Assignment3 - Computer vision

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I will create a function that searches matched images from gallery images. As I observed in the gallery, all the images were named by it characteristic, for example: dog1.jpg, cup1.jpg, etc. Therefore, I will only apply SIFT extracture on objects with the same type. This will help reduce the computational resources. Hpwever, if we name the images randomly, we need to iterate the whole gallery.

I utilized the glob and re module to read and extract the objects's name.

As we can see in the report, SamL98 PySIFT library is very useful for understanding SIFT, but the code is very slow and hardly can be applied here. That's why I will use a highly optimized library, OpenCV, for this task.

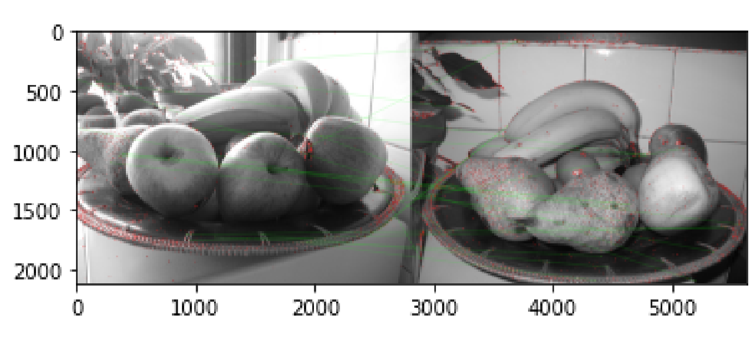
Firstly the function will read the input image directory then convert it into gray scale, and calculate its keypoints. The same procedure is done for all the same type of images in the gallery.

After we get the features of the two images, we can apply Brute-Force Matcher by OpenCV. This method the decriptor of one feeture in first set and is matched with all other features in second set using some distance calculation. And the closest one is returned. In this function I use knnMatch which is standed for K-nearest neighbor match. This method will return k best matches. Subsequently, we check if two of these features are close or not. If they are close enough (for a specific threshold) then we consider them as potentially matched. Further threshold is applied to get the final result. Finally, we save the matched image in the database.

In [1]:
```python
import cv2
import re
import matplotlib.pyplot as plt
import glob
def match_image(img_path,img_dict_path):
    sift = cv2.xfeatures2d.SIFT_create() # create a SIFT detector
    bf = cv2.BFMatcher() # create a matcher
    img1_object = re.split('\d+',img_path.split('/')[-1])[0] # split the string for extracting the object name
    img1 = cv2.imread(img_path)
    img1 = cv2.cvtColor(img1, cv2.COLOR_BGR2GRAY)
    keypoints_1, descriptors_1 = sift.detectAndCompute(img1,None) # compute keypoints
    img_dict = glob.glob(img_dict_path)
    for img in img_dict:
        if img.split('\\')[1].lower() == img_path.split('/')[-1].lower(): continue # same image -> skip
        img2_object = re.split('\d+',img.split('\\')[1])[0] # split the string the extract the name of object
        if img2_object != img1_object: continue # different object -> skip
        img2 = cv2.imread(img)
        img2 = cv2.cvtColor(img2, cv2.COLOR_BGR2GRAY)
        keypoints_2, descriptors_2 = sift.detectAndCompute(img2,None)
        matches = bf.knnMatch(descriptors_1,descriptors_2, k=2) # match  features of the image we're considering and the image in the gallery
        save_file = 'C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/results/'+'match_with_'+img.split('\\')[1].split('.')[0]+'.jpg'
        # Apply ratio test
        good = []
        for m,n in matches:
            if m.distance < 0.75*n.distance: # if two feature have 75% similar then considering them as close
                # where matches object has the attribute distance stand for the distance between descriptors.
                good.append([m])
        if len(good) >=20: # apply further threshold
            img3 = cv2.drawMatchesKnn(img1, keypoints_1, img2, keypoints_2, (good), None, # draw matched image
                                  matchColor=(0, 255, 0), matchesMask=None,
                                  singlePointColor=(255, 0, 0), flags=0)
            print("match with",img.split('\\')[1].split('.')[0])
            plt.imshow(img3)
            plt.savefig(save_file)
        else: print("not match with",img.split('\\')[1].split('.')[0])
```

