Part 1 :
Codes runs faster if the displays or couts to console are OFF, for spped checking please make sure the code displays are commented.

Image Matching using the SIFT descriptor :
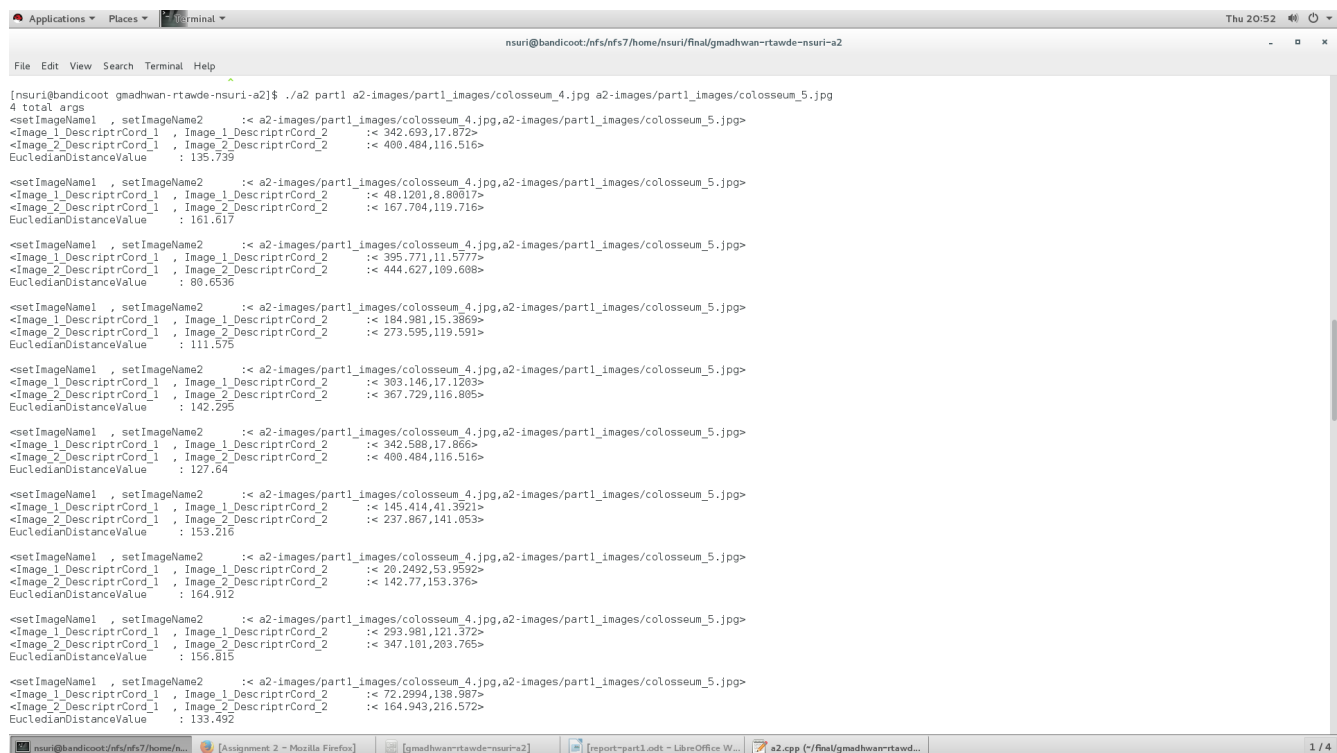
1. Finding matching sift descriptors:
    The **line** inside the function
MatchGivenTwoImageDescriptors(vector<SiftDescriptor> imageDescriptor_1,vector<SiftDescriptor> imageDescriptor_2,string image1, string image2)

 MatchedSwiftVectorsOfSingleImage.back()→printDistProcesdDesciptr(); should be enabled, which will give the matched sift descriptors between two files. **The line inside the IF function**

