In [22]:

```
#importing required libraries
import cv2
import numpy as np
import matplotlib.pyplot as plt
```

In [23]:

```
#reading test image
train_img = cv2.imread('./train.jpg')

#reading train image
test_img = cv2.imread('./test.jpg')
```

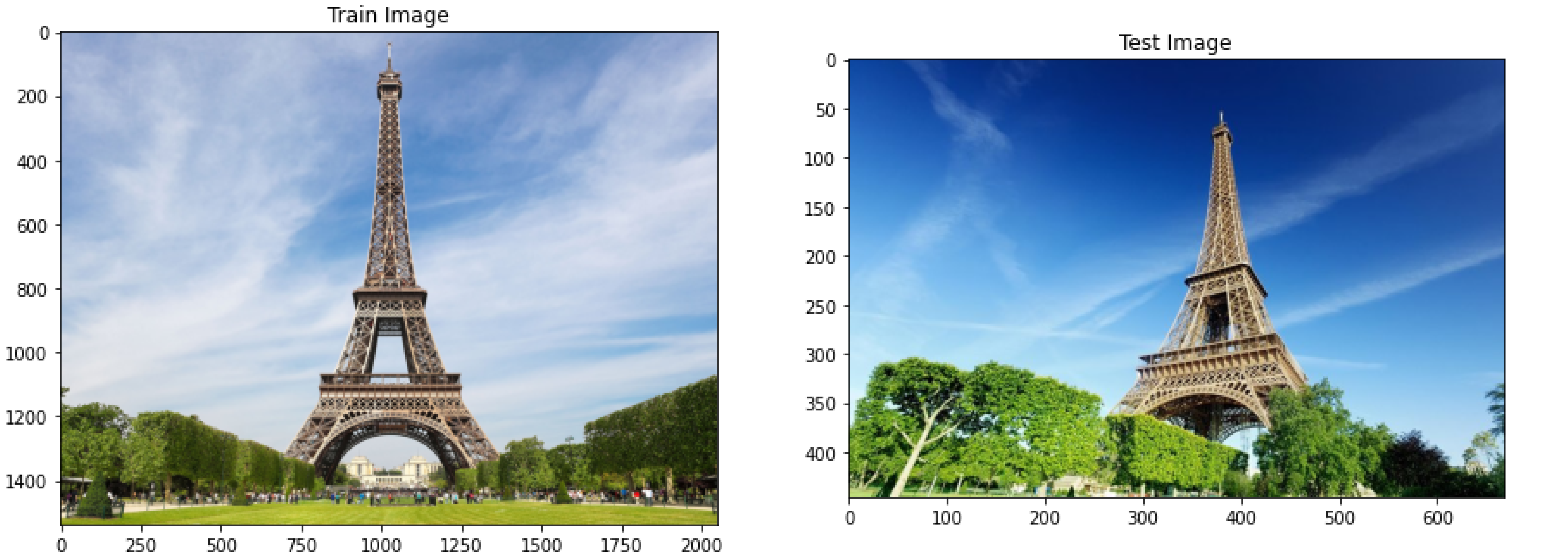
In [32]:

```
#function to plot signed 32bit signed matrix images side by side
def plot_32bs_images(img1, img2, title1="", title2=""):
    fig = plt.figure(figsize=[15, 15])
    axis1 = fig.add_subplot(121)
    axis1.imshow(cv2.cvtColor(img1, cv2.CV_32S))
    axis1.set(title=title1)
    axis2 = fig.add_subplot(122)
    axis2.imshow(cv2.cvtColor(img2, cv2.CV_32S))
    axis2.set(title=title2)


#function to plot gray images side by side
def plot_images(img1, img2, title1="", title2=""):
    fig = plt.figure(figsize=[15, 15])
    axis1 = fig.add_subplot(121)
    axis1.imshow(img1, cmap="gray")
    axis1.set(title=title1)
    axis2 = fig.add_subplot(122)
    axis2.imshow(img2, cmap="gray")
    axis2.set(title=title2)
```

In [33]:

```
# Show Original Images
plot_32bs_images(train_img, test_img, "Train Image", "Test Image")
```

