

HW 3

Part A (1 pts) - Data

1. Download Caltech 101 database:
http://www.vision.caltech.edu/Image_Datasets/Caltech101/101_ObjectCategories.tar.gz
2. Download Linnaeus 5 database:
<http://chaladze.com/l5/img/Linnaeus%205%20128X128.rar>
3. Partition the Linnaeus training data into a training set, and a validation set (80/20)

Part B (6 pts) – Visual vocabulary

4. Find key points and descriptors in each image, using SIFT (lect. 3).
Voluntary: use other feature detector and descriptor (SURF, MSER, SUSAN ...).
5. Build a visual vocabulary by finding representatives of the gathered features. This is done by k-means clustering (lect. 5). