Exercise 8

April 4, 2022

0.0.1 Exercise 08

0.0.2 Index No: 190108X

0.0.3 Name: Chathuranga M.M.P.

[11]:

```python
# Question 1,2

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

f=open(r'templeSparseRing/templeSR_par.txt','r')
assert f is not None

# Reading the information on the first image
n=int(f.readline())
l=f.readline().split()
im1_fn=l[0]
K1=np.array([float(i) for i in l[1:10]]).reshape((3,3))
R1=np.array([float(i) for i in l[10:19]]).reshape((3,3))
t1=np.array([float(i) for i in l[19:22]]).reshape((3,1))

l = f.readline().split()
im2_fn =l[0]

K2 = np.array([float(i) for i in l[1:10]]).reshape((3,3))
R2 = np.array([float(i) for i in l[10:19]]).reshape((3,3))
t2 = np.array([float(i) for i in l[19:22]]).reshape((3,1))

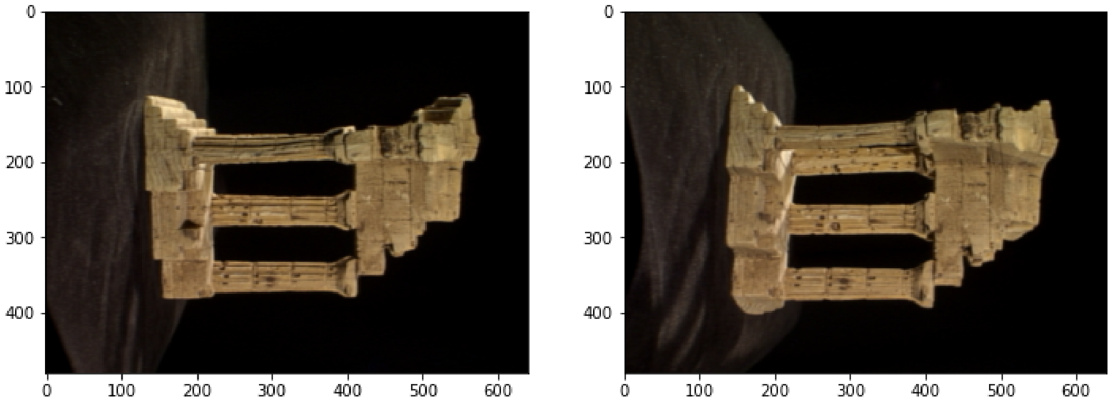
im1 = cv.imread(r'templeSparseRing/'+im1_fn,cv.IMREAD_COLOR)
im2 = cv.imread(r'templeSparseRing/'+im2_fn,cv.IMREAD_COLOR)
assert im1 is not None
assert im2 is not None

fig,ax = plt.subplots(1,2,figsize=(12,10))
ax[0].imshow(cv.cvtColor(im1,cv.COLOR_BGR2RGB))
ax[1].imshow(cv.cvtColor(im2,cv.COLOR_BGR2RGB))
```

```
P1 = K1 @ np.hstack((R1,t1))
P2 = K2 @ np.hstack((R2,t2))

print(P1)
```

```
[[ 4.80251845e+01  1.44011271e+03 -5.71648932e+02  7.53293366e+01]
 [ 1.53577034e+03 -6.41434324e+01 -1.63127843e+02  1.85810055e+02]
 [ 4.88387837e-02 -1.81568392e-01 -9.82164799e-01  6.14604846e-01]]
```



[12]:

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# Question 3

from scipy.linalg import null_space
def skew(x):
    x = x.ravel()
    return np.array([[0,-x[2],x[1]],[x[2],0,-x[0]],[-x[1],x[0],0]])

C = null_space(P1)
C=C*np.sign(C[0,0])
e2 = P2 @ C
e2x = skew(e2)

F=e2x @ P2 @ np.linalg.pinv(P1)
print('F =',F)

x = np.array([130,115,1])
cv.circle(im1,(x[0],x[1]),5,(0,0,255),-1)

l2 = F @ x.T

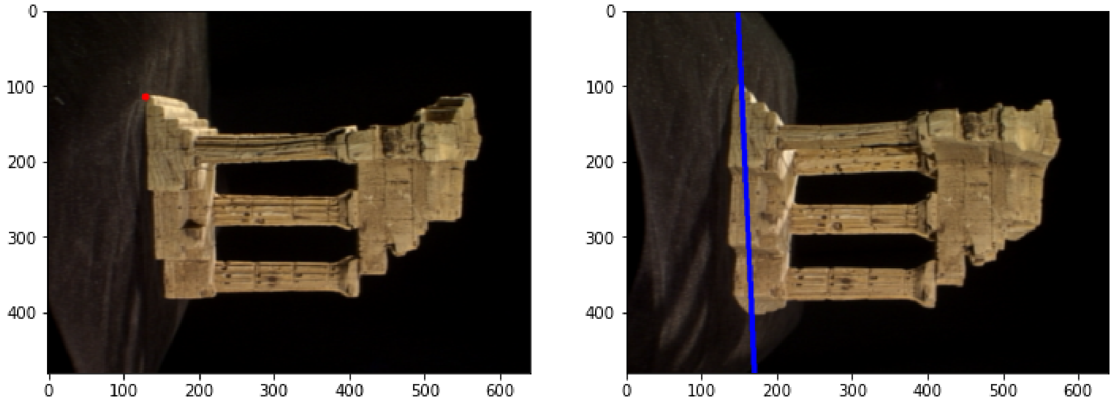
p1 = np.array([0,(l2[0]*0+l2[2])/l2[1]]).astype(int)
p2 = np.array([500,(l2[0]*500+l2[2])/l2[1]]).astype(int)
cv.line(im2,(p1[0],p1[1]),(p2[0],p2[1]),(255,0,0),5)
```

