

```
#The code below is intended to find the homography matrix after feature matching  
#The code is adapted from the image alignment tutorial  
#The website is as follows: https://www.pyimagesearch.com/2020/08/31/image-alignment-and-registration-with-opencv/
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```
#Import libraries  
import numpy as np  
import imutils  
import cv2
```

```
#A helper function that finds the homography matrix  
#Input: the image/camera input and the template/desired position  
#Output: the homography matrix between the two images
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```
def homography_matrix(image, template, maxFeatures=500, keepPercent=0.2, debug=False):
```

```
# convert both the input image and template to grayscale  
imageGray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)  
templateGray = cv2.cvtColor(template, cv2.COLOR_BGR2GRAY)  
  
# use ORB to detect keypoints and extract (binary) local invariant features  
orb = cv2.ORB_create(maxFeatures)  
(kpsA, descA) = orb.detectAndCompute(imageGray, None)  
(kpsB, descB) = orb.detectAndCompute(templateGray, None)
```

```
# match the features  
method = cv2.DESCRIPTOR_MATCHER_BRUTEFORCE_HAMMING  
matcher = cv2.DescriptorMatcher_create(method)  
matches = matcher.match(descA, descB, None)
```

```
# sort the matches by their distance  
# the smaller the distance, the "more similar" the features are)
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matches = sorted(matches, key=lambda x:x.distance)
```

```
# keep only the top matches
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keep = int(len(matches) * keepPercent)  
matches = matches[:keep]
```

```
# allocate memory for the keypoints (x, y)-coordinates from the  
# top matches -- we'll use these coordinates to compute the homography matrix
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```
ptsA = np.zeros((len(matches), 2), dtype="float")  
ptsB = np.zeros((len(matches), 2), dtype="float")
```

```
# loop over the top matches
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for (i, m) in enumerate(matches):
```

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# indicate that the two keypoints in the respective images  
# map to each other
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ptsA[i] = kpsA[m.queryIdx].pt  
ptsB[i] = kpsB[m.trainIdx].pt
```

```
#computes the homography matrix between two sets of matched points
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(H, mask) = cv2.findHomography(ptsA, ptsB, method=cv2.RANSAC)  
return H
```