

Exercise 06

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Question 1

In []:

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

im = cv.imread('sudoku.png', cv.IMREAD_COLOR)
assert im is not None

gray=cv.cvtColor(im,cv.COLOR_BGR2GRAY)
edges=cv.Canny(gray,20,120,apertureSize=3)
lines=cv.HoughLines(edges,1,np.pi/180,175)

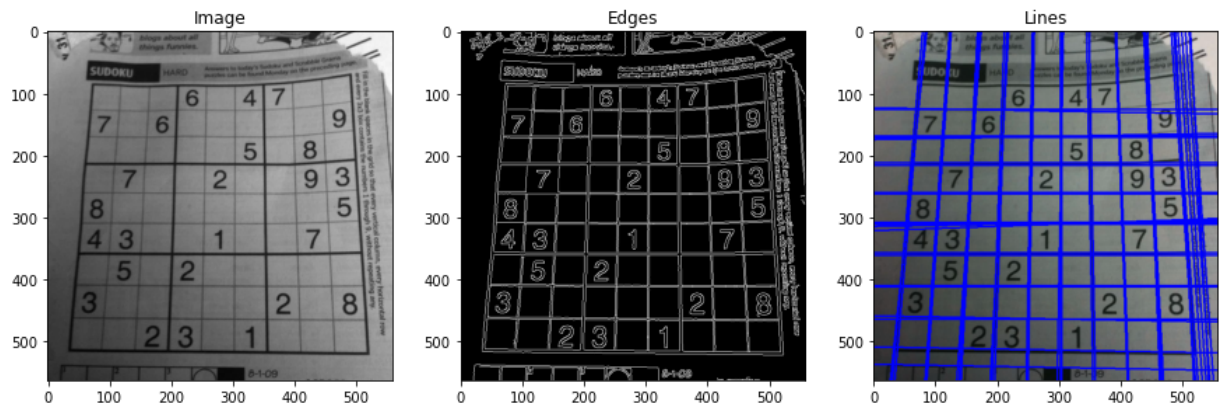
for line in lines:
    rho,theta=line[0]
    a=np.cos(theta)
    b=np.sin(theta)
    x0,y0=a*rho,b*rho
    x1,y1= int(x0+1000*(-b)),int(y0+1000*(a))
    x2,y2= int(x0-1000*(-b)),int(y0-1000*(a))
    cv.line(im, (x1,y1),(x2,y2),(0,0,255),2)

fig,ax = plt.subplots(1,3,figsize = (15,15))
ax[0].imshow( gray, cmap = "gray")
ax[0].set_title("Image")

ax[1].imshow(edges, cmap= "gray")
ax[1].set_title("Edges")

ax[2].imshow(im, cmap = "gray")
ax[2].set_title("Lines")

plt.show()
```



Question 2

In []:

```

im = cv.imread('coins.jpg', cv.IMREAD_COLOR)
assert im is not None

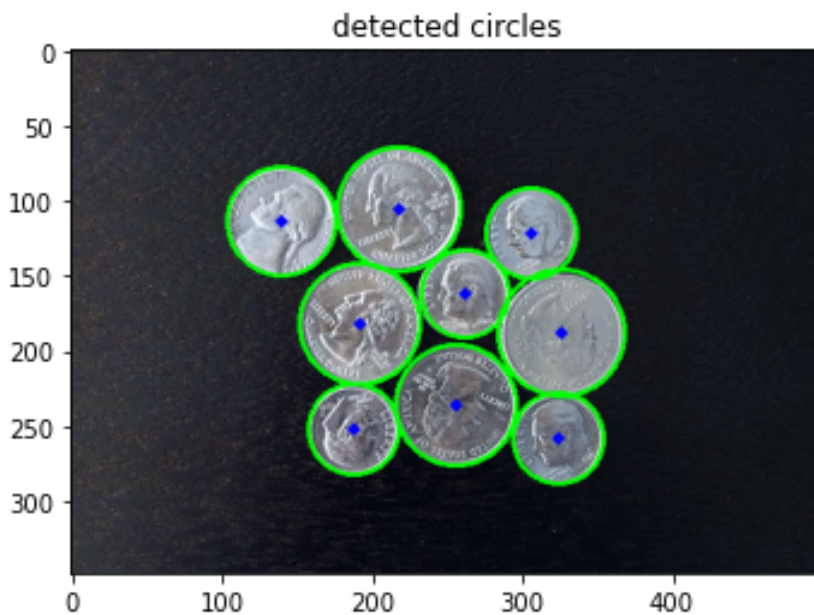
gray = cv.cvtColor(im, cv.COLOR_BGR2GRAY)
gray = cv.medianBlur(gray,5)
circles = cv.HoughCircles(gray,cv.HOUGH_GRADIENT,1,50, param1=150,param2=100,
circles = np.uint16(np.around(circles))
for i in circles[0,:]:
    # draw the outer circle
    cv.circle(im,(i[0],i[1]),i[2],(0,255,0),2)
    # draw the center of the circle
    cv.circle(im,(i[0],i[1]),2,(0,0,255),3)

cv.imshow('detected circles',im)
cv.waitKey(0)
cv.destroyAllWindows()

fig,ax = plt.subplots()
ax.imshow( im, cmap = "gray")
ax.set_title("detected circles")

plt.show()

```



Question 3

```
In [ ]: im = cv.imread('pic1.png', cv.IMREAD_REDUCED_GRAYSCALE_2)
        templ = cv.imread('templ.png', cv.IMREAD_REDUCED_GRAYSCALE_2)

        im_edges = cv.Canny(im, 50, 250)
        templ_edges = cv.Canny(templ, 50, 250)
        alg = cv.createGeneralizedHoughGuil()
        alg.setTemplate(templ_edges)
        alg.setAngleThresh(100000)
        alg.setScaleThresh(40000)
        alg.setPosThresh(1000)
        alg.setAngleStep(1)
        alg.setScaleStep(0.1)
        alg.setMinScale(0.9)
        alg.setMaxScale(1.1)
        positions, votes = alg.detect(im_edges)

        out = cv.cvtColor(im, cv.COLOR_BAYER_BG2BGR)
        for x,y,scale,orientation in positions[0]:
            halfHeight = templ.shape[0] / 2. * scale
            halfWidth = templ.shape[1] / 2. * scale
            p1 = (int(x - halfWidth), int(y - halfHeight))
            p2 = (int(x + halfWidth), int(y + halfHeight))
            print("x = {}, y = {}.scale = {}, orientation = {}, p1 = {}, p2 = {}".format(x, y, scale, orientation, p1, p2))
            cv.rectangle(out, p1, p2, (0,0,255))

        cv.namedWindow("Image",cv.WINDOW_NORMAL)
        cv.imshow("Image", templ)
        cv.waitKey()
        cv.imshow("Image", im)
        cv.waitKey()
```

```

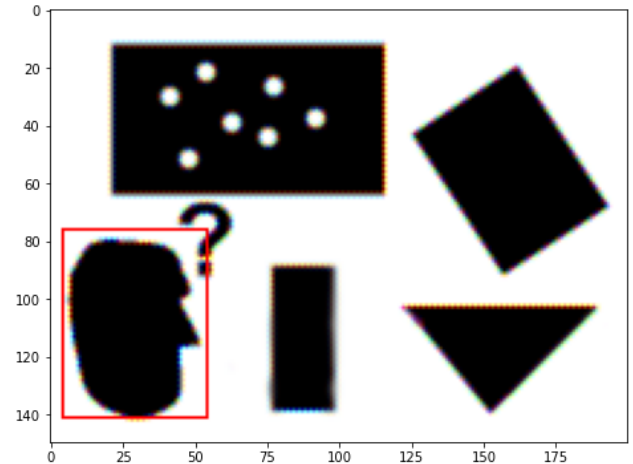
cv.imshow("Image", out)
cv.waitKey()
cv.destroyAllWindows()

