Task12

2019 年 6 月 12 日

1 图像处理 +180776+ 胡欣毅 (Python 版)

2 15 周上课随堂任务

1. 二维高斯函数等高线值的角度特征
2. 二维高斯函数等高线值的角度旋转
3. Gabor 初步

```
In [1]: import matplotlib.pyplot as plt
        %matplotlib inline
        from matplotlib import cm
        import matplotlib as mpl
        import numpy as np
        import cv2
```

```
In [2]: def rotate(image, angle, center=None, scale=1.0):
            # angle 负是顺时针旋转
            (h, w) = image.shape[:2]
            if center is None:
                center = (w // 2, h // 2)
            M = cv2.getRotationMatrix2D(center, angle, scale)
            rotated = cv2.warpAffine(image, M, (w, h))
            return rotated
```

```
In [3]: sigma1 = 1.
        sigma2 = 2.
        ro = [-0.9 ,-0.4 , 0 , 0.4 , 0.9]

        X = np.arange(-10, 10, 0.2)
```

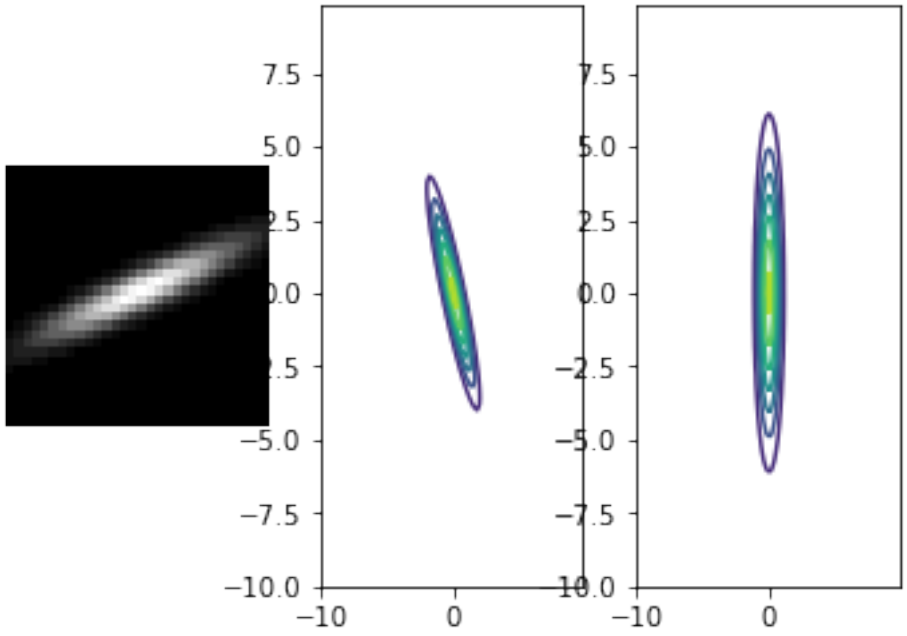
```
Y = np.arange(-10, 10, 0.2)
X, Y = np.meshgrid(X, Y)
X_len,Y_len = len(X)//2 ,len(Y)//2
```