Below is the image is the sift descriptors for the 2 images given.

```
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                          nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2                        _  □  ×

File  Edit  View  Search  Terminal  Help

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 78.0444,135.338>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 169.94,214.466>
EucledianDistanceValue   : 140.855

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 28.7252,141.553>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 127.168,217.631>
EucledianDistanceValue   : 177.014

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 65.5199,141.546>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 158.935,218.577>
EucledianDistanceValue   : 131.537

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 284.064,149.769>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 331.169,227.288>
EucledianDistanceValue   : 163.129

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 37.5571,122.522>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 139.198,203.969>
EucledianDistanceValue   : 165.665

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 103.796,82.9271>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 200.424,173.899>
EucledianDistanceValue   : 179.424

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 128.527,148.945>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 210.926,223.963>
EucledianDistanceValue   : 121.585

<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2    :< 128.527,148.945>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2    :< 210.926,223.963>
EucledianDistanceValue   : 121.585

The swift matches are going to be mapped and saved to file  a2-images/part1_images/colosseum_4.jpg  :: a2-images/part1_images/colosseum_5.jpg
image width before appending is 500
image width after appending is 1000
Finished Executing ::  1  ::  files over the given query image
The last processed image is :  a2-images/part1_images/colosseum_5.jpg
total argc count   4
Match Number :: 1
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg>
TotalMatchesBetweenImage1and2    : 37

[nsuri@bandicoot gmadhwan-rtawde-nsuri-a2]$ []

nsuri@bandicoot:/nfs/nfs7/home/n...   [Assignment 2 – Mozilla Firefox]   [gmadhwan-rtawde-nsuri-a2]   [report-part1.odt – LibreOffice W...   a2.cpp (~/final/gmadhwan-rtawd...                    1 / 4
```

So the above image says between a2-images/part1_images/colosseum_4.jpg,a2-images/part1_images/colosseum_5.jpg , there are 37 sift matches. These are obtained after finding the ratio of the best and next best for each descriptor in first image and second image, as code explains. Of these I have plotted the best ones which meet the threshold of 0.5

Visualize the sift matches: (decimal coordinates are converted to integer values to plot, so you see the points moving on either sides a bit)

1. Find the matching of interest points from one image and other image using the sift vectors with threshold of 0.6 we can see more matching descriptors and their visualized image. Please run the code to see this images descriptor.
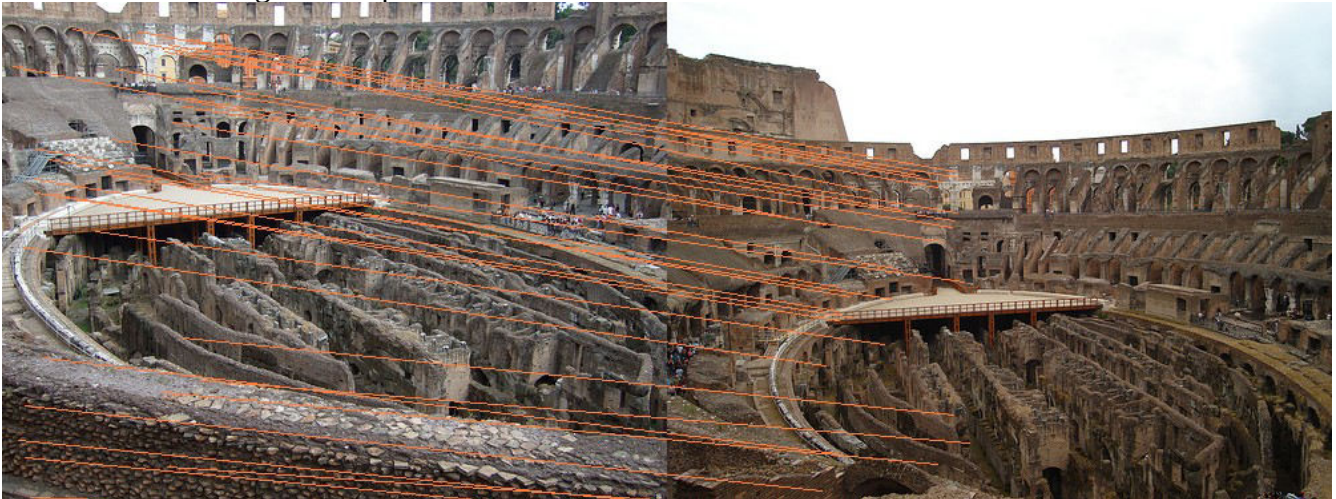
Example 2:

```
nsuri@silo:~/gmadhwan-rtawde-nsuri-a2
[nsuri@silo gmadhwan-rtawde-nsuri-a2]$ ./a2 part1 a2-images/part1_images/colosseum_5.jpg a2-images/part1_images/colosseum_8.jpg
4 total args
The swift matches are going to be mapped and saved to file  a2-images/part1_images/colosseum_5.jpg   :: a2-images/part1_images/colosseum_8.jpg
image width before appending is 500
image width after appending is 1000
Finished Executing ::  1  ::  files over the given query image
The last processed image is :  a2-images/part1_images/colosseum_8.jpg
total argc count   4
Match Number :: 1
<setImageName1  , setImageName2       :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_8.jpg>
TotalMatchesBetweenImage1and2      : 17

[nsuri@silo gmadhwan-rtawde-nsuri-a2]$
```