fig, ax = plt.subplots(1, 2, figsize=(18, 6))
ax[0].imshow(cv.cvtColor(templ, cv.COLOR_BGR2RGB))
ax[1].imshow(cv.cvtColor(out, cv.COLOR_BGR2RGB))

```

x = 29.0, y = 109.0, scale = 1.0, orientation = 0.0, p1 = (4, 76), p2 = (54, 141)

Out[]: <matplotlib.image.AxesImage at 0x1fa306d1c10>



In []:

```

a, b, c, d = [0, 0, 1], [0, 1, 1], [1, 1, 1], [1, 0, 1]
X = np.array([a, b, c, d]).T

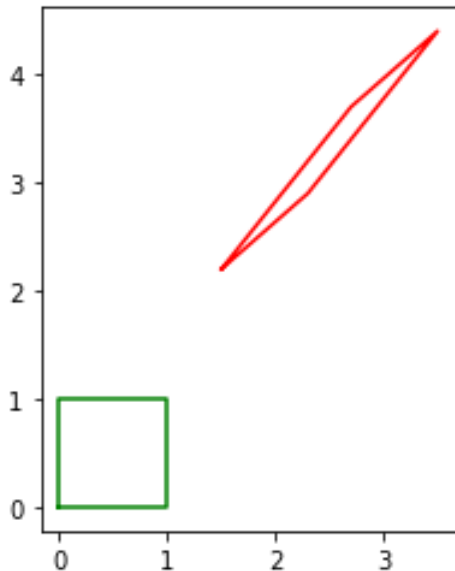
theta = np.pi * 30 / 180
s = 1
tx, ty = 1.5, 2.2
# H = np.array([[s * np.cos(theta), -s * np.sin(theta), tx], [s * np.sin(theta), s * np.cos(theta), ty]])
# Y = H @ X

a11, a12, a21, a22 = 0.8, 1.2, 0.7, 1.5 # Should be a non-singular matrix
A = np.array([[a11, a12, tx], [a21, a22, ty], [0, 0, 1]])
Y = A @ X

x = np.append(X[0, :], X[0, 0])
y = np.append(X[1, :], X[1, 0])
fig, ax = plt.subplots(1, 1)
ax.plot(x, y, color='g')
ax.set_aspect('equal')

x = np.append(Y[0, :], Y[0, 0])
y = np.append(Y[1, :], Y[1, 0])
ax.plot(x, y, color='r')
ax.set_aspect('equal')
plt.show()

```



Question 5

```
In [ ]: #reading image
img1 = cv.imread('img1.ppm', cv.IMREAD_ANYCOLOR)
img4= cv.imread('img4.ppm', cv.IMREAD_ANYCOLOR)

H = np.array([[6.6378505e-01, 6.8003334e-01, -3.1230335e+01],[-1.44

img4to1 = cv.warpPerspective(img4, np.linalg.inv(H), (2000,2000))

# cv.namedWindow("Image",cv.WINDOW_NORMAL)
cv.imshow("Image1", img1)
cv.waitKey()
cv.imshow("Image4", img4)
cv.waitKey()
cv.imshow("Image4 Warped", img4to1)
cv.waitKey()
cv.destroyAllWindows()

fig,ax=plt.subplots(1,3,figsize=(18,6))
ax[0].imshow(cv.cvtColor(img1,cv.COLOR_BGR2RGB))
ax[0].set_title("Image 1")
ax[1].imshow(cv.cvtColor(img4,cv.COLOR_BGR2RGB))
ax[1].set_title("Image 4")
ax[2].imshow(cv.cvtColor(img4to1,cv.COLOR_BGR2RGB))
ax[2].set_title("Image4 wrapped")
```

```
Out[ ]: Text(0.5, 1.0, 'Image4 wrapped')
```

