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CS415 HW5 report

Image classification

Algorithm & process:

Firstly, I store the image I will use by a class, and put the instances of the class, which are the images, into a list. Here the class has such attributes like label, descriptor, key point, image file, image name, and also a image ID I assigned.

And then I update the key point and descriptor of the class for every images. Also, I put all the descriptors from all images into one 2darray.

Next step is to apply k-means algorithm to all the descriptors, which returns the centroid, say visual word of the clusters.

And then, for every image in the training set and testing set, and for every descriptor in an image, calculate the Euclidean distance between the descriptor and the centroids I got. Then find the nearest centroid to the descriptor, and that centroid's vote plus one. Now we have the histogram, which represents the distribution of visual word, for each image.

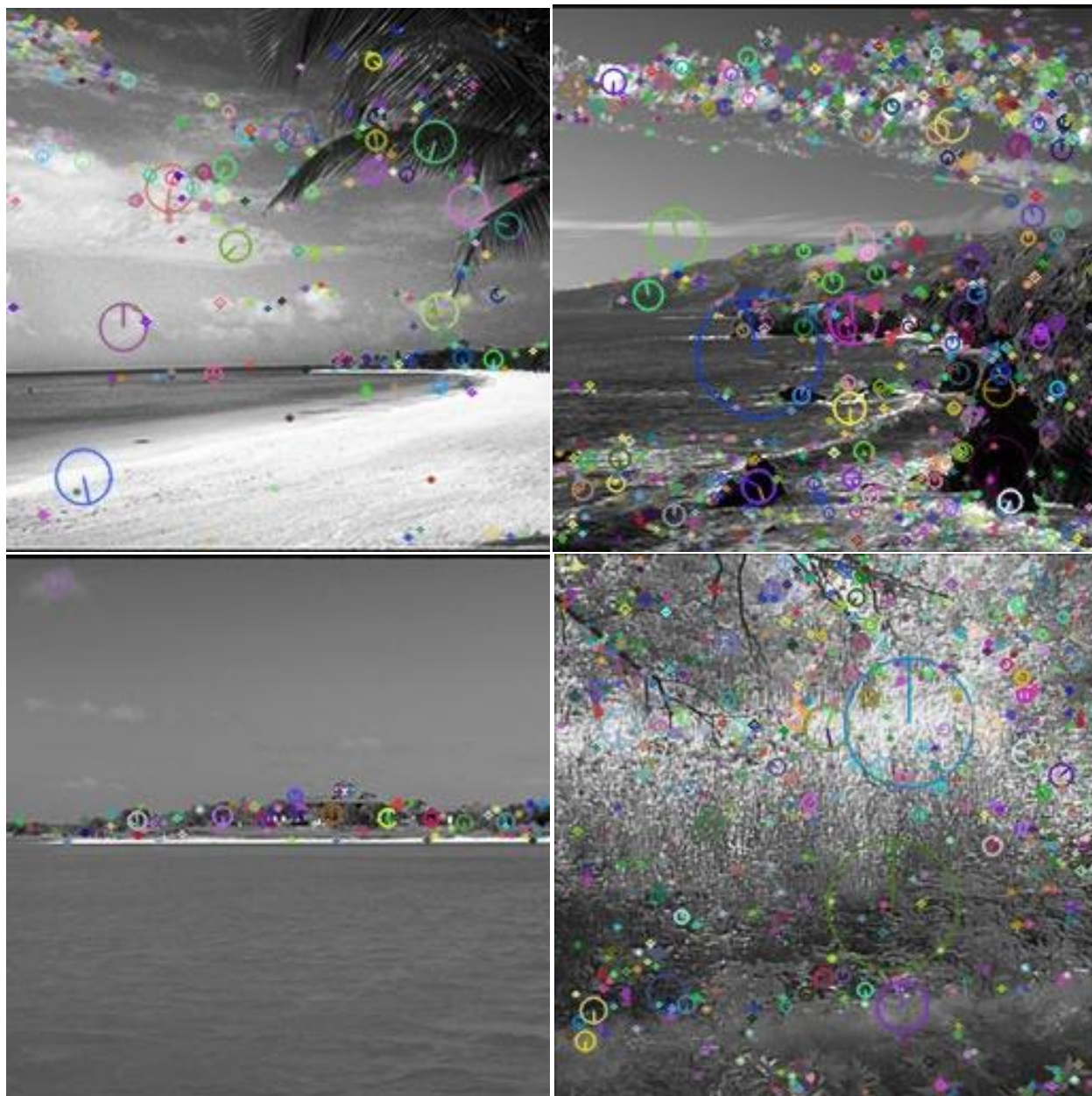
Until now, for every image class, we have the image file, ID, key point, its actual label, descriptor, and histogram. Then I need to implement the knn classifier.

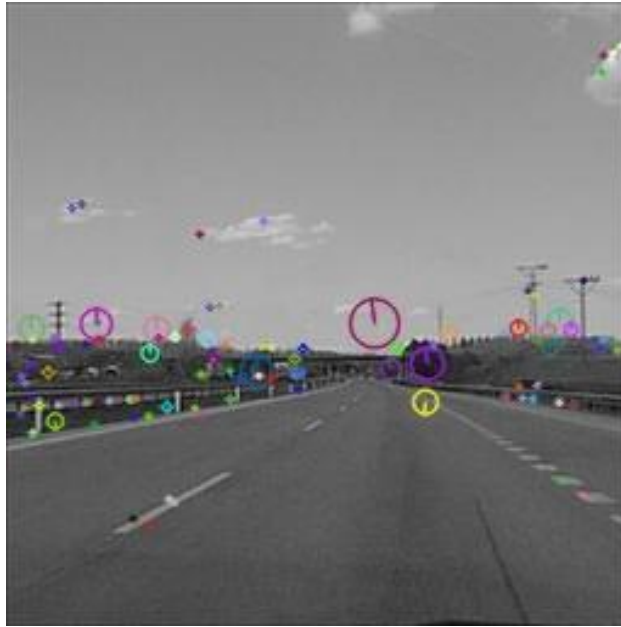
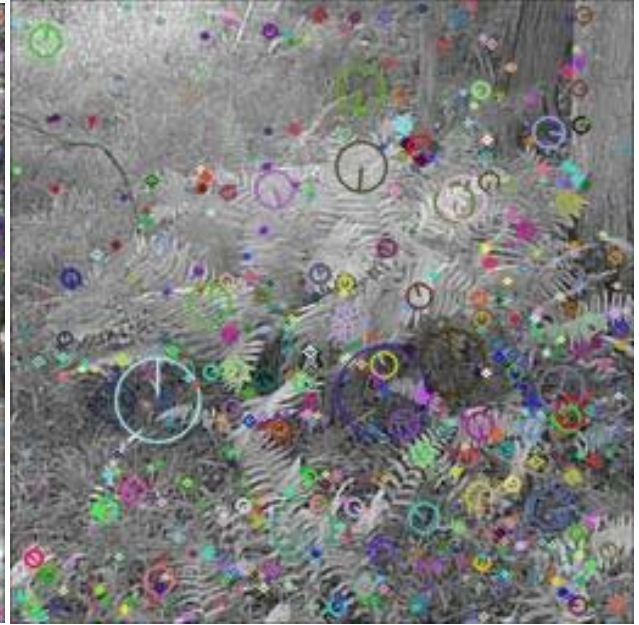
The idea of the algorithm is that, for every test image in testing set, calculate the Euclidean distance between the test image's histogram and every training image's histogram, and vote for nearest k training images' label. Then assign the label which appears the most frequent to the processing test image. Go through all the test images. The assigned label will be stored in predicted label, an attribute of image class.

The predicted label is used to calculate the accuracy of the classifier by comparing actual label and predicted label.