For a 0.8limit value set, we get too many interest points. However they are not good, as the threshold is too big.

Also, the image captures very different perspecives of same collesum building. This gives the different sift matches with the different sift vectors. So the direct euclidean distance doesn't help in matching all its corresponding images. As you see below the collesum 5 and collesum 8, the images are so different and the information is so different so the sift vectors euclidean values are not really giving a best result. The below image says it had 17 matches which met the threshold. Excluded the display of match vectors to reduce the console output.

Once you give an input to my code as below :
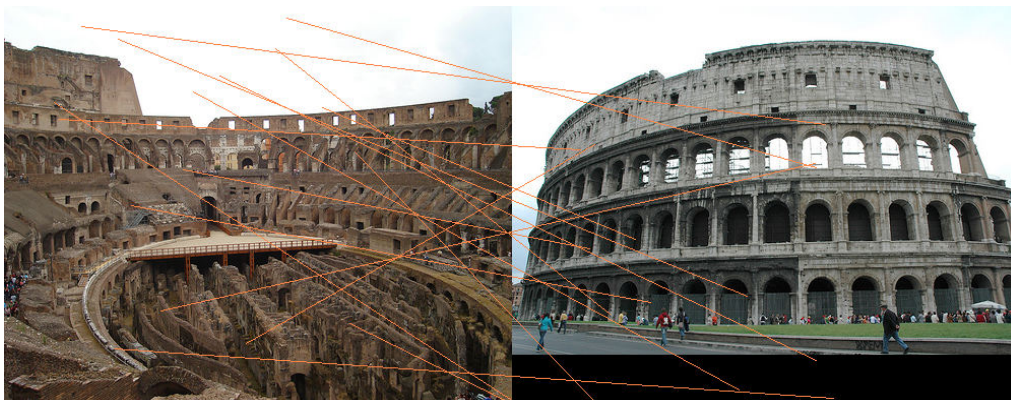
Big-Ben Match Sift Vectors :

[nsuri@bandicoot gmadhwan-rtawde-nsuri-a2]$ ./a2 part1 a2-images/part1_images/bigben_2.jpg a2-images/part1_images/bigben_3.jpg
4 total args
<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 354.118,115.872>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 429.205,244.174>
EucledianDistanceValue : 137.201

<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 356.581,117.284>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 432.988,246.414>
EucledianDistanceValue : 147.872

<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 356.581,117.284>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 432.988,246.414>
EucledianDistanceValue : 143.722

<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 370.551,118.886>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 457.507,250.831>
EucledianDistanceValue : 117.673

<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 400.336,171.429>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 484.483,317.9>
EucledianDistanceValue : 150.14

<setImageName1 , setImageName2 :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2 :< 309.422,204.026>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2 :< 240.638,293.717>

EucledianDistanceValue   : 157.379

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 167.498,220.47>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 74.0241,341.944>
EucledianDistanceValue   : 112.628

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 316.072,105.423>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 245.164,153.725>
EucledianDistanceValue   : 160.86