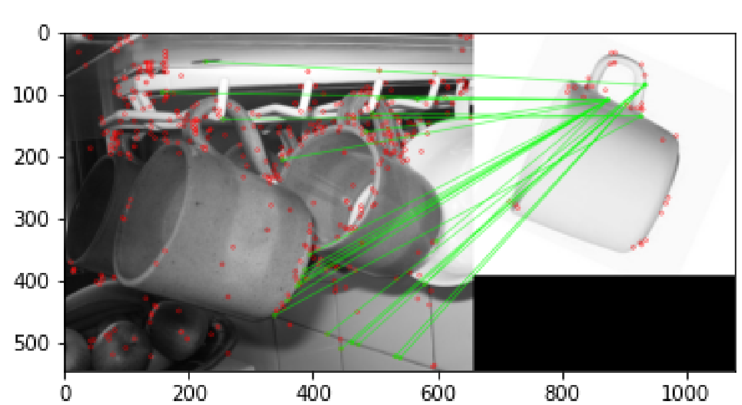
In [2]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/fruit1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with fruit2
match with fruit3
match with fruit4
```



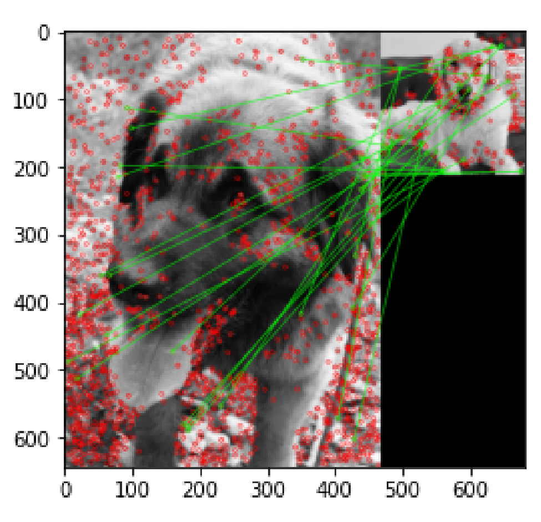
In [3]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/cup1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with cup10
match with cup2
not match with cup3
match with cup4
not match with cup5
not match with cup6
not match with cup7
not match with cup8
not match with cup9
```



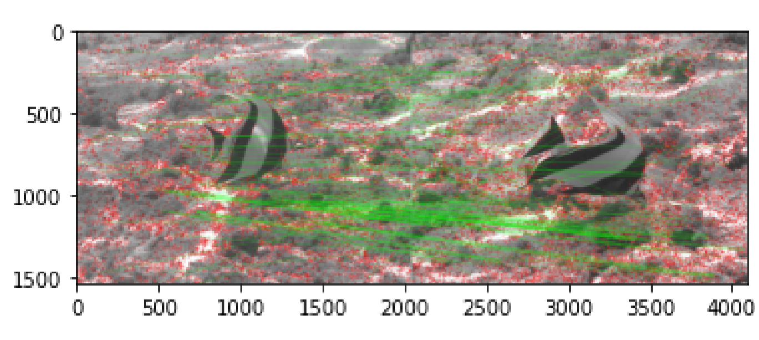
In [4]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/dog1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with dog2
not match with dog3
not match with dog4
match with dog5
```



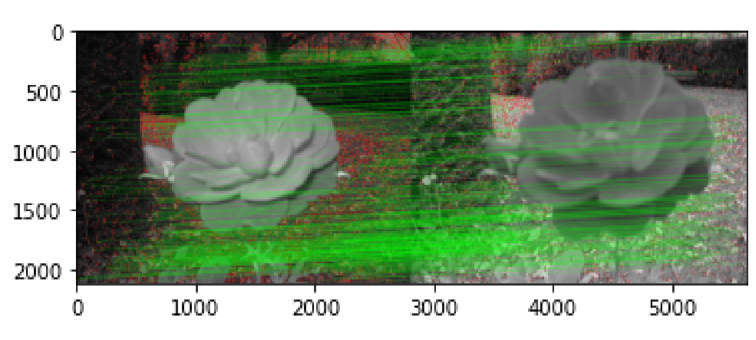
In [5]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/fish1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with fish2
match with fish3
```



