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Assignment 10

Computer Vision
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The codebook (bag of word) is constructed based on the K-means cluster of all the pixels of all the images. As we all know, K-means's result depends on the initialization of cluster centers. Under random initialization, K-means result would vary a lot. So we have to take the average of accuracy of several trials to better compare the result of different classification methods with various codebook size (number of clusters).

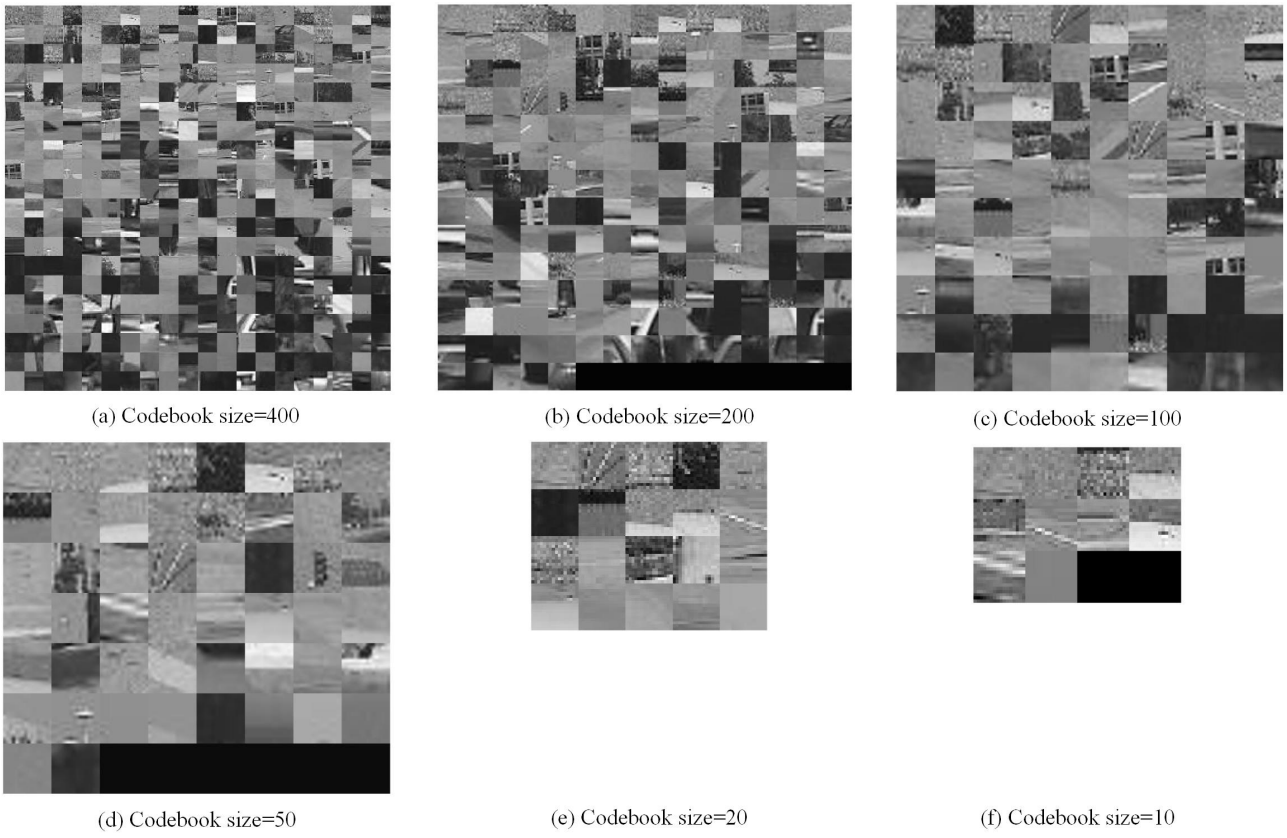
The codebooks for various number of clusters are shown in Fig.1.

The comparison of Bayesian classification and nearest neighbor's performance with regard to different code book size are shown in Table 1 and Fig.2.

From these results, I draw the following conclusions:

1. Bayesian classification has higher accuracy than nearest neighbor classification when code book size is larger than 20. Since Bayesian classification models probabilities rather than just relying on a single nearest neighbour from the training data, it would be better than Nearest Neighbor when detailed features are provided (codebook size is relatively large).