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 321.789,211.77>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 261.525,307.507>
EucledianDistanceValue   : 117.038

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 170.81,221.05>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 78.798,342.538>
EucledianDistanceValue   : 192.377

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 403.201,136.578>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 486.989,265.765>
EucledianDistanceValue   : 180.994

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 139.219,78.341>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 168.908,228.898>
EucledianDistanceValue   : 196.125

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 144.26,84.2721>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 175.682,237.488>
EucledianDistanceValue   : 203.551

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-
images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 402.534,141.206>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 486.502,272.061>
EucledianDistanceValue   : 193.881

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 309.811,212.95>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 242.09,307.333>
EucledianDistanceValue   : 160.287

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 320.954,154.318>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 254.825,224.346>
EucledianDistanceValue   : 186.051

<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
<Image_1_DescriptrCord_1 , Image_1_DescriptrCord_2   :< 320.954,154.318>
<Image_2_DescriptrCord_1 , Image_2_DescriptrCord_2   :< 254.825,224.346>
EucledianDistanceValue   : 186.051

The swift matches are going to be mapped and saved to file a2-images/part1_images/bigben_2.jpg :: a2-images/part1_images/bigben_3.jpg
image width before appending is 500
image width after appending is 1000
Finished Executing :: 1 :: files over the given query image
The last processed image is : a2-images/part1_images/bigben_3.jpg
total argc count   4
Match Number :: 1
<setImageName1 , setImageName2   :< a2-images/part1_images/bigben_2.jpg,a2-images/part1_images/bigben_3.jpg>
TotalMatchesBetweenImage1and2   : 16

##
To see the image retrieval results better, please comment the

The **line** inside the function
MatchGivenTwoImageDescriptors(vector<SiftDescriptor> imageDescriptor_1,vector<SiftDescriptor> imageDescriptor_2,string image1, string image2)
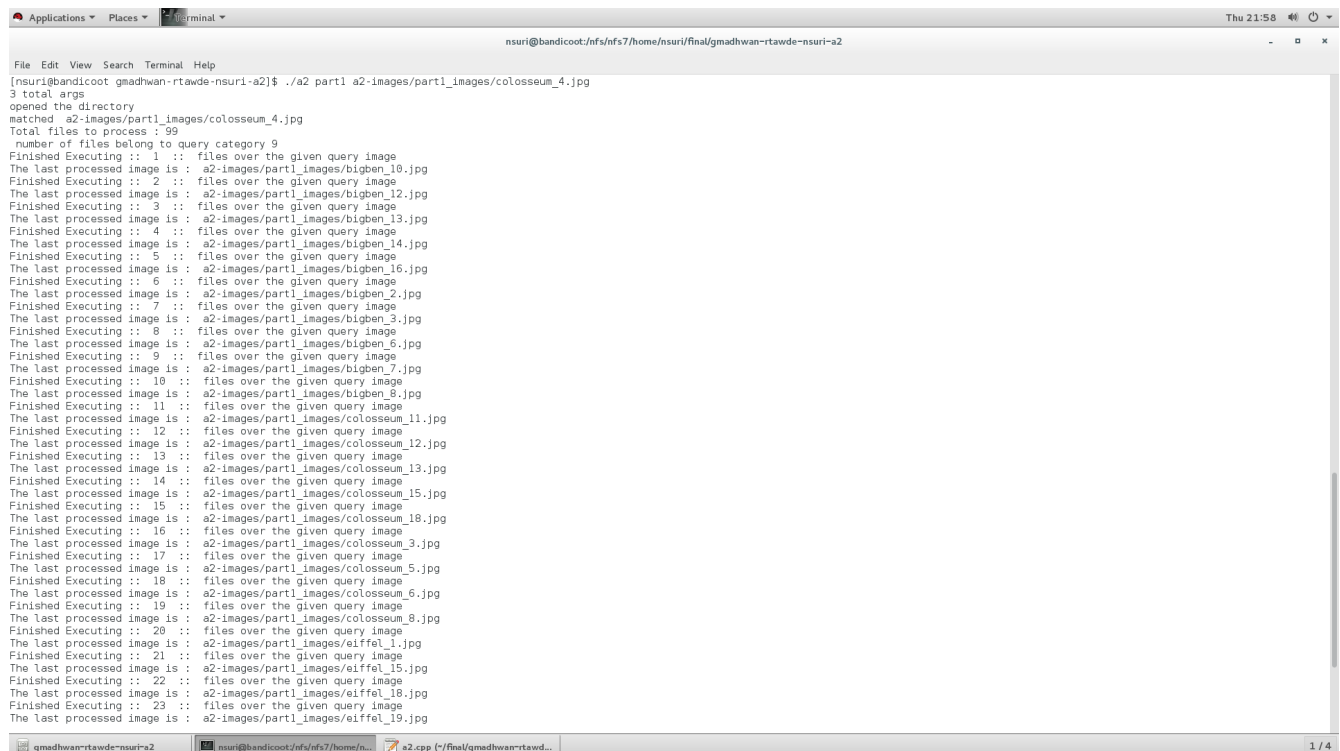
 MatchedSwiftVectorsOfSingleImage.back()→printDistProcesdDesciptr(); should be enabled, which will give the matched sift descriptors between two files. **This line inside the "IF()" function**

