

2025 Spring CV HW2

Yelin Zhang

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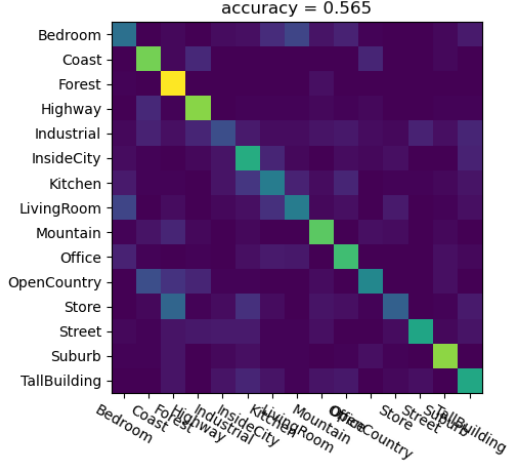
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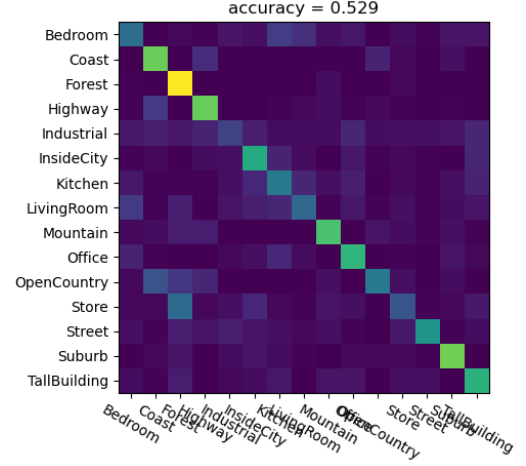
1 Scene recognition

In general accuracy improved with a larger visual dictionary size. Up until a certain point, when the accuracy started to decline again. Due to a too large dictionary.

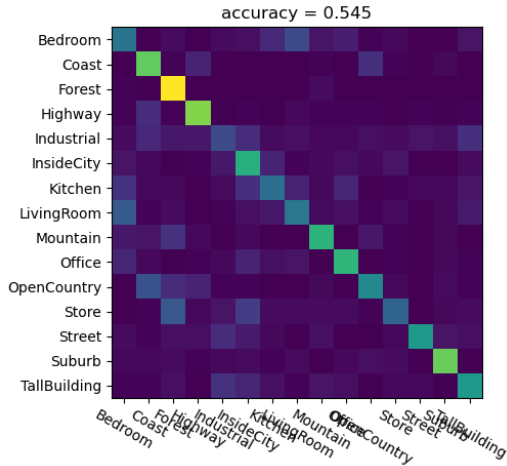
1.1 KNN



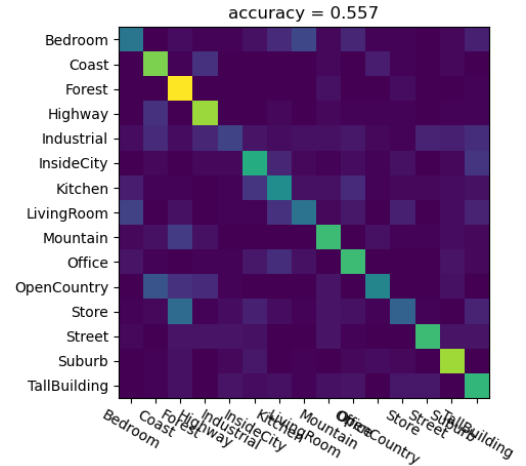
(a) 10 neighbors and visual dictionary size 400.



(b) 10 neighbors and visual dictionary size 200.



(c) 5 neighbors and visual dictionary size 400.



(d) 20 neighbors and visual dictionary size 400.

Figure 1: Confusion matrix and accuracy for KNN scene recognition.

The visual dictionary size needed for KNN is 400. Below and above that the accuracy is lower [1b](#). Due to the choice of number of neighbors being crucial the accuracy varies if the number of neighbors is too small or too large. The highest accuracy of 56.5% was achieved with 10 neighbors [1a](#). 15 and 20 neighbors were also tested, but the accuracy was lower than with 10 neighbors, but also higher than the baseline of 55% [1d](#). 5 neighbors resulted in a lower accuracy than the baseline [1c](#).

1.2 SVM

C is the regularization parameter for SVM. A smaller C means a larger margin, but a smaller C means a smaller margin. The visual dictionary size needed for SVM is 600. Below and above that the accuracy is lower [2b](#). As well as a correct choice of C, which is crucial for the accuracy. The accuracy is lower with a smaller C, but also lower with a larger C [2c](#). The best accuracy of 66.2% was achieved with C=2 and visual dictionary size 600 [2a](#).