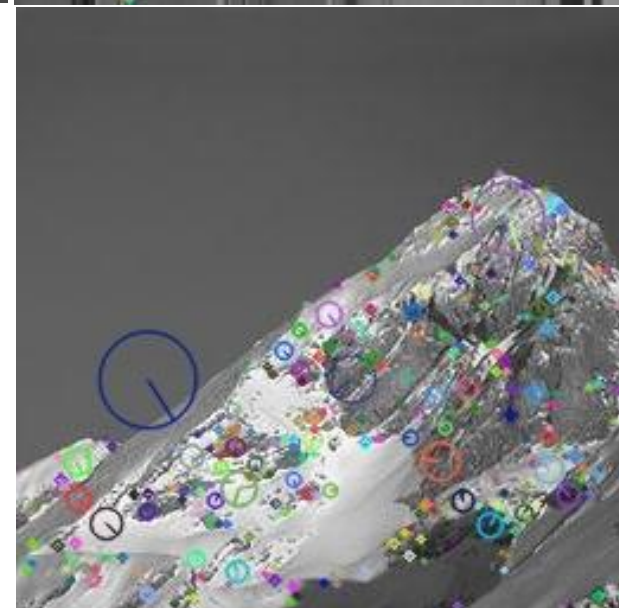
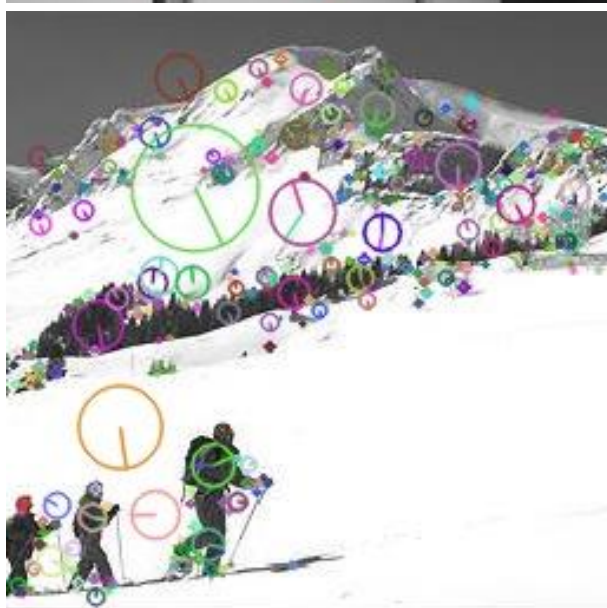
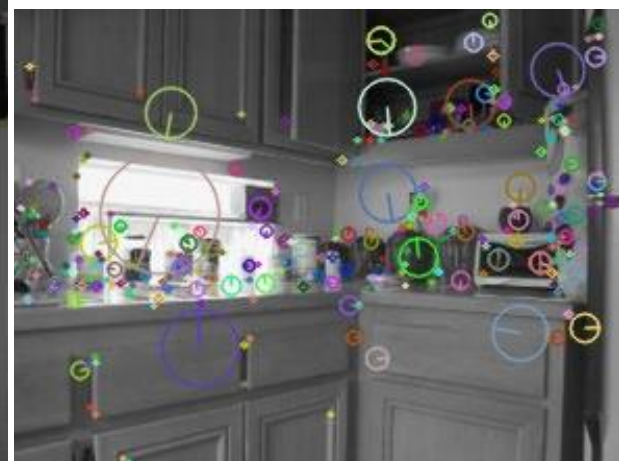
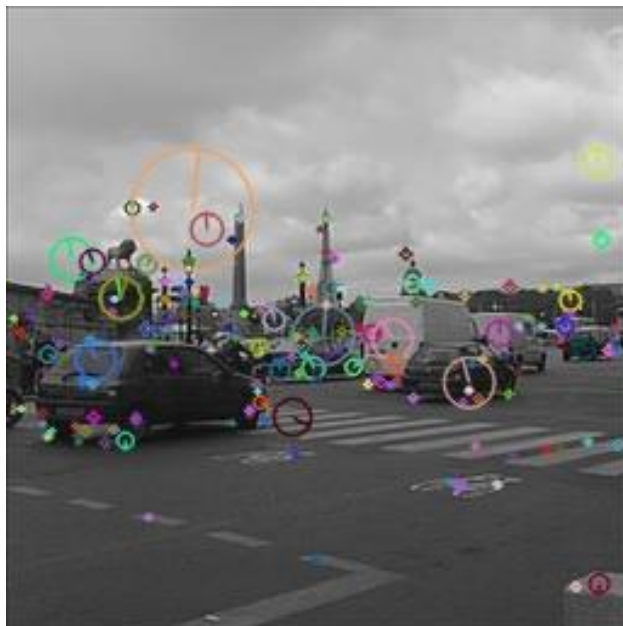
Until now, the classification is done.