Note: during image retrieval and precision calculation, im not using the same image to match again. For example if bigben_3 is the query image, I wont match the bigben3 image again while processing all files. Because assignment clearly says match across all other files. So in my precision, the result value may be less than others who are matching with the same image. Because matching with the same image gives euclidean distance 0 and gives it as best image. Which means they get one more extra match, which changes the precision value, but I didn't use because as assignment asks to check on remaining images. So precision values may be different.

Randomly choose an image in each attractions as the query image, and compare it with all others

To do this just give one input image. It automatically runs over all other images

 ./a2 part1 a2-images/part1_images/colosseum_4.jpg

skipping all in between images, showing final set of images

nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2   –   □   ✕

File Edit View Search Terminal Help

```
Finished Executing :: 75  :: files over the given query image
The last processed image is : a2-images/part1_images/sanmarco_20.jpg
Finished Executing :: 76  :: files over the given query image
The last processed image is : a2-images/part1_images/sanmarco_22.jpg
Finished Executing :: 77  :: files over the given query image
The last processed image is : a2-images/part1_images/sanmarco_3.jpg
Finished Executing :: 78  :: files over the given query image
The last processed image is : a2-images/part1_images/sanmarco_4.jpg
Finished Executing :: 79  :: files over the given query image
The last processed image is : a2-images/part1_images/sanmarco_5.jpg
Finished Executing :: 80  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_11.jpg
Finished Executing :: 81  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_13.jpg
Finished Executing :: 82  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_14.jpg
Finished Executing :: 83  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_16.jpg
Finished Executing :: 84  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_2.jpg
Finished Executing :: 85  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_24.jpg
Finished Executing :: 86  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_4.jpg
Finished Executing :: 87  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_6.jpg
Finished Executing :: 88  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_8.jpg
Finished Executing :: 89  :: files over the given query image
The last processed image is : a2-images/part1_images/tatemodern_9.jpg
Finished Executing :: 90  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_1.jpg
Finished Executing :: 91  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_15.jpg
