EN2550 _ Exercise 06

Index Number : 190328V

Name : KUMARA B.W.J.C.

Importing Libraries

In [ ]:

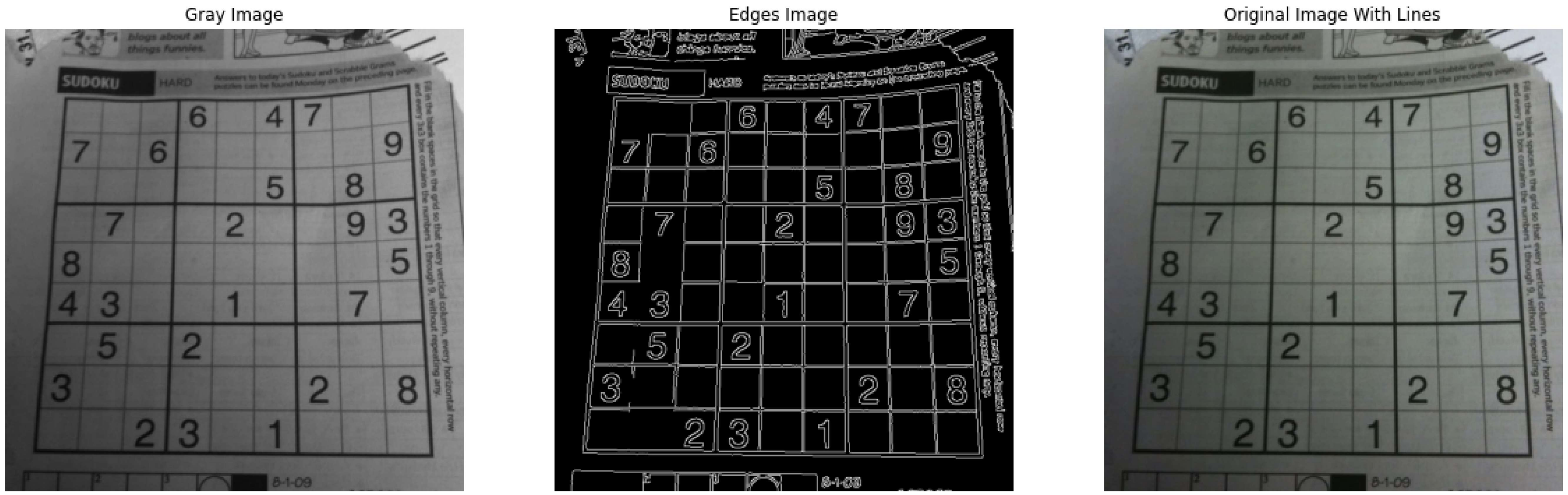
```
%matplotlib inline

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

Q1).

In [ ]:

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

gray = cv.cvtColor(im, cv.COLOR_BGR2GRAY)
edges = cv.Canny(gray, 50, 150, apertureSize=3)
lines = cv.HoughLines(edges, 1, np.pi/180, 200)

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),(8,0,255),2)


fig, ax = plt.subplots(1,3, figsize = (20,8))

gray = cv.cvtColor(gray, cv.COLOR_BGR2RGB)
edges = cv.cvtColor(edges, cv.COLOR_BGR2RGB)
im = cv.cvtColor(im, cv.COLOR_BGR2RGB)
```

```
ax[0].imshow(gray)
ax[0].set_title('Gray Image')
ax[0].axis("off")

ax[1].imshow(edges)
ax[1].axis('off')
ax[1].set_title("Edges Image")

ax[2].axis('off')
ax[2].imshow(im)
ax[2].set_title('Original Image With Lines')
plt.show()
```



Gray Image

Edges Image

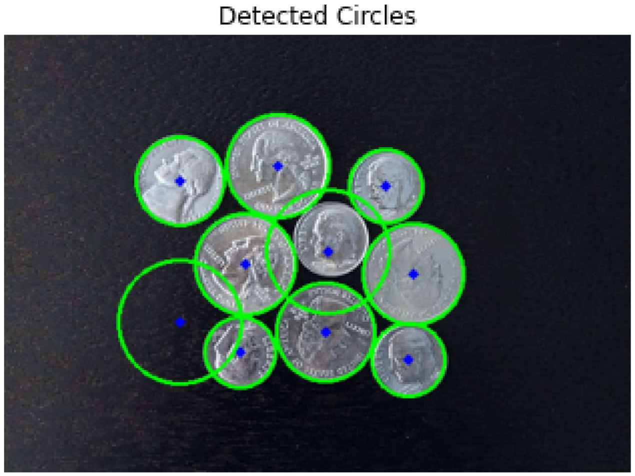
Original Image With Lines

Q2).