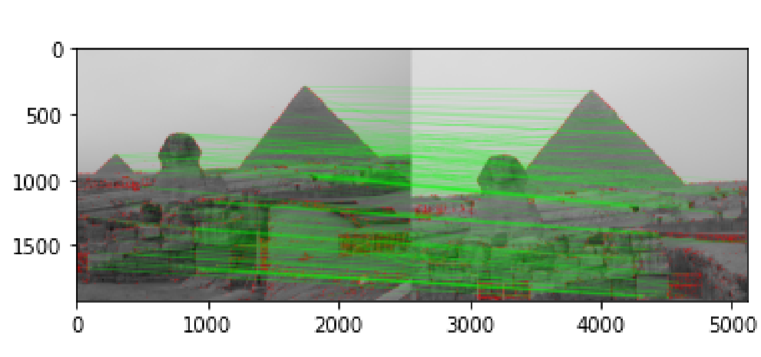
In [6]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/rose2.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with rose1
match with rose3
```



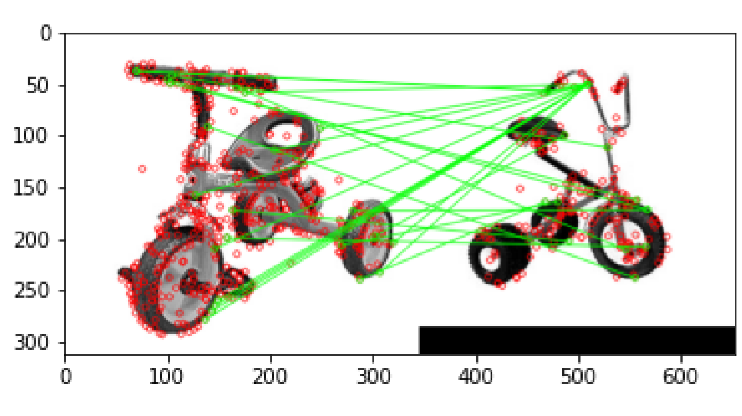
In [7]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/pyramid1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with pyramid2
match with pyramid3
match with pyramid4
```



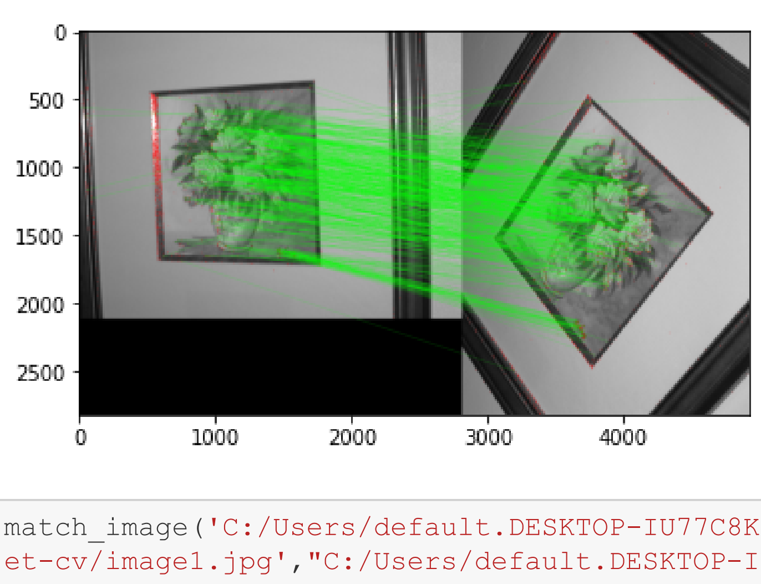
In [8]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/tricycle1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with tricycle2
match with tricycle3
not match with tricycle4
not match with tricycle5
match with tricycle6
```



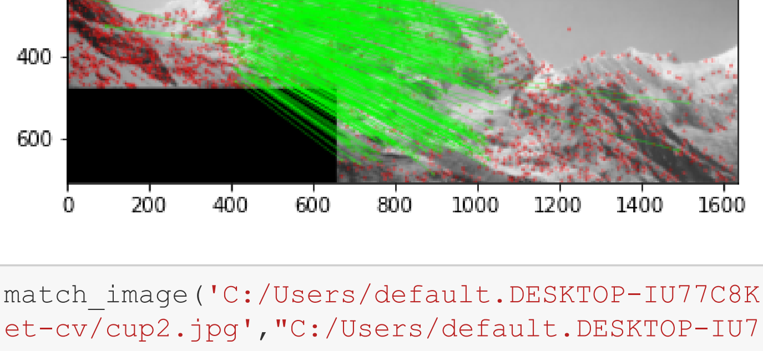
In [9]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/painting1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with painting2
match with painting3
```