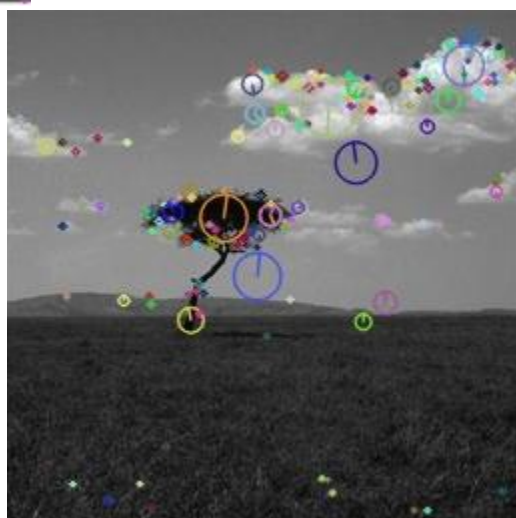
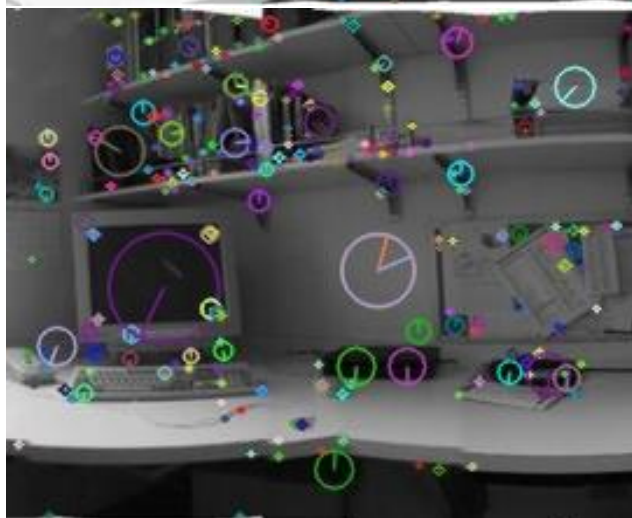
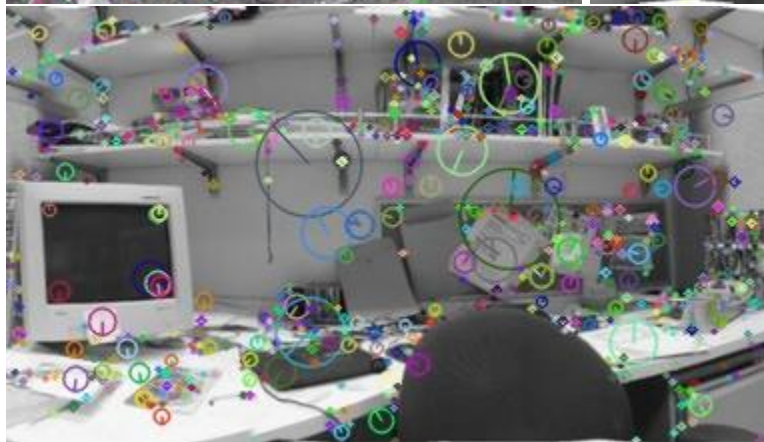
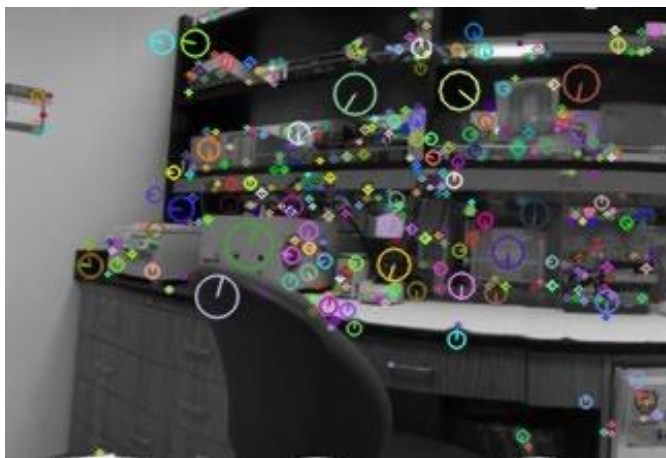
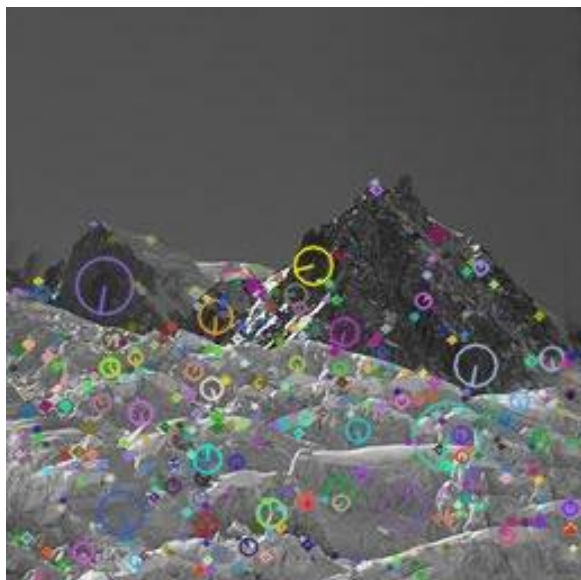
Here are the images of the detected features:



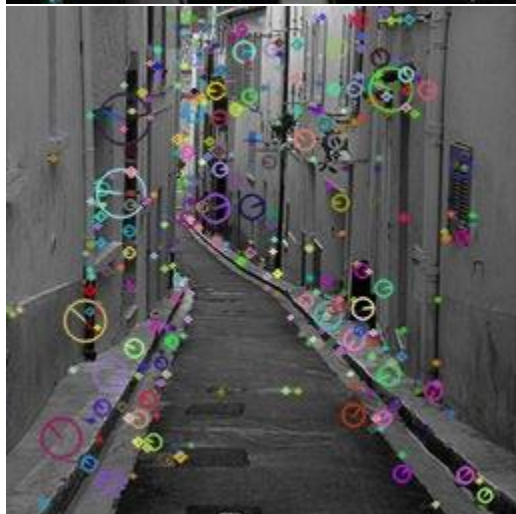
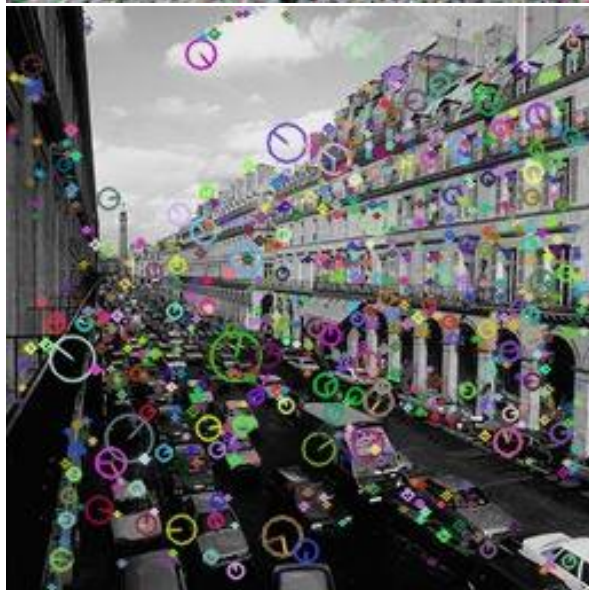
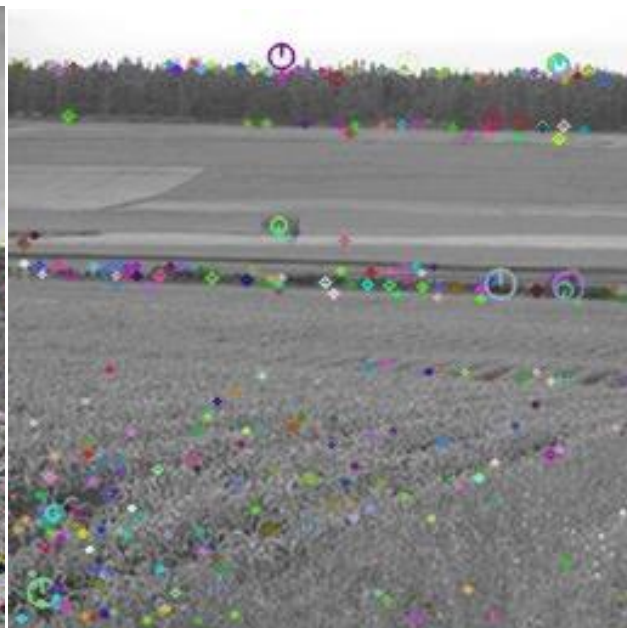
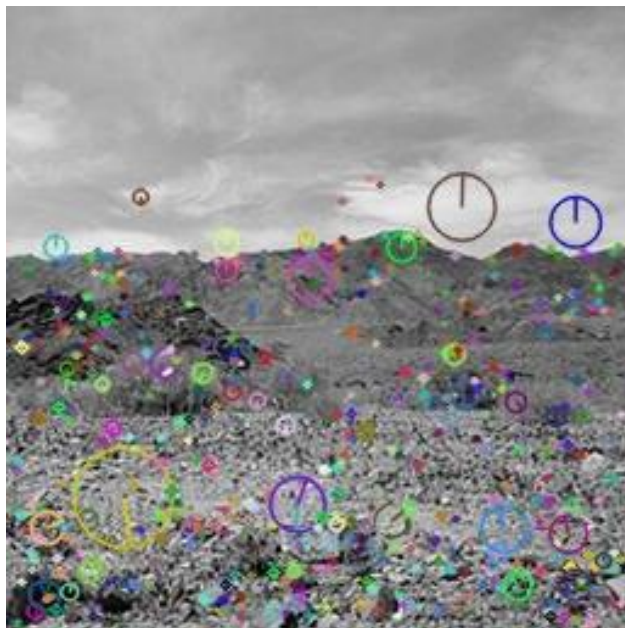