2.0.1 二维高斯函数 FFT、等高线值、角度旋转

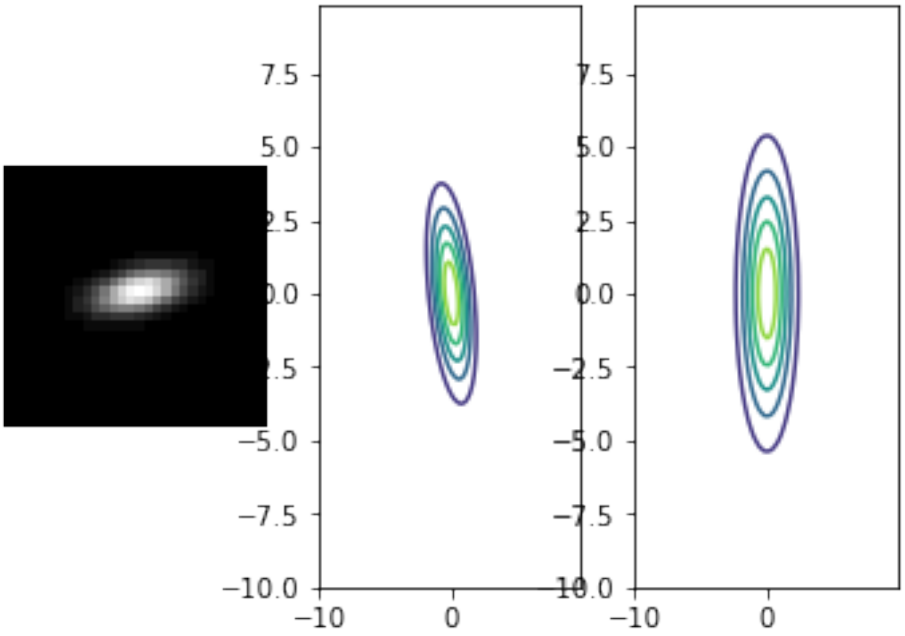
```
In [4]: for i in range(len(ro)):
            rho = ro[i]

            Z = np.exp((-0.5)*((X*X)/(sigma1**2) + \
                           (Y*Y)/(sigma2**2) - \
                       2*rho*(X*Y)/(sigma1*sigma2))/(1-rho**2) )\
                       /(2*np.pi*sigma1*sigma2*np.sqrt(1-rho**2))

            plt.figure()
            plt.subplot(132)
            plt.contour(X,Y,Z)
            #plt.imshow(Z)
            #plt.axis('off')

            z = np.fft.fft2(Z)
            z = np.fft.fftshift(z)

            plt.subplot(131)
            plt.imshow(np.abs(z).astype(int)[X_len-15:X_len+15,\
                Y_len-15:Y_len+15],cmap="gray",origin='lower')
            plt.axis('off')

            theta = (180/np.pi) * np.arctan(2*rho*sigma1*sigma2/(sigma1**2- sigma2**2) ) /2
            print("旋转角: ",theta)
            # theta 负是顺时针旋转 (imshow 坐标系)
            # theta 负是逆时针旋转 (contour 坐标系)
            plt.subplot(133)
            plt.contour(X,Y, rotate(Z, theta ,scale = 1.4)  )
            #plt.imshow(rotate(Z, theta ,scale = 1.4) )
            #plt.axis('off')
```

```
        plt.show()
```

