100,200) #image, LT,HT

fig, ax = plt.subplots(1,2, figsize=(20,20))
ax[0].imshow(im, cmap = 'gray')
ax[1].imshow(edges, cmap = 'gray')
ax[0].axis('off')
ax[1].axis('off')
plt.plot()
```

Out[ ]: []

In [ ]:

```
im = cv.imread('Images/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]
cv.imshow('dst', im)
cv.waitKey(0)
cv.destroyAllWindows()

fig, ax = plt.subplots(figsize=(10,10))
im = cv.cvtColor(im, cv.COLOR_BGR2RGB)
ax.imshow(im)
ax.axis('off')
plt.plot()
```

Out[ ]: []



In [ ]:

```
from skimage.feature import peak_local_max

im = cv.imread(r'./Images/building.tif',cv.IMREAD_COLOR)
assert im is not None


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
coordinates = peak_local_max(R,min_distance =2)

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

Out[ ]: []