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Aim: Use descriptors to align images

Task 1: Determine location of key points and descriptors for an image and image to be aligned

Task 2: Determine matching key points of the two images

Task 3: Determine transformation matrix using matched key points

Task 4: Use transformation matrix to align the image to be aligned

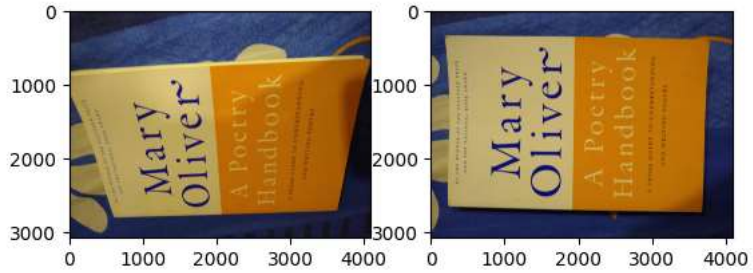
```
import cv2
import matplotlib.pyplot as plt
import numpy as np
import imutils
```

```
img1 = cv2.imread('/content/book2.jpg')
img2 = cv2.imread('/content/book1.jpg')
```

```
img1 = cv2.cvtColor(img1, cv2.COLOR_BGR2RGB)
img2 = cv2.cvtColor(img2, cv2.COLOR_BGR2RGB)
```

```
fig, ax = plt.subplots(1,2)
ax[0].imshow(img1)
ax[1].imshow(img2)
```

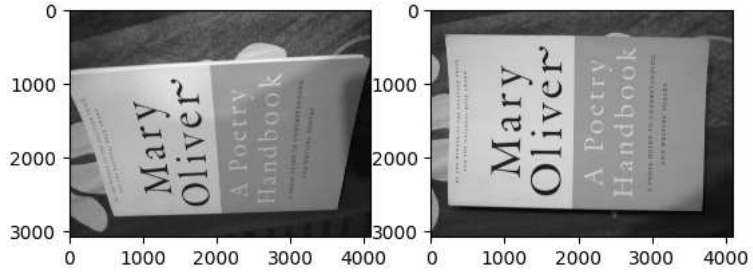
```
<matplotlib.image.AxesImage at 0x7d2acb982ed0>
```




```
img1_g = cv2.cvtColor(img1, cv2.COLOR_RGB2GRAY)
img2_g = cv2.cvtColor(img2, cv2.COLOR_RGB2GRAY)
```

```
fig, ax = plt.subplots(1,2)
ax[0].imshow(img1_g, cmap="gray")
ax[1].imshow(img2_g, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7d2ac5f12c90>
```




```
orb = cv2.ORB_create(500)
k1, d1 = orb.detectAndCompute(img1_g, None)
k2, d2 = orb.detectAndCompute(img2_g, None)
```

```
matcher = cv2.BFMatcher(cv2.NORM_HAMMING)
matches = matcher.match(d1, d2)
```

```
ln = len(matches)
```

```
matches = sorted(matches, key=lambda x: x.distance)


print(matches[0].distance)
```

```
14.0
```

```
ln = int(ln * 0.9)


matches = matches[:ln]


kp1 = np.zeros((ln, 2))
kp2 = np.zeros((ln, 2))


kp1.shape
kp2.shape
```

```
(450, 2)
```

```
for i in range(ln):
  kp1[i, :] = k1[matches[i].queryIdx].pt
  kp2[i, :] = k2[matches[i].trainIdx].pt


h, mask = cv2.findHomography(kp1, kp2, cv2.RANSAC)

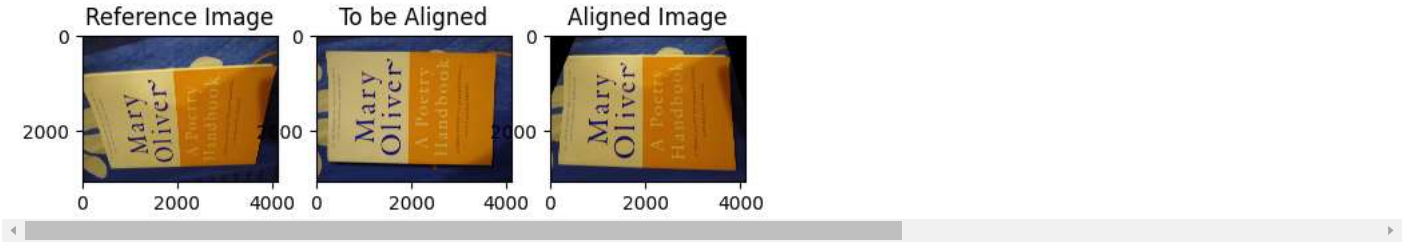

h
```

```
array([[ 7.08082041e-01, -3.32342682e-01,  6.03295064e+02],
       [ 3.02387006e-02,  6.14703129e-01, -1.18835423e+02],
       [-9.15349545e-06, -1.41771774e-04,  1.00000000e+00]])
```

```
img_warp = cv2.warpPerspective(img1, h, (img2_g.shape[1], img2_g.shape[0]))


fig, ax = plt.subplots(1,3)
ax[0].imshow(img1)
ax[0].set_title("Reference Image")
ax[1].imshow(img2)
ax[1].set_title("To be Aligned")
ax[2].imshow(img_warp)
ax[2].set_title("Aligned Image")
```

```
Text(0.5, 1.0, 'Aligned Image')
```