```
fig,ax = plt.subplots(1,2,figsize=(12,10))
ax[0].imshow(cv.cvtColor(im1,cv.COLOR_BGR2RGB))
ax[1].imshow(cv.cvtColor(im2,cv.COLOR_BGR2RGB))
```

```
F = [[-2.87071497e-04 -3.96261289e-02  2.94221686e+02]
 [-3.55039713e-02  1.65329260e-04  1.78860854e+01]
 [-2.76702814e+02  2.12942175e+01 -9.06669374e+03]]
```

[12]:

```
<matplotlib.image.AxesImage at 0x186dfc9fc10>
```



[14]:

```
# Question 4

import numpy as np
import cv2 as cv
from matplotlib import pyplot as plt

img1 = cv.imread(r'templeSparseRing/'+im1_fn,0)
img2 = cv.imread(r'templeSparseRing/'+im2_fn,0)
assert img1 is not None
assert img2 is not None

sift = cv.SIFT_create()

keypoint1, descriptor1 = sift.detectAndCompute(img1,None)
keypoint2, descriptor2 = sift.detectAndCompute(img2,None)

FLANN_INDEX_KDTREE = 1
index_params = dict(algorithm = FLANN_INDEX_KDTREE, trees = 5)
search_params = dict(checks=50)
flann = cv.FlannBasedMatcher(index_params,search_params)
matches = flann.knnMatch(descriptor1,descriptor2,k=2)
pts1 = []
pts2 = []
```

```
for i,(m,n) in enumerate(matches):
    if m.distance < 0.8*n.distance:
        pts2.append(keypoint2[m.trainIdx].pt)
        pts1.append(keypoint1[m.queryIdx].pt)

pts1 = np.int32(pts1)
pts2 = np.int32(pts2)
F, mask = cv.findFundamentalMat(pts1,pts2,cv.FM_LMEDS)

pts1 = pts1[mask.ravel()==1]
pts2 = pts2[mask.ravel()==1]

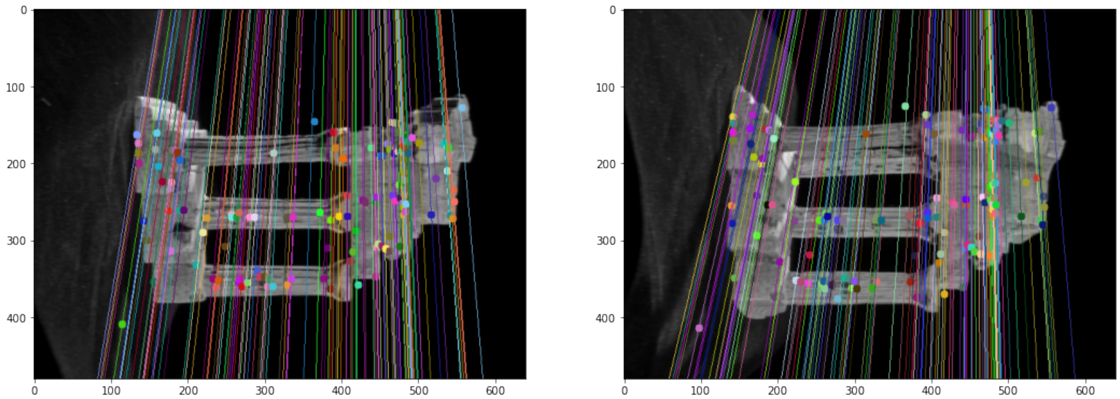
def drawlines(img1,img2,lines,pts1,pts2):

    r,c = img1.shape
    img1 = cv.cvtColor(img1,cv.COLOR_GRAY2BGR)
    img2 = cv.cvtColor(img2,cv.COLOR_GRAY2BGR)
    for r,pt1,pt2 in zip(lines,pts1,pts2):
        color = tuple(np.random.randint(0,255,3).tolist())
        x0,y0 = map(int, [0, -r[2]/r[1] ])
        x1,y1 = map(int, [c, -(r[2]+r[0]*c)/r[1] ])
        img1 = cv.line(img1, (x0,y0), (x1,y1), color,1)
        img1 = cv.circle(img1,tuple(pt1),5,color,-1)
        img2 = cv.circle(img2,tuple(pt2),5,color,-1)
    return img1,img2



lines1 = cv.computeCorrespondEpilines(pts2.reshape(-1,1,2), 2,F)
lines1 = lines1.reshape(-1,3)
img5,img6 = drawlines(img1,img2,lines1,pts1,pts2)

lines2 = cv.computeCorrespondEpilines(pts1.reshape(-1,1,2), 1,F)
lines2 = lines2.reshape(-1,3)
img3,img4 = drawlines(img2,img1,lines2,pts2,pts1)
plt.figure(figsize=(18,16))
plt.subplot(121),plt.imshow(img5)
plt.subplot(122),plt.imshow(img3)
plt.show()
```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