In [ ]:

```
im = cv.imread(r'Images/coins.jpg', cv.IMREAD_COLOR)
assert im is not None
gray = cv.cvtColor(im, cv.COLOR_BGR2GRAY)

circles = cv.HoughCircles(gray, cv.HOUGH_GRADIENT , 1, 50, param1=150, param2=20, minRadius=20, maxRadius=50)
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 Nge circle
  cv.circle(im, (i[0],i[1]),2, (0,0,255),3)
```

```
fig, ax = plt.subplots()
ax.imshow(im)
ax.set_title('Detected Circles')
ax.axis('off')
plt.show()
```



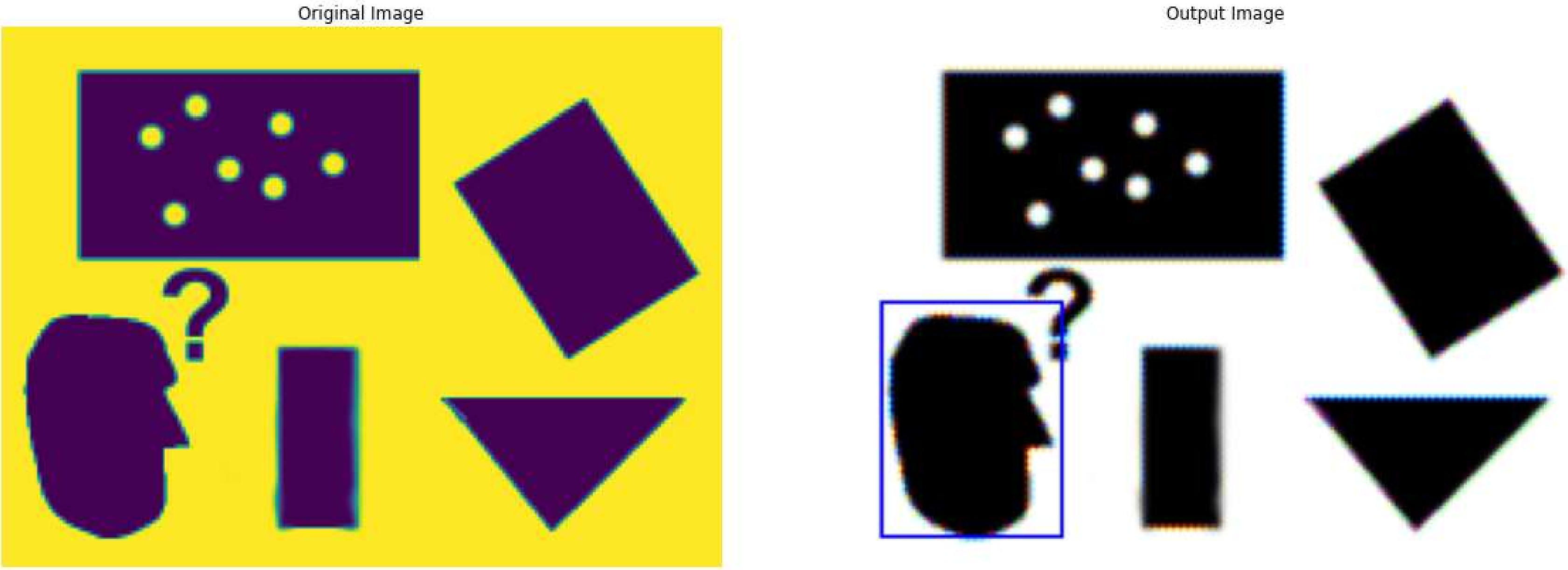
Q3).

In [ ]:

```
im=cv.imread(r'Images/pic1.png',cv.IMREAD_REDUCED_GRAYSCALE_2)
assert im is not None
templ=cv.imread(r'Images/templ.png',cv.IMREAD_REDUCED_GRAYSCALE_2)
assert templ is not None

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))

fig, ax = plt.subplots(1,2, figsize = (20,8),facecolor = 'white')

ax[0].imshow(im)
ax[0].set_title('Original Image')
ax[0].axis("off")

ax[1].imshow(out)
ax[1].axis('off')
ax[1].set_title("Output Image")
plt.show()
```

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



Original Image

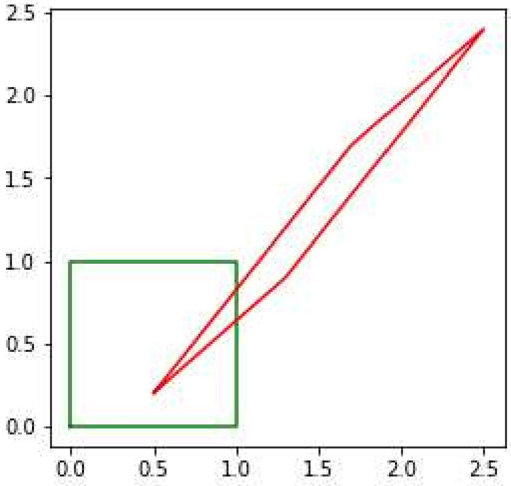
Output Image

Q4).