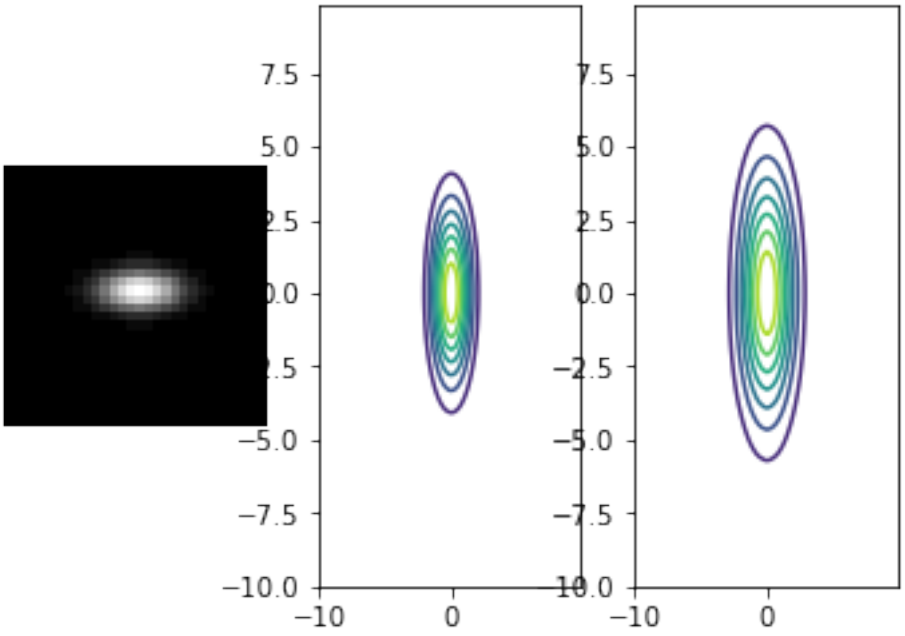
旋转角： 25.097214453867405



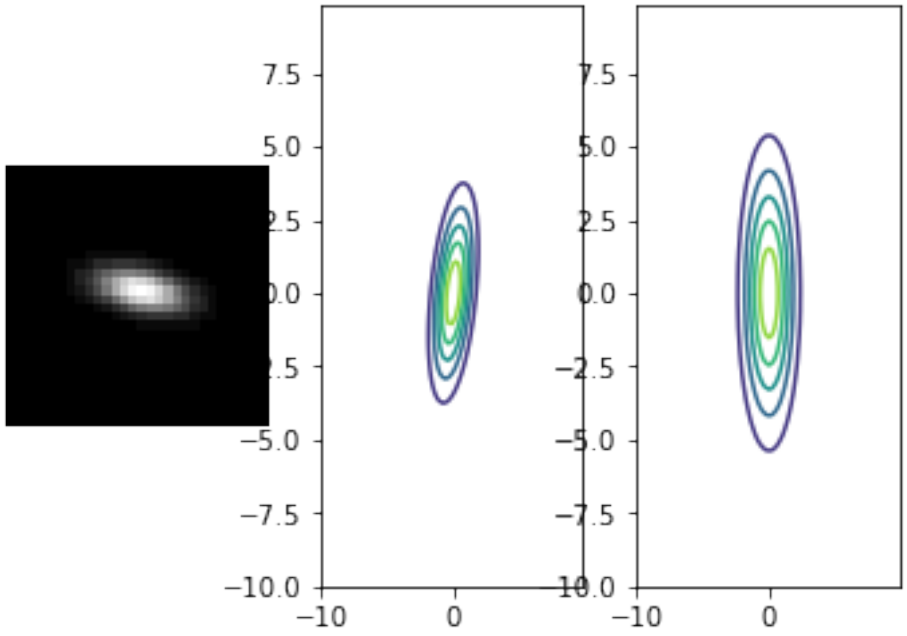
旋转角： 14.036243467926479



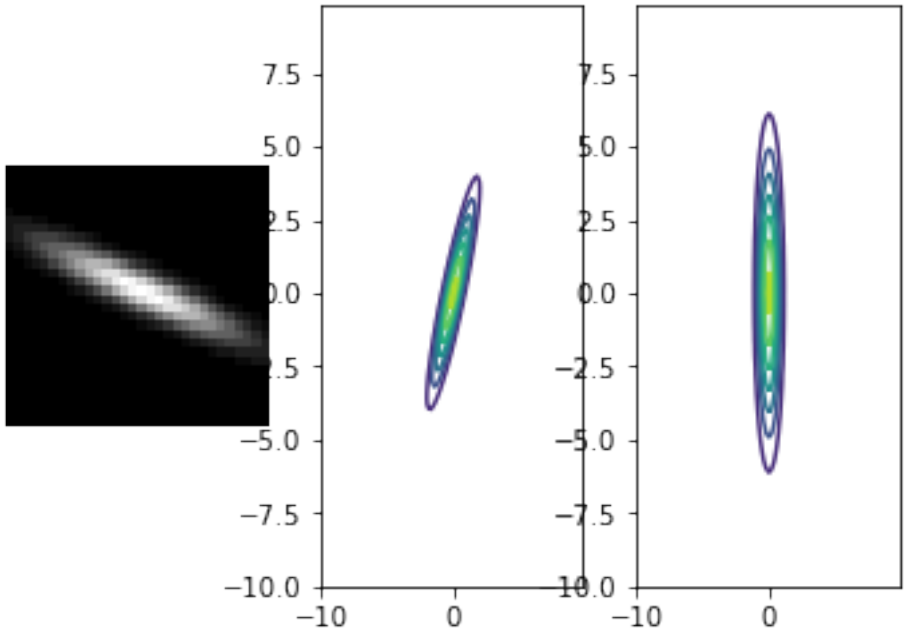
旋转角： -0.0



旋转角： -14.036243467926479

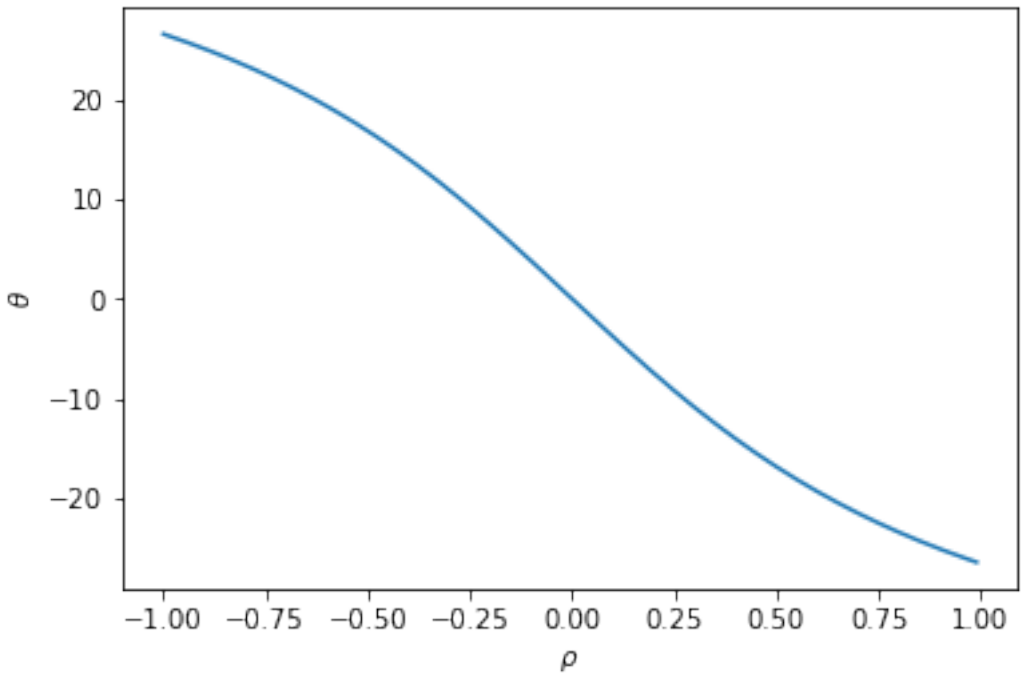


旋转角： -25.097214453867405



2.0.2 相关系数与旋转角度的关系

```
In [5]: rho = np.arange(-1, 1, 0.01)
        plt.figure( )
        theta = (180/np.pi) * np.arctan(2*rho*sigma1*sigma2/(sigma1**2- sigma2**2) ) /2
        # theta 负是顺时针旋转
        plt.plot(rho ,theta)
        plt.xlabel(r'$\rho$')
        plt.ylabel(r'$\theta$')
        plt.savefig("../rho.png")
        plt.show()
```



2.0.3 衰减系数

```
In [6]: x = np.arange(-3, 3, 0.1)
        aa = [1,4]
```

```
for a in aa:
    y = np.exp(-a*x**2)
    plt.plot(x ,y)
plt.show()
```