Finished Executing :: 92  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_16.jpg
Finished Executing :: 93  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_20.jpg
Finished Executing :: 94  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_21.jpg
Finished Executing :: 95  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_22.jpg
Finished Executing :: 96  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing :: 97  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing :: 98  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing :: 99  :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_4.jpg>
```
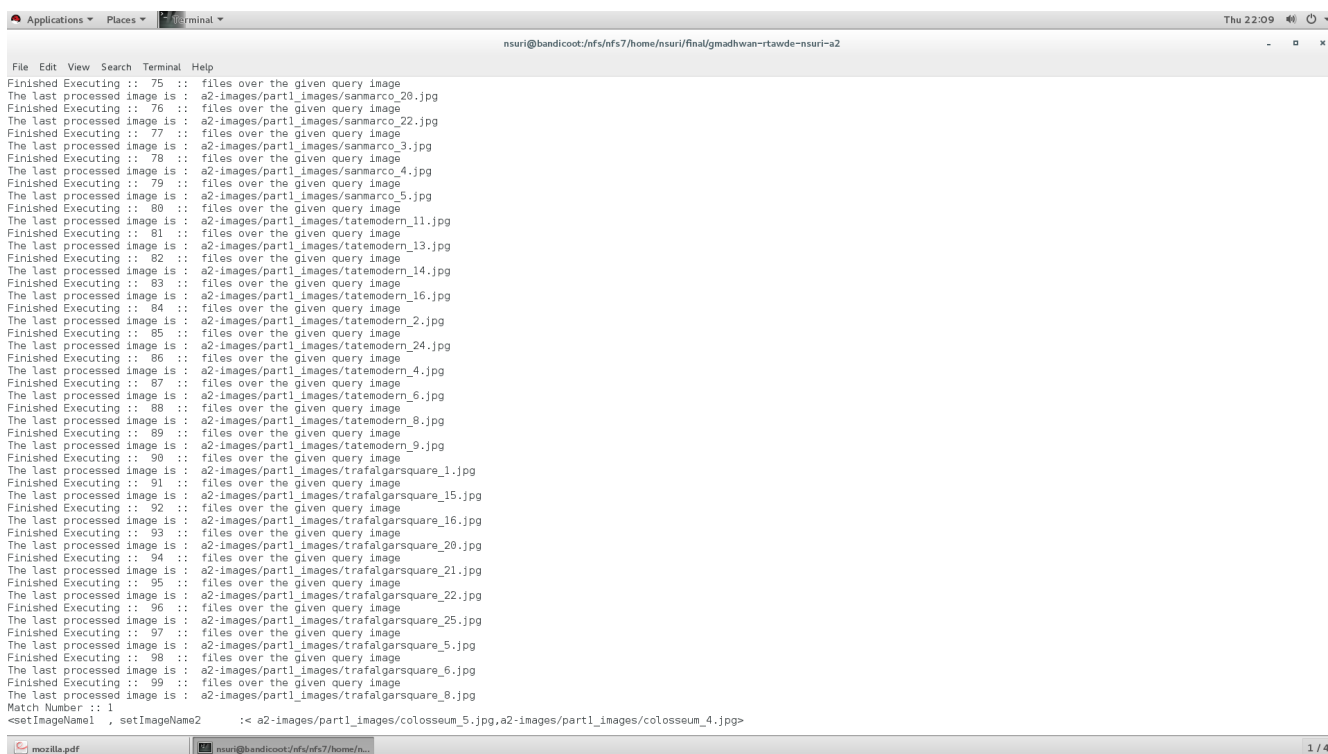
nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2   _ □ ×

File Edit View Search Terminal Help

```
Finished Executing :: 96 :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing :: 97 :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing :: 98 :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing :: 99 :: files over the given query image
The last processed image is : a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_4.jpg>
TotalMatchesBetweenImage1and2     : 31

In top 10- of same category!! a2-images/part1_images/colosseum_4.jpgMatch Number :: 2
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_15.jpg>
TotalMatchesBetweenImage1and2     : 22

In top 10- of same category!! a2-images/part1_images/colosseum_15.jpgMatch Number :: 3
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/tatemodern_13.jpg>
TotalMatchesBetweenImage1and2     : 3

Match Number :: 4
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/sanmarco_4.jpg>
TotalMatchesBetweenImage1and2     : 3

Match Number :: 5
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_12.jpg>
TotalMatchesBetweenImage1and2     : 3

In top 10- of same category!! a2-images/part1_images/colosseum_12.jpgMatch Number :: 6
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/louvre_9.jpg>
TotalMatchesBetweenImage1and2     : 3

Match Number :: 7
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/londoneye_22.jpg>
TotalMatchesBetweenImage1and2     : 3

Match Number :: 8
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/londoneye_13.jpg>
TotalMatchesBetweenImage1and2     : 3

Match Number :: 9
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/bigben_13.jpg>
TotalMatchesBetweenImage1and2     : 2

Match Number :: 10
<setImageName1  , setImageName2     :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/trafalgarsquare_22.jpg>
TotalMatchesBetweenImage1and2     : 2

Match Number :: 11
total argc count   100
The total precision for Query :a2-images/part1_images/colosseum_5.jpg  is  ::: 33
[nsuri@bandicoot gmadhwan-rtawde-nsuri-a2]$ []
```

This is shown for 1 image, will give the table with all the 10 attractions separately below.

Implement the image retrieval system and **show top 10 results :**

I have displayed the **top 10 results in the image retrieval system.** However, we can display all. You can see all the matches the given query made. I have sorted by the maximum matches, so maximum matched images comes first.

You can see in the code that I'm stopping display in the function after 10, if we change it to 99, you can see the sift matches for all images. As asked only for 10, I showed only 10.

```
nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2

File  Edit  View  Search  Terminal  Help
Finished Executing ::  96  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing ::  97  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing ::  98  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing ::  99  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_4.jpg>
TotalMatchesBetweenImage1and2      : 31

In top 10- of same category!! a2-images/part1_images/colosseum_4.jpgMatch Number :: 2
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_15.jpg>
TotalMatchesBetweenImage1and2      : 22

In top 10- of same category!! a2-images/part1_images/colosseum_15.jpgMatch Number :: 3
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/tatemodern_13.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 4
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/sanmarco_4.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 5
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/colosseum_12.jpg>
TotalMatchesBetweenImage1and2      : 3

In top 10- of same category!! a2-images/part1_images/colosseum_12.jpgMatch Number :: 6
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/louvre_9.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 7
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/londoneye_22.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 8
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/londoneye_13.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 9
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/bigben_13.jpg>
TotalMatchesBetweenImage1and2      : 2

Match Number :: 10
<setImageName1  , setImageName2      :< a2-images/part1_images/colosseum_5.jpg,a2-images/part1_images/trafalgarsquare_22.jpg>
TotalMatchesBetweenImage1and2      : 2

Match Number :: 11
total argc count   100
The total precision for Query :a2-images/part1_images/colosseum_5.jpg  is  ::: 33
[nsuri@bandicoot gmadhwan-rtawde-nsuri-a2]$
```

for the given query, **3 Colosseum images came up in the top 10 results.** So this gave a 33% accuracy as shown in the above image.

Calculate the precision for each attractions, 10 attractions in total
(in report)

1. Colosseum_4 is the query image : Precision 33% see the above image.
2. Bigben_3 is the query image : Precision 55% see the below image.
3. Eifel_3 is the query image : Precision 11% see the below image.
4.loure_11 is the query image : Precision 22% see the below image.
5. notredame_24 is the query image : Precision 22% see the below image.
6. Empirestates_14 is the query image : Precision 0% see the below image.
7. sanmarco_20 => 44%
8. trafalgarsquare_5.jpg is ::: 11%
9. londoneye_17.jpg is ::: 11%
10. tatemodern_6.jpg is ::: 0%

nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2/para   — ▫ ✕

File Edit View Search Terminal Help

```
Finished Executing ::  96  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing ::  97  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing ::  98  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing ::  99  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/sanmarco_1.jpg>
TotalMatchesBetweenImage1and2      : 10

Match Number :: 2
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/louvre_13.jpg>
TotalMatchesBetweenImage1and2      : 10

Match Number :: 3
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/louvre_10.jpg>
TotalMatchesBetweenImage1and2      : 9

Match Number :: 4
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/bigben_8.jpg>
TotalMatchesBetweenImage1and2      : 9

Match Number :: 5
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/louvre_4.jpg>
TotalMatchesBetweenImage1and2      : 7

Match Number :: 6
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/londoneye_22.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 7
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/sanmarco_3.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 8
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/trafalgarsquare_25.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 9
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/sanmarco_13.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 10
<setImageName1  , setImageName2      :< a2-images/part1_images/empirestate_14.jpg,a2-images/part1_images/tatemodern_13.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 11
total argc count   100
The total precision for Query :a2-images/part1_images/empirestate_14.jpg  is  ::: 0
[nsuri@bandicoot para]$ ./a2 part1 a2-images/part1_images/
```

| 🖼 part1_images | | 🖥 nsuri@bandicoot:/nfs/nfs7/home/n... | 🖥 nsuri@bandicoot:/nfs/nfs7/home/n... | 📄 report-part1.odt – LibreOffice Wr... | 🖼 [nsuri@bandicoot:/nfs/nfs7/home/... | 🖼 Pictures | | 1 / 4 |

nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2/para2   — ▫ ✕

File Edit View Search Terminal Help

```
Finished Executing ::  96  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing ::  97  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing ::  98  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing ::  99  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/tatemodern_13.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 2
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/trafalgarsquare_22.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 3
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/sanmarco_13.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 4
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/trafalgarsquare_15.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 5
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/tatemodern_4.jpg>
TotalMatchesBetweenImage1and2      : 2

Match Number :: 6
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/bigben_12.jpg>
TotalMatchesBetweenImage1and2      : 1

Match Number :: 7
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/colosseum_18.jpg>
TotalMatchesBetweenImage1and2      : 1

Match Number :: 8
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/eiffel_7.jpg>
TotalMatchesBetweenImage1and2      : 1

Match Number :: 9
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/empirestate_15.jpg>
TotalMatchesBetweenImage1and2      : 1

Match Number :: 10
<setImageName1  , setImageName2      :< a2-images/part1_images/londoneye_17.jpg,a2-images/part1_images/londoneye_12.jpg>
TotalMatchesBetweenImage1and2      : 1

In top 10- of same category!! a2-images/part1_images/londoneye_12.jpgMatch Number :: 11
total argc count   100
The total precision for Query :a2-images/part1_images/londoneye_17.jpg  is  ::: 11
[nsuri@bandicoot para2]$
```

| 🖼 [part1_images] | | 🖥 nsuri@bandicoot:/nfs/nfs7/home/n... | 🖥 nsuri@bandicoot:/nfs/nfs7/home/n... | 📄 report-part1.odt – LibreOffice Wr... | 🖥 nsuri@bandicoot:/nfs/nfs7/home/n... | 🖼 Pictures | | 1 / 4 |

nsuri@bandicoot:/nfs/nfs7/home/nsuri/final/gmadhwan-rtawde-nsuri-a2

File Edit View Search Terminal Help

```
Finished Executing :: 96  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_25.jpg
Finished Executing :: 97  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_5.jpg
Finished Executing :: 98  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_6.jpg
Finished Executing :: 99  ::  files over the given query image
The last processed image is :  a2-images/part1_images/trafalgarsquare_8.jpg
Match Number :: 1
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/bigben_10.jpg>
TotalMatchesBetweenImage1and2      : 6

Match Number :: 2
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/sanmarco_19.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 3
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/louvre_4.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 4
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/londoneye_13.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 5
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/eiffel_15.jpg>
TotalMatchesBetweenImage1and2      : 5

Match Number :: 6
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/bigben_12.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 7
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/trafalgarsquare_25.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 8
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/louvre_15.jpg>
TotalMatchesBetweenImage1and2      : 4

Match Number :: 9
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/notredame_14.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 10
<setImageName1  , setImageName2    :< a2-images/part1_images/tatemodern_6.jpg,a2-images/part1_images/notredame_24.jpg>
TotalMatchesBetweenImage1and2      : 3

Match Number :: 11
total argc count   100
The total precision for Query :a2-images/part1_images/tatemodern_6.jpg  is  ::: 0
[nsuri@bandicoot gmadhwan-rtawde-nsuri-a2]$
```

Analysis:
 The SIFT descriptors actually should match the same image is scaled up or down and its also scale invariant and orientation invariant. However, if one image some information and other has the different perspective or the image as shown below, then its difficult to extrapolate.

Though they are of same image type, they are representing completely different thing. So the sift descriptors for first image and second image is going to be different. Basically all the interest points wont match.

I observed that the complex images with lot of changes like light, complete different perspective had given bad matches.

However, if we can increase the threshold, the matches may given better results. However the false matches of the descriptors values also increase, that is the false positives would increase.