

CS 415 Machine Problem #5

1 Image classification

The purpose of this MP is to familiarize you with the general pipeline of image classification. What you need to do is to follow the steps below. Both the training and validation data (10 scene categories) can be downloaded from the course website. The due date of this assignment is 11/11/2020 (Wed).

1. *Local features.* The first step is to detect interest points on each image and collect their feature descriptors.
2. *Visual dictionary.* Build a visual dictionary by clustering the local features collected from training images. You can visualize each visual word as the image patch whose feature descriptor is closest to the corresponding cluster representative.
3. *Image-level features.* Encode local feature descriptors into visual words and build a bag-of-words vector for each image.
4. *Classify.* Use a K Nearest Neighbor (KNN) classifier to classify each validation image. You need to implement your own KNN function.
5. *Evaluation.* Calculate the percentage of validation images that are correctly classified and report the accuracy.

You are free to call the implementations of the following algorithms from any packages: SIFT feature detector, descriptor and visualization, K-means, histogram. Hint: you can use OpenCV.

2 Hyper-parameters (optional)

Try different hyper-parameters, including the number of clusters and the number of nearest neighbors, and compare the performances.

3 Confusion matrix (optional)

A confusion matrix is a table that allows visualization of the performance of a classification algorithm. It is a C -by- C matrix where C is the number of categories ($C=10$ for our problem). An entry at (i, j) of the matrix is the percentage of images with true class i that are classified as class j . Thus, each row should sum to one.

You only need to calculate one confusion matrix, i.e., for your best model.

4 What to turn in

Each individual student should turn in their own solution. What you need to turn in includes:

- your code in Python (recommended) or MATLAB;
- a short report.