2. It is found that when codebook's size is relatively small, Nearest neighbor gets higher accuracy while Bayesian classification's accuracy is relatively low. However, for both of the classification methods, when the codebook's size is larger than a certain value (for example 100), the code book size would not have too much affect on the result. This may due to fact that the further divided clusters may not contain more natural features of the images when keep increasing the number of clusters so that the accuracy would not improve.



(a) Codebook size=400 (b) Codebook size=200 (c) Codebook size=100

(d) Codebook size=50 (e) Codebook size=20 (f) Codebook size=10

Figure 1: Generated codebook of different size (the last several black pixels are not involved in the codebook, they are just for the integrity of the rectangle)

Table 1: Average accuracy of 5 trials w.r.t codebook size for Bayesian and NN classification

Codebook size	400	200	100	50	20	10
Bayesian Classification	0.9818	0.9879	0.9778	0.9576	0.8788	0.9051
Nearest neighbor	0.9010	0.9172	0.8869	0.9232	0.9515	0.9232

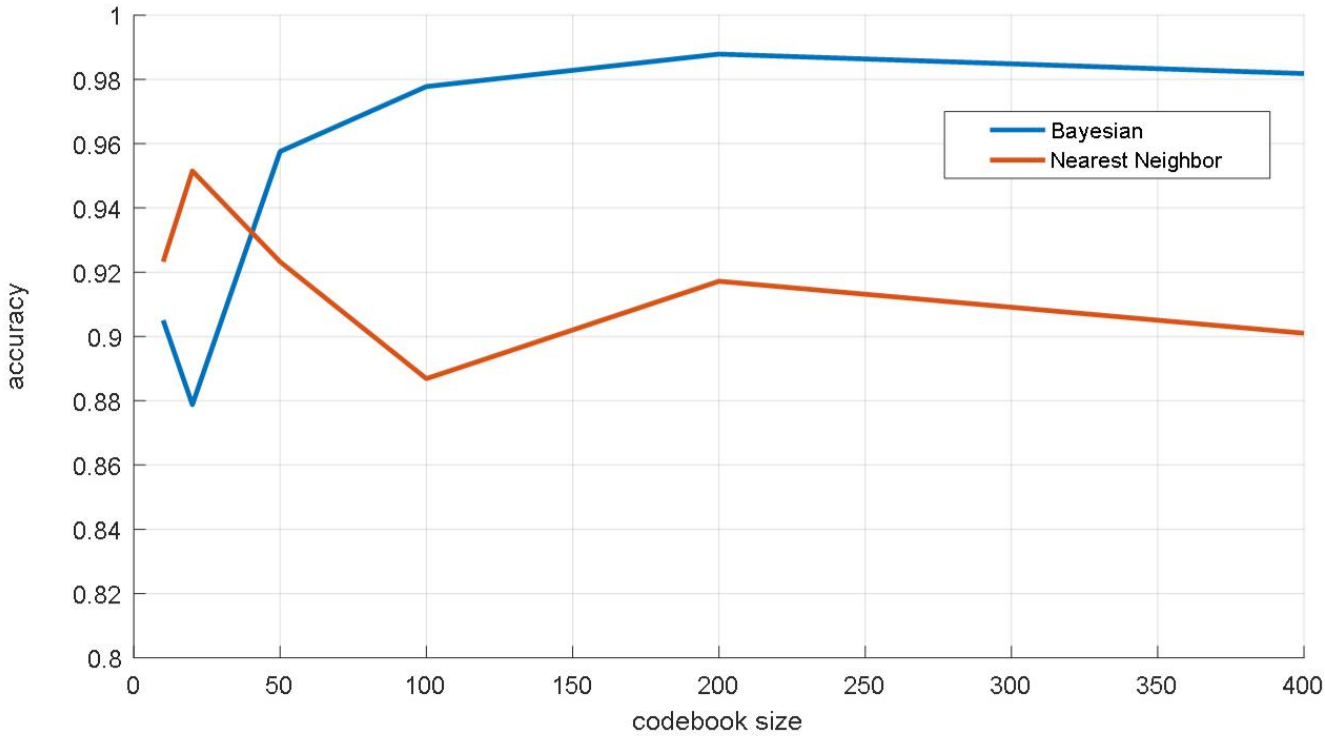


Figure 2: Classification accuracy comparison of Bayesian and Nearest Neighbor method