The visual dictionary is larger than for KNN, which is expected since SVM is a more complex model.

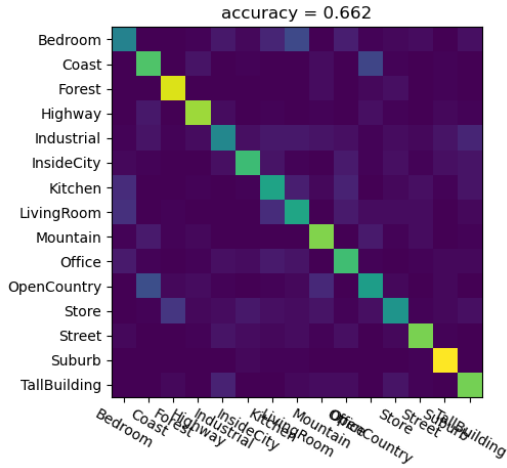
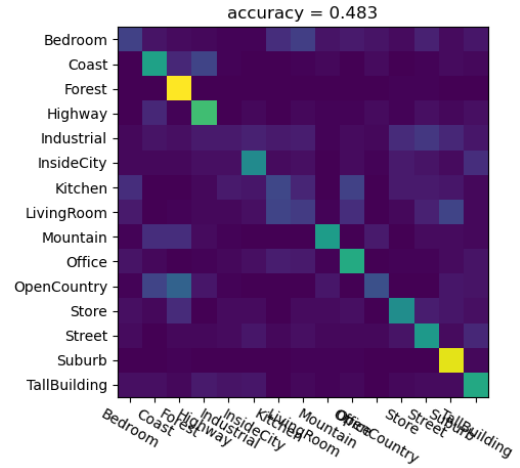
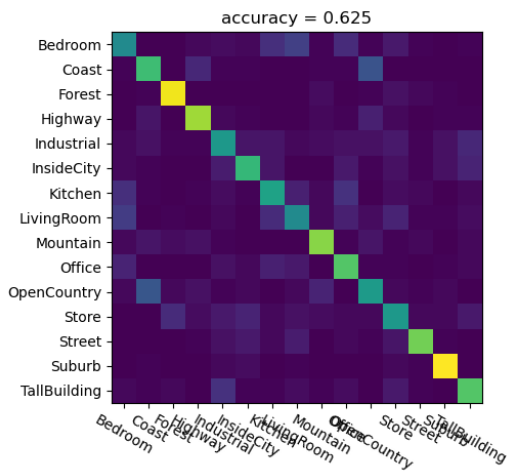
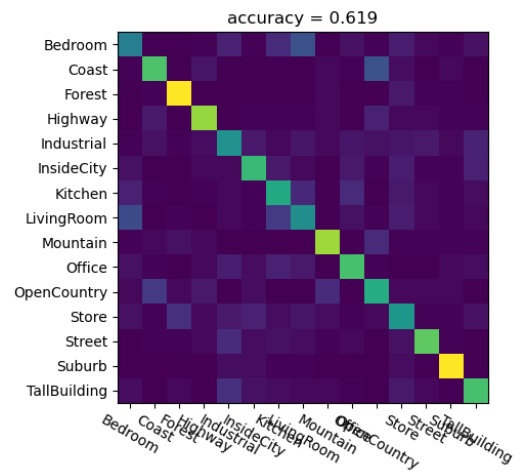
(a) $C=2$ and visual dictionary size 600.(b) $C=0.01$ and visual dictionary size 200.(c) $C=10$ and visual dictionary size 600.(d) $C=10$ and visual dictionary size 800.

Figure 2: Confusion matrix and accuracy for SVM scene recognition.

2 Eigen Face

2.1 Normalization

First normalization is the mean of axis 0 (x axis) of all faces is subtracted from every face. The second normalization is the mean of axis 1 (y axis) of all faces is subtracted from every face. The effect of this normalization is to center the data around the mean. Which is needed for PCA, due to it being sensitive to the scale of the data.

2.2 Eigenvectors

The eigenvalue order indicates the amount of variance explained by each eigenvector. The larger the eigenvalue, the more variance is explained by the corresponding eigenvector. Using a reduced number of eigen-coefficients can lead to dimensionality reduction, which can simplify the model and reduce computation time. However, it may also result in loss of information and reduced reconstruction accuracy.