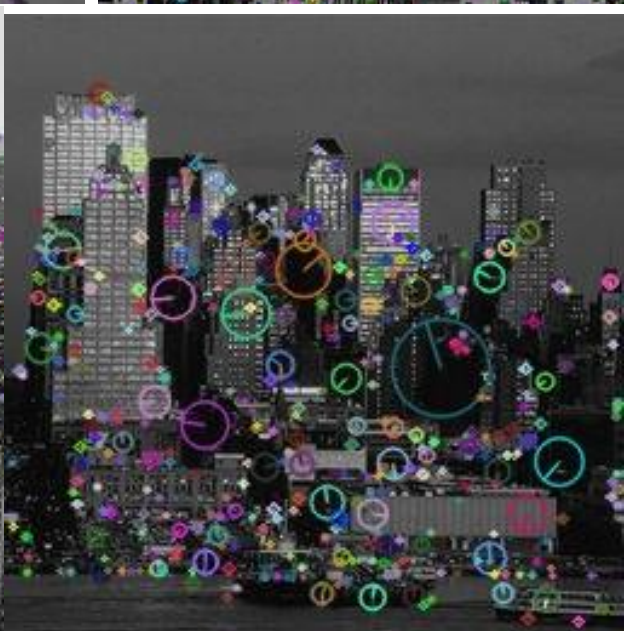
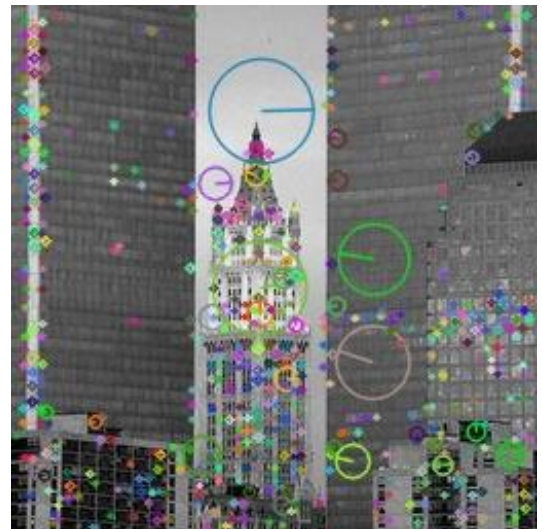






