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Assignment 7

1. Below are the input images used to match features:



original image



sample image

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lighting image (brightened)



rotation image

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scale image

2. First the key points and image descriptors are calculated for each image using the orb.detectAndCompute function. A brute force matcher is then created using the Hamming distance and cross-checking, ensuring two feature in both images match. Next the brute force matcher is used to determine the matches between the two images. Once a list of matches is created it is then sorted by distance. Finally the key points of each image along with the top ten matches is returned as seen in the code below:

```
# WRITE YOUR CODE HERE
sift = SIFT()

image_1_kp, image_1_desc = sift.detectAndCompute(image_1, None)
image_2_kp, image_2_desc = sift.detectAndCompute(image_2, None)

bf = cv2.BFMatcher(cv2.NORM_HAMMING, crossCheck=True)

matches = bf.match(image_1_desc, image_2_desc)
matches = sorted(matches, key = lambda x:x.distance)

# We coded the return statement for you. You are free to modify it -- just
# make sure the tests pass.
return image_1_kp, image_2_kp, matches[:10]
# END OF FUNCTION.
```

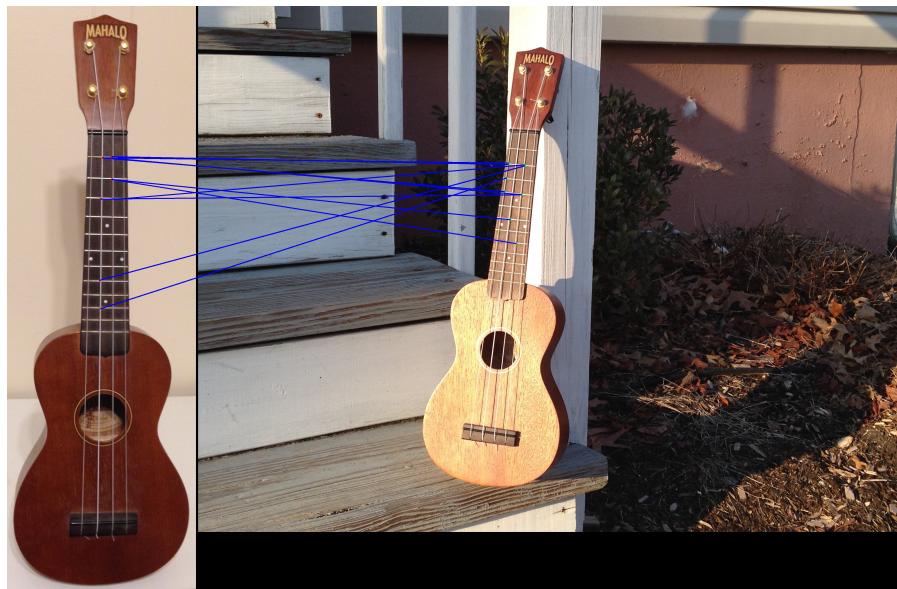
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sample:



Only one feature seems to be detected, the right most dot on the 7th fret. The errors may occur due to the repeating patterns on the neck of the ukulele, or the size of the template image.

lighting:



No features were detected in the lighted image. This may be due to a lower magnitude of the gradient due to the increased intensity from the additional light.

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rotation:



One feature is detected, the last dot on the 10th fret (bottom dot in the original image), in the rotated image. This may be due to the repeating patterns of the ukulele or the angle the ukulele was placed at as well as the size of the template image.

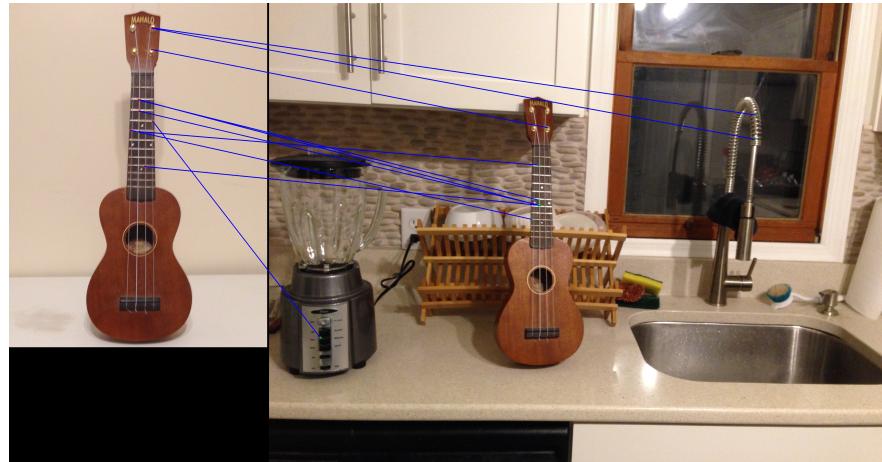
scale:



One feature was detected on the 6th fret (bar above the double dots). This may be due to the size of the template image or the angle of the camera and ukulele.

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The previous photos portray the second attempt of the experiment. The first attempt of the experiment yielded a similar amount of detected features. The first original image was not cropped as well as the second. The errors may have been due to the extra area (noise) around the ukulele in the original image. In the sample image below one feature was detected the bottom right machine head near the top of the ukulele:



The third attempt involved cropping a smaller image of the ukulele as the original image. This resulted in zero features detected in the sample image as shown below:

