Pankajan T. 190428D

In [ ]:

```
import cv2 as cv
import matplotlib.pyplot as plt
import numpy as np
from scipy.linalg import null_space
```

In [ ]:

```
f = open('templeSR_par.txt')
assert f is not None
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=(15,15))
ax[0].imshow(cv.cvtColor(im1, cv.COLOR_BGR2RGB))
ax[0].set_title('Image 1')
ax[0].set_xticks([]), ax[0].set_yticks([])

ax[1].imshow(cv.cvtColor(im2, cv.COLOR_BGR2RGB))
ax[1].set_title('Image 2')
ax[1].set_xticks([]), ax[1].set_yticks([])
```

Out[ ]:

```
([], [])
```

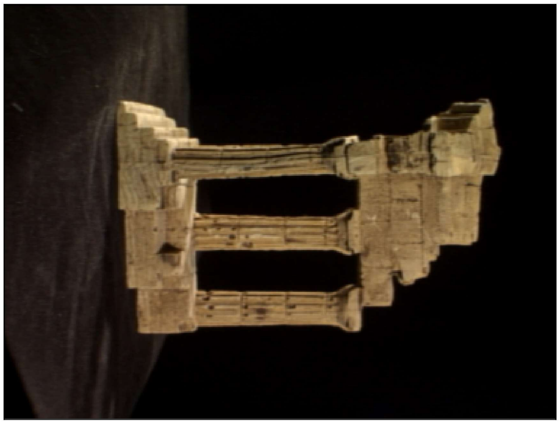


Image 1

Image 2

In [ ]:

```
#Compute P1 and P2

P1 = K1 @ np.hstack((R1,t1)) # P = K*[R|t]
P2 = K2 @ np.hstack((R2,t2)) # P = K*[R|t]
print('P1 =',P1)
print('P2 =',P2)
```

```
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]]
P2 = [[-1.55882371e+02  1.44377186e+03 -5.42436214e+02  6.81806220e+01]
 [ 1.34928131e+03 -8.41979541e+01 -7.49443961e+02  1.99929996e+02]
 [-3.40999743e-01 -1.74474039e-01 -9.23730472e-01  6.00850565e-01]]
```

In [ ]:

```
#Compute F

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)

#Compute the epipolar line corresponding to the given x and plot

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)
#cv.namedWindow('Im')
#cv.imshow('Im',im1)
#cv.waitKey(0)
#cv.imshow('Im',im2)
#cv.waitKey(0)/
#cv.destroyAllWindows()
```

```
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]]
```

Out[ ]:

```
array([[[17, 22, 28],
        [16, 21, 27],
        [16, 21, 27],
        ...,
        [ 0,  0,  0],
        [ 0,  0,  0],
        [ 0,  0,  0]],

       [[14, 19, 25],
        [13, 17, 23],
        [14, 19, 25],
        ...,
        [ 0,  0,  0],
        [ 0,  0,  0],
        [ 0,  0,  0]],

       [[12, 19, 25],
        [13, 20, 26],
        [14, 19, 25],
        ...,
        [ 0,  0,  0],
        [ 0,  0,  0],
        [ 0,  0,  0]],

       ...,

       [[ 2,  7, 11],
        [ 1,  7, 11],
        [ 2,  6, 12],
        ...,
        [ 0,  0,  0],
        [ 0,  0,  0],
        [ 0,  0,  0]],

       [[ 1,  6, 11],
        [ 0,  5, 10],
        [ 1,  5, 11],
        ...,
        [ 1,  0,  0],
        [ 1,  0,  0],
        [ 1,  0,  0]],

       [[ 1,  5, 10],
        [ 1,  5, 10],
        [ 2,  5, 10],
        ...,
        [ 0,  0,  0],
        [ 0,  0,  0],
        [ 0,  0,  0]]], dtype=uint8)
```

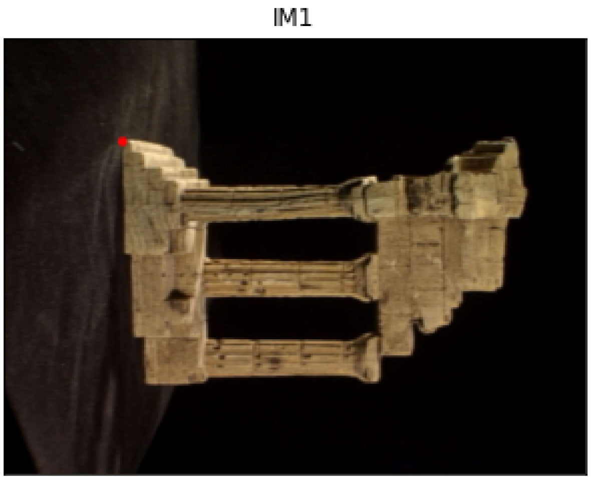
In [ ]:

```
x = np.array([130, 115,1])

cv.circle(im1 , (x[0], x[1]), 5 , (0,0,255),-1)
fig , ax =  plt.subplots()
ax.imshow(cv.cvtColor(im1, cv.COLOR_BGR2RGB))
ax.set_title('IM1')
ax.set_xticks([]), ax.set_yticks([])
```

Out[ ]:

```
([], [])
```



In [ ]:

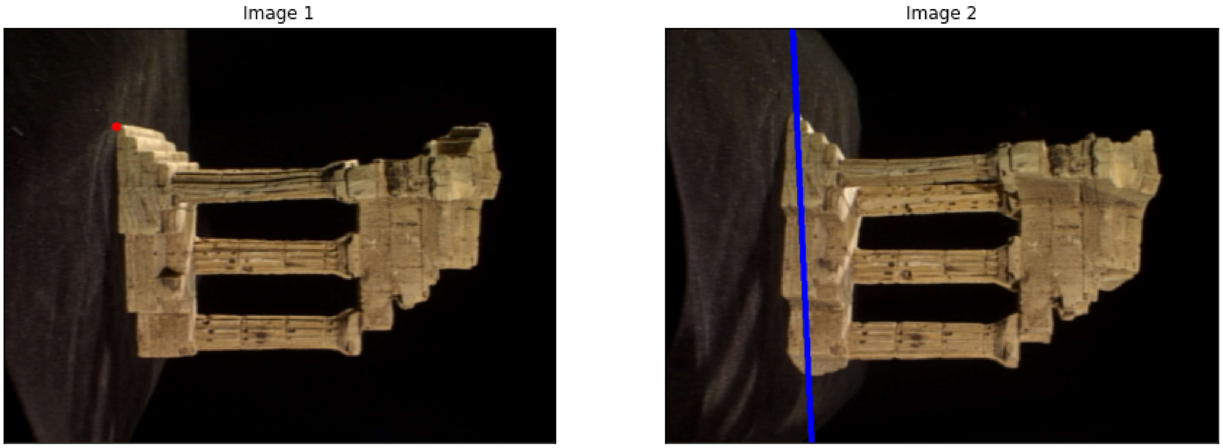
```
l2 = F @ x.T
p1 = np.array([0, (l2[0]*0 + l2[2])/l2[1]]).astype(int)
p2 = np.array([500, (l2[0]*500 + l2[2])/l2[1]]).astype(int)

cv.line(im2, (p1[0],p1[1]),(p2[0], p2[1]),(255,0,0),5)
img1=cv.cvtColor(im1, cv.COLOR_BGR2RGB)
img2=cv.cvtColor(im2, cv.COLOR_BGR2RGB)
fig , ax =  plt.subplots(1,2,figsize=(15,15))
ax[0].imshow(cv.cvtColor(im1, cv.COLOR_BGR2RGB))
ax[0].set_title('Image 1')
ax[0].set_xticks([]), ax[0].set_yticks([])

ax[1].imshow(cv.cvtColor(im2, cv.COLOR_BGR2RGB))
ax[1].set_title('Image 2')
ax[1].set_xticks([]), ax[1].set_yticks([])
```

Out[ ]:

```
([], [])
```



In [ ]:

```
sift = cv.SIFT_create()
# find the keypoints and descriptors with SIFT
kp1, des1 = sift.detectAndCompute(img1,None)
kp2, des2 = 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(des1,des2,k=2)
```

```
pts1 = []
pts2 = []


for i,(m,n) in enumerate(matches):
    if m.distance < 0.8*n.distance:
        pts2.append(kp2[m.trainIdx].pt)
        pts1.append(kp1[m.queryIdx].pt)
```

In [ ]:

```
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 linedraw(img1,img2,lines,pts1,pts2):
    r,c =img1.shape[0],img1.shape[1]
    img1 = cv.cvtColor(img1,cv.COLOR_RGB2BGR)
    img2 = cv.cvtColor(img2,cv.COLOR_RGB2BGR)
    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 = linedraw(img1,img2,lines1,pts1,pts2)

lines2 = cv.computeCorrespondEpilines(pts1.reshape(-1,1,2), 1,F)
lines2 = lines2.reshape(-1,3)
img3,img4 = linedraw(img2,img1,lines2,pts2,pts1)
fig , ax =  plt.subplots(1,2,figsize=(15,15))
ax[0].imshow(cv.cvtColor(img5, cv.COLOR_BGR2RGB))
ax[0].set_title('Image 1')
ax[0].set_xticks([]), ax[0].set_yticks([])

ax[1].imshow(cv.cvtColor(img3, cv.COLOR_BGR2RGB))
ax[1].set_title('Image 2')
ax[1].set_xticks([]), ax[1].set_yticks([])
plt.show()
```

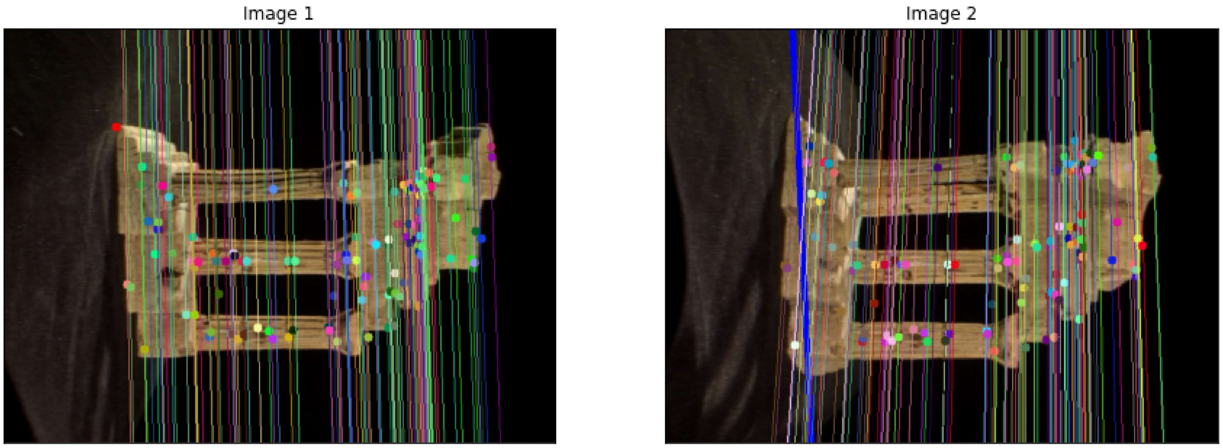


Image 1

Image 2

In [ ]: