

Computer Vision Exercise 10

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June 2, 2018

1 IMAGE CATEGORIZATION

1.1 PIPELINE

I have implemented the pipeline as it was described in the exercise sheet. The main steps are as following:

- Extract the points on the mesh grid from the image
- Calculate the descriptor for each point on the grid. Descriptor is the histogram of oriented gradients. These are also called "visual words."
- Constructing of the codebook: cluster all the descriptors from the class-1 images with k-means and choose the centroids to be representative "words" in the vocabulary.
- Represent each word with the bag of words from the vocabulary. Here I build the histogram of words for each image.
- Classify the test images based on the "bag-of-words" representation. Here I have implemented both nearest neighbor and Bayesian classifier.

1.2 CHOOSING K

Here I am going to shortly present my choice of K for the k-means. In Figure 1.1 I have plotted the loss (sum of distances from each data point to its cluster center) for different K-s. X-Axis represent different K-s and Y-Axis are the losses. As expected, the

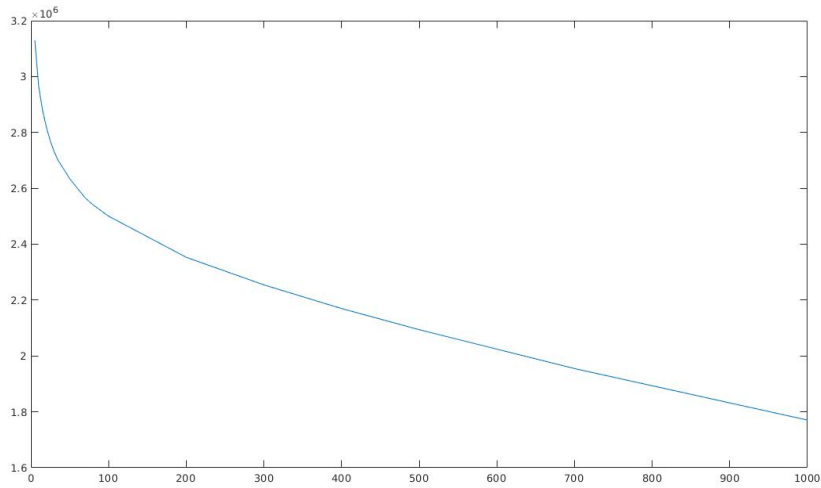


Figure 1.1: Loss for different K.

K	70	150	300
NN	0.87, 0.9, 0.92	0.79, 0.83, 0.99	0.82, 0.91, 0.93
Bayesian	0.85, 0.86, 0.9	0.73, 0.78, 0.78	0.7, 0.72, 0.77

Table 1.1: Results for different classifiers and different K. Each cell contains classification accuracy obtained in 3 trials.

loss decreases for higher K, but there is no clear K for which we can notice the biggest impact. I have run the k-means 10 times for each value of K to get more accurate results.

Also I have compared the classification results for $K = [70, 150, 300]$ and I have noticed the improvement of Bayesian classifier with lower K and pretty random results with NN classifier. Thus I have decided to choose $K = 70$.

1.3 NEAREST NEIGHBOR VS BAYESIAN CLASSIFIER

As mentioned above, the results obtained by Bayesian classifier were more stable then those of NN classifier which is to be expected since NN with only 1 neighbor is very sensitive to outliers. The Table 1.1 represents the results obtained by running the algorithm 3 times for each configuration.

As we can see from the table, the NN classifier seems to have better performance on average.