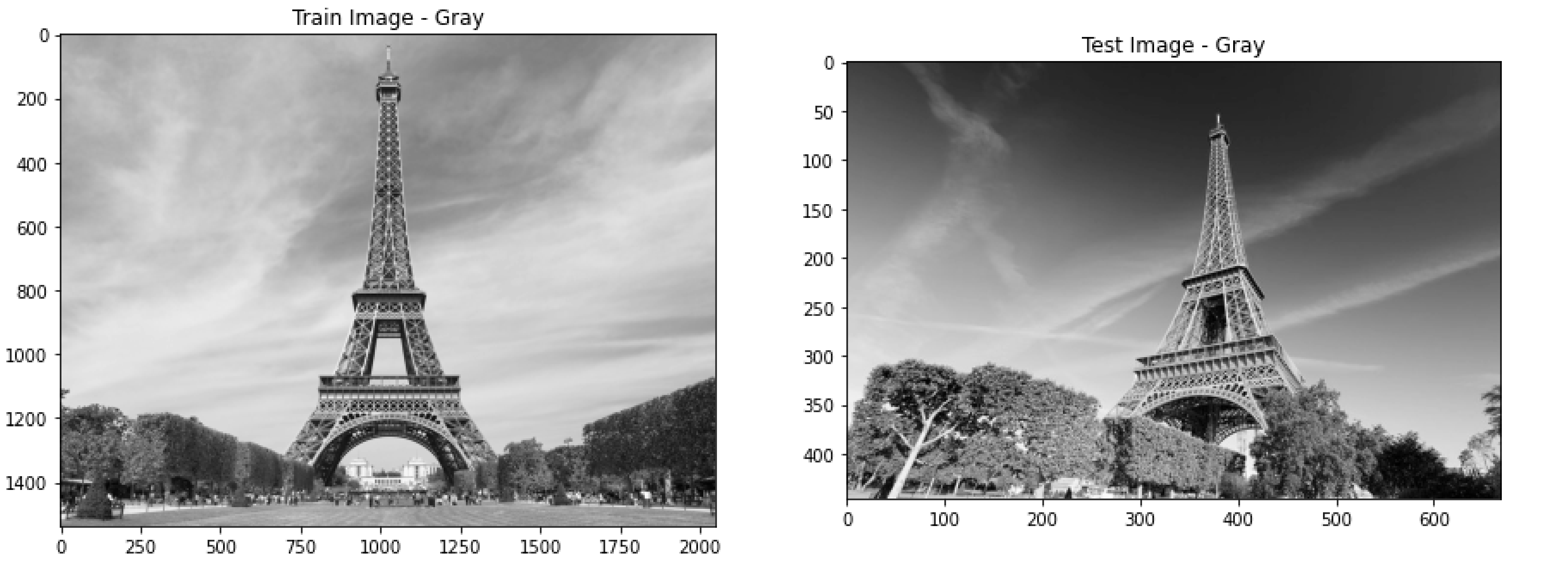


In [34]:

```
# changing Images to grayscale
train_gray_img = cv2.cvtColor(train_img, cv2.COLOR_BGR2GRAY)
test_gray_img = cv2.cvtColor(test_img, cv2.COLOR_BGR2GRAY)
```

In [36]:

```
#plot grayscale images
plot_images(train_gray_img, test_gray_img, 'Train Image - Gray', 'Test Image - Gray')
```



In [37]:

```
# Initialise Open CV SIFT detector
sift = cv2.SIFT_create()
```

In [38]:

```
#function to get keypoints and descriptors
def get_KP_DESC(img):
    return sift.detectAndCompute(img, None)
```

In [41]:

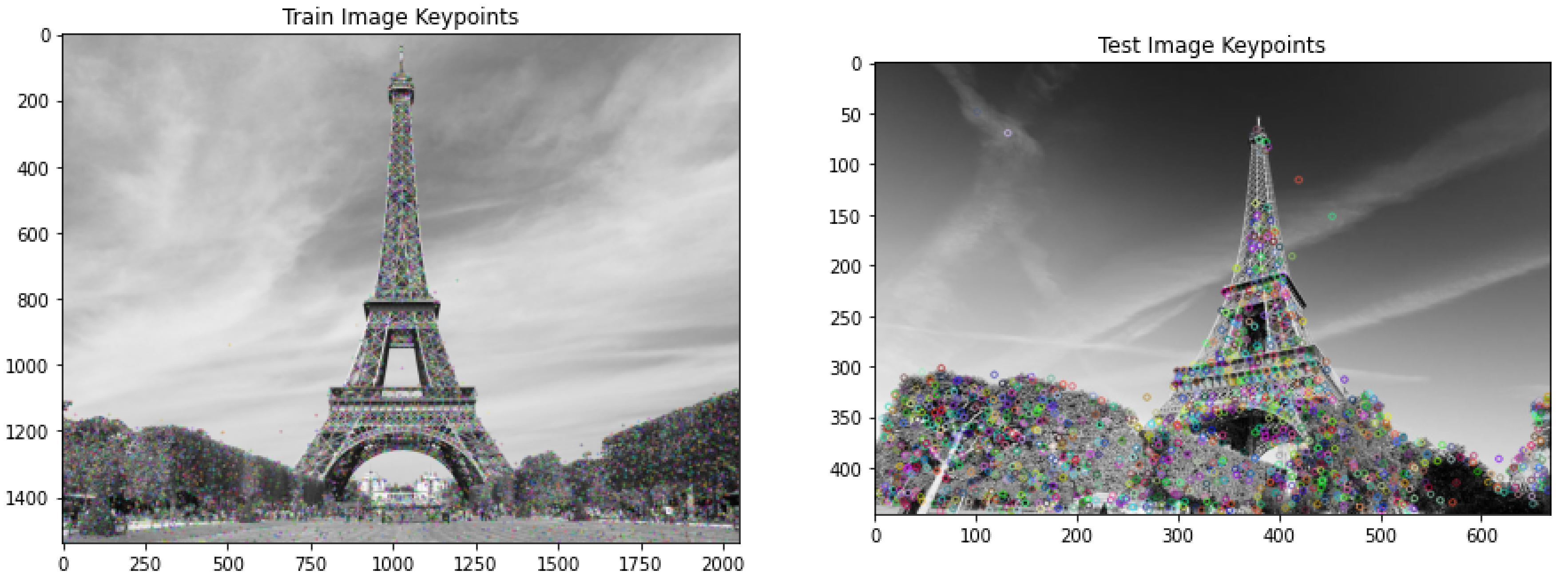
```
# Generate SIFT keypoints and descriptors
train_kp, train_desc = get_KP_DESC(train_gray_img)
test_kp, test_desc = get_KP_DESC(test_gray_img)
```

In [44]:

```
#function to draw keypoints on image
def draw_KP(gray_img_1, kp1, orig_img_1, title1, gray_img_2, kp2, orig_img_2, title2):
    img1 = cv2.drawKeypoints(gray_img_1, kp1, orig_img_1.copy())
    img2 = cv2.drawKeypoints(gray_img_2, kp2, orig_img_2.copy())
    fig = plt.figure(figsize=[15, 15])
    axis1 = fig.add_subplot(121)
    axis1.imshow(img1)
    axis1.set(title=title1)
    axis2 = fig.add_subplot(122)
    axis2.imshow(img2)
    axis2.set(title=title2)
```

In [45]:

```python
#draw detected keypoints on images
draw_KP(train_gray_img, train_kp, train_img, 'Train Image Keypoints', test_gray_img, test_kp, test_img, 'Test Image Keypoints')
```



In [49]:

```python
# create a Brute Force Matcher object which will match the SIFT features
brute_force = cv2.BFMatcher(cv2.NORM_L2, crossCheck=True)

matches = brute_force.match(train_desc, test_desc)
```

In [50]:

```python
# Sort the matches in the order of their distance in ascending order.
matches = sorted(matches, key = lambda x:x.distance)
```

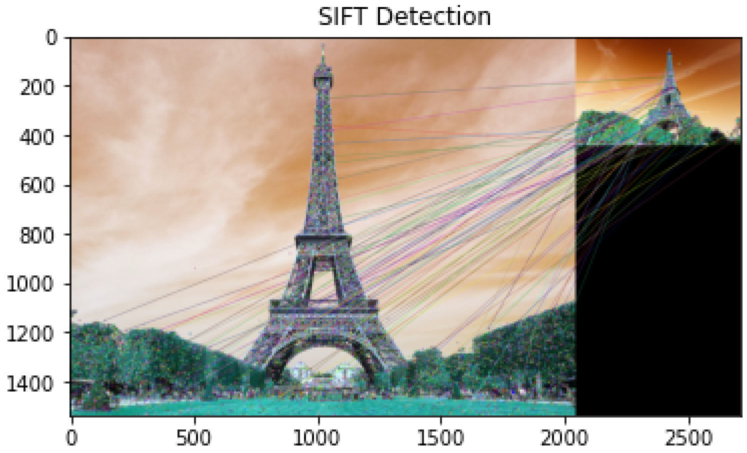
In [51]:

```python
# draw the top N matches
N_MATCHES = 100

matched_img = cv2.drawMatches(train_img, train_kp, test_img, test_kp, matches[:N_MATCHES], test_img.copy(), flags=0)
```

In [53]:

```python
#Plotting matched image
plt.figure()
plt.imshow(matched_img)
plt.title('SIFT Detection')
plt.show()
```


SIFT Detection
0
200
400
600
800
1000
1200
1400
0
500
1000
1500
2000
2500

```
In [ ]:
```

```
In [ ]:
```

```
In [ ]:
```