In [10]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/image1.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
match with image2
```



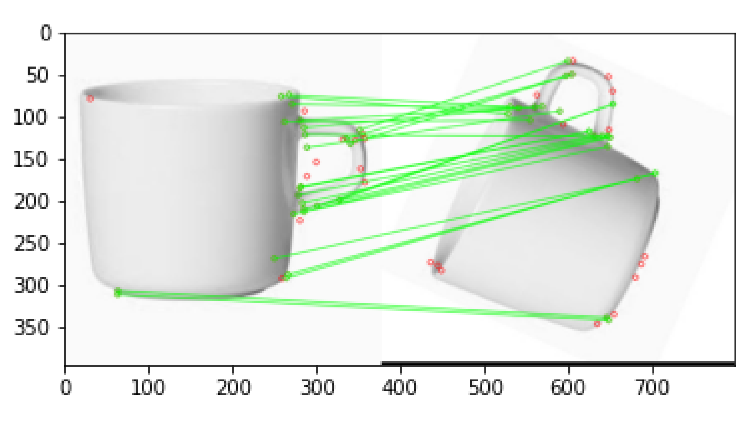
In [11]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/cup2.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with cup1
not match with cup10
not match with cup3
not match with cup4
not match with cup5
not match with cup6
not match with cup7
not match with cup8
not match with cup9
```

We can see that there is no match for cup 2 in the database

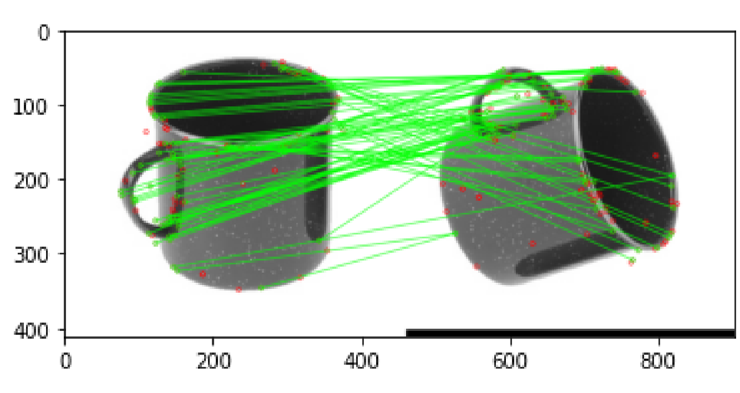
In [12]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/cup3.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with cup1
not match with cup10
not match with cup2
match with cup4
not match with cup5
not match with cup6
not match with cup7
not match with cup8
not match with cup9
```



In [13]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/cup5.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with cup1
not match with cup10
not match with cup2
not match with cup3
match with cup4
match with cup6
not match with cup7
not match with cup8
not match with cup9
```



In [14]:
```python
match_image('C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/cup7.jpg',"C:/Users/default.DESKTOP-IU77C8K/Desktop/github/Computer-Vision/project3_sift/PySIFT/dataset-cv/*.jpg")
```

```
not match with cup1
not match with cup10
not match with cup2
not match with cup3
not match with cup4
not match with cup5
not match with cup6
match with cup8
not match with cup9
```