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 = 2
tx, ty = 0.5, 0.2

# H = np.array([[s*np.cos(theta), -s*np.sin(theta), tx], [s*np.sin(theta), s*np.cos(theta), ty], [0, 0, 1]])
# Y = H @ X

a11, a12, a21, a22 = 0.8, 1.2, 0.7, 1.5
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,facecolor = 'white')
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()
```



Q5).

In [ ]:

```
im1 = cv.imread(r'Images/img1.ppm', cv.IMREAD_ANYCOLOR)
```

```python
im4 = cv.imread(r'Images/img4.ppm', cv.IMREAD_ANYCOLOR)

# H = np.array([[6.6378505e-01,6.8003334e-01-3.1230335e+01],
# [-1.4495500e-01,9.7128304e-01,1.4877420e+02],
# [4.2518504e-04,-1.3930359e-05,1.0000000e+00]])

H = []
with open(r'Images/H1to4p') as f:
  H = np.array([[float(h) for h in line.split()] for line in f])

imlto4 =cv.warpPerspective(im4, np.linalg.inv(H), (2000,2000))

fig, ax = plt.subplots(1,3, figsize = (20,8),facecolor ='white')

im1 = cv.cvtColor(im1, cv.COLOR_BGR2RGB)
ax[0].imshow(im1)
ax[0].axis('off')
ax[0].set_title('Image 1')

im4 = cv.cvtColor(im4, cv.COLOR_BGR2RGB)
ax[1].imshow(im4)
ax[1].axis('off')
ax[1].set_title('Image 2')

imlto4 = cv.cvtColor(imlto4, cv.COLOR_BGR2RGB)
ax[2].axis('off')
ax[2].imshow(imlto4)
ax[2].set_title('Image 1 Warped')

plt.show()
```

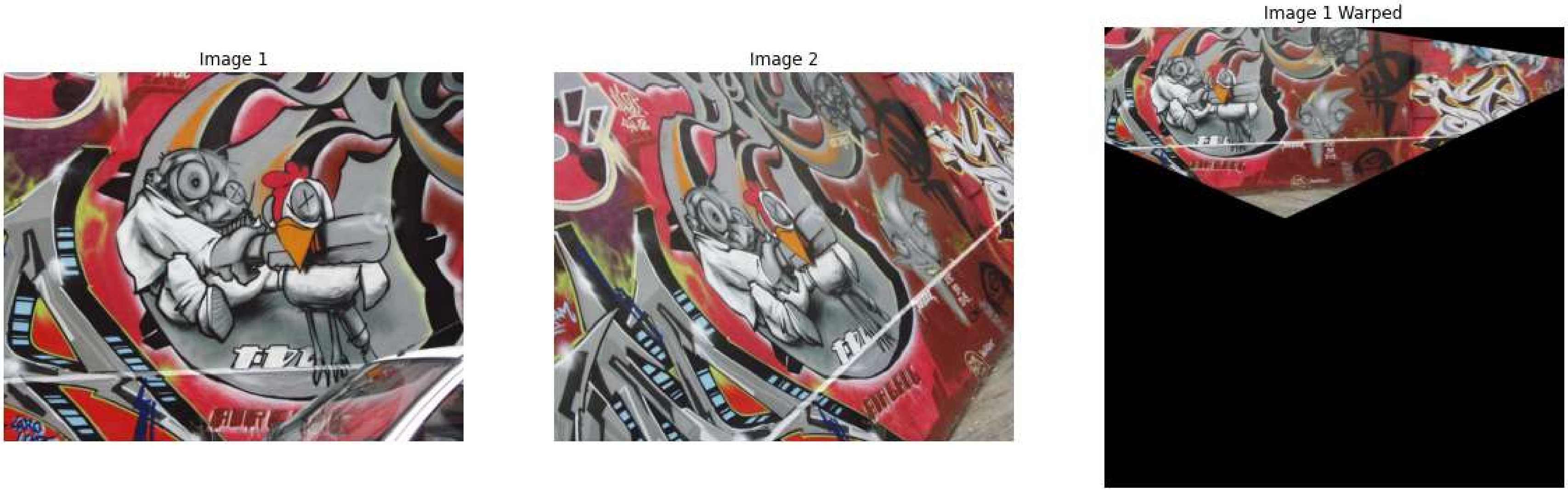


Image 1

Image 2

Image 1 Warped

```
In [ ]:
```