Computer Vision
Assignment 2

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Image Retrieval: SIFT and ORB feature Detection

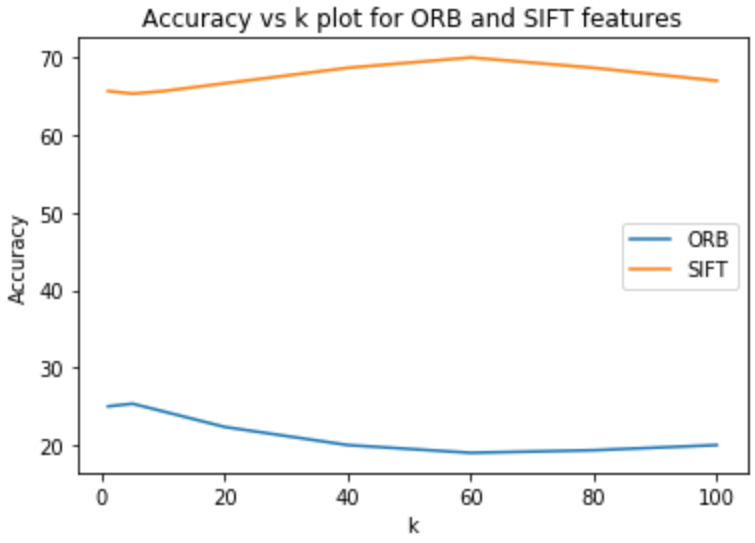
1. **Dataset generation**
   - Captured 60 images from 10 different scenes, 6 images per scene using the mobile phone camera. The images captured are from stationary scenes with no moving objects.
   - The images from the same scene have angle variation, rotation, zoom in/out etc. to make them distinct.
2. **Grayscaling and Resizing:**
   - All the images are converted to grayscale.
   - The 60 images are then resized keeping their aspect ratio same such that max(row, column)=1024
3. **SIFT and ORB Feature extraction**
   - SIFT and ORB feature extractors available in python-opencv are used to find keypoints and corresponding descriptors in all the images.
   - Keypoints and descriptors help in finding correspondence between two images.
   - SIFT provides descriptors of size 128, while ORB of size 32.
4. **Feature Matching**
   - Between two images, we find the corresponding keypoints using euclidean distances or L2 norm(numpy). These minimum euclidean distances between unique keypoints are stored in increasing order.
   - Finally, we add the smallest-k values of a pair of images. We take this as ranking criteria to define the correspondence between two images. The lower the value of the sum the higher the correspondence between the two images.
5. **Query image to find top-5 corresponding images**

- We can query using an image to find the top-5 most similar images in the dataset. These images may or may not be from the same scene depending on the accuracy of the model.

6. **Finding accuracy of image retrieval**
   - For a given query image, we find the top-5 similar images. We then find how many of these images are from the same scene as the query image. This count gives us the accuracy of the algorithm for the query image.
7. **Finding accuracy for a given value of k**
   - We can obtain the accuracy for each image for a given k. We add all the accuracy values obtained and divide by the total number of images, to get the accuracy for the whole dataset.
   - We find accuracy values separately while using SIFT descriptors and ORB descriptors.
8. For the value of k=10, the accuracy of SIFT is 65.67 and of ORB is 24.33.
9. **Comparison of SIFT and ORB for different values of k**
   - Finally we compare the accuracy values for different values of k=1,5,10,20,40,60,80,max matches.
   - Here, max matches are the total number of keypoints we choose to have in each image. In my case, max matches=100.
   - This step helps us to compare the accuracy of SIFT and ORB also.

We find that SIFT gives better accuracy compared to ORB. One reason for this can be the fact that SIFT uses 128 size feature descriptors, while ORB uses 32 size feature descriptors.

Plot of the accuracy of ORB and SIFT for different values of k



Sample images from the dataset

Scene 1 | 

Scene 2 | 

References:

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