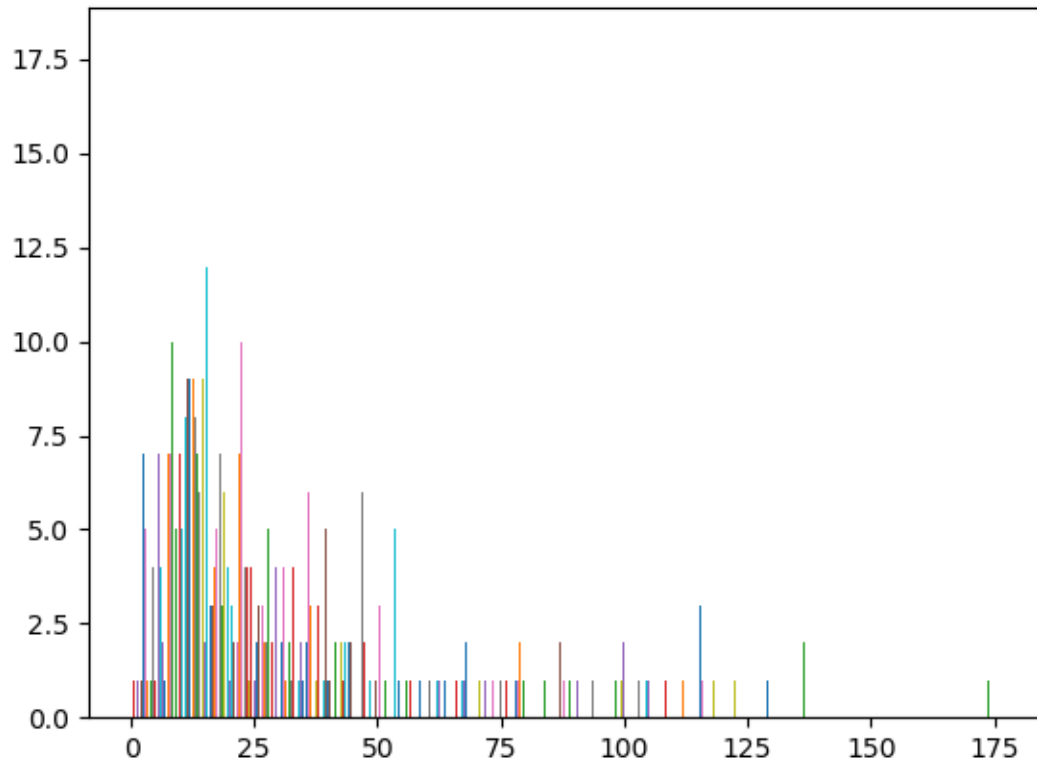






The visual dictionary of 100 visual words:

my understanding is the distribution of the clusters



The predicted label:

The program will save the image to a folder named by their predicted label, s.t. if a image is actually labeled as coast, its name will be coast something; if it's predicted as tallbuilding, it will be added to the folder called tallbuilding.

The prediction results are in the attached folder

The accuracy score:

```
Number of clusters: 100; K value: 1
Accuracy Score: 0.1
```

Analysis:



My assumption is that the k value of knn classifier does not affect the accuracy score a lot, the main factor that influence the score a lot should be the number of the cluster. As the output of the program says, the accuracy score is low as 0.1.

However, I have tried 50 clusters, which bring me a lower score than the one I currently have. Thus, I would say as the number of cluster increases, the accuracy rate should be increased somehow. Though the classifier I currently have bring me a low rate.

The accuracy rate as I tried number of clusters with 100, 250; tried k value with 1, 3, 5:

```
Number of clusters: 100; K value: 1
    Accuracy Score: 0.1
Number of clusters: 100; K value: 3
    Accuracy Score: 0.1
Number of clusters: 100; K value: 5
    Accuracy Score: 0.1
Number of clusters: 250; K value: 1
    Accuracy Score: 0.1
Number of clusters: 250; K value: 3
    Accuracy Score: 0.1
Number of clusters: 250; K value: 5
    Accuracy Score: 0.1
```