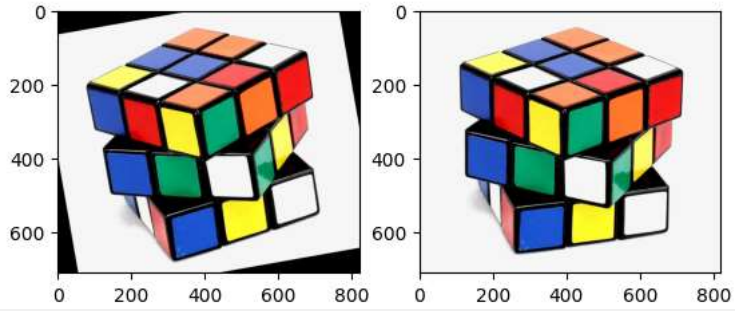
Self-code

```
img2 = cv2.imread('/content/cube.png')
img1 = imutils.rotate(img2, 10)


img1 = cv2.cvtColor(img1, cv2.COLOR_BGR2RGB)
img2 = cv2.cvtColor(img2, cv2.COLOR_BGR2RGB)


fig, ax = plt.subplots(1,2)
ax[0].imshow(img1)
ax[1].imshow(img2)
```

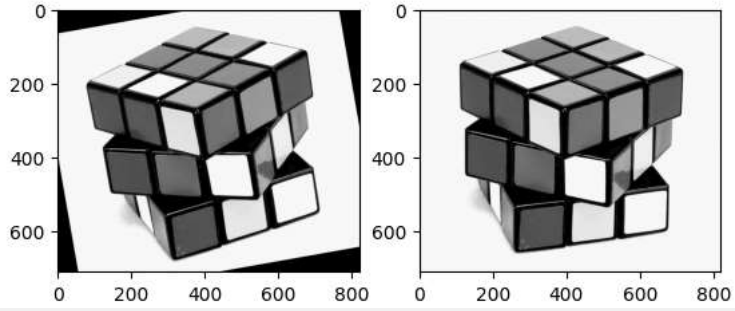
```
<matplotlib.image.AxesImage at 0x7d2a7c4dbed0>
```



```
img1_g = cv2.cvtColor(img1, cv2.COLOR_RGB2GRAY)
img2_g = cv2.cvtColor(img2, cv2.COLOR_RGB2GRAY)


fig, ax = plt.subplots(1,2)
ax[0].imshow(img1_g, cmap="gray")
ax[1].imshow(img2_g, cmap="gray")
```

```
<matplotlib.image.AxesImage at 0x7d2a79926090>
```



```
orb = cv2.ORB_create(500)
k1, d1 = orb.detectAndCompute(img1_g, None)
k2, d2 = orb.detectAndCompute(img2_g, None)


matcher = cv2.BFMatcher(cv2.NORM_HAMMING)
matches = matcher.match(d1, d2)


ln = len(matches)


matches = sorted(matches, key=lambda x: x.distance)


print(matches[0].distance)
```

```
1.0
```

```
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```
for i in range(ln):
  kp1[i, :] = k1[matches[i].queryIdx].pt
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```

```
h, mask = cv2.findHomography(kp1, kp2, cv2.RANSAC)
```

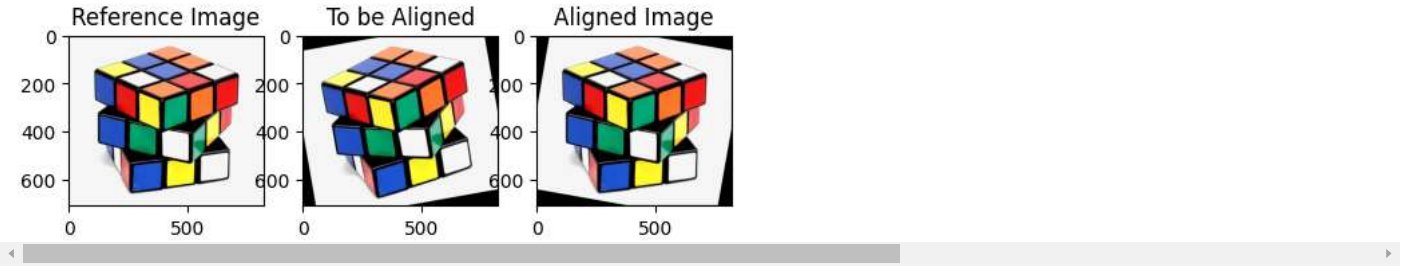
```
h
```

```
array([[ 9.87395625e-01, -1.71456169e-01,  6.69922355e+01],
       [ 1.73964135e-01,  9.90352221e-01, -6.66485389e+01],
       [ 8.66613168e-07,  7.02027382e-06,  1.00000000e+00]])
```

```
img_warp = cv2.warpPerspective(img1, h, (img2_g.shape[1], img2_g.shape[0]))
```

```
fig, ax = plt.subplots(1,3)
ax[0].imshow(img2)
ax[0].set_title("Reference Image")
ax[1].imshow(img1)
ax[1].set_title("To be Aligned")
ax[2].imshow(img_warp)
ax[2].set_title("Aligned Image")
```

```
Text(0.5, 1.0, 'Aligned Image')
```



Conclusion: ORB descriptor is used to align images with 450 keypoints are used to generate homography matrix which is used to warp the image is used to warp the image by 10 degrees even then the image can be aligned to reference image using the above technique. The requirement of alignment is that the images should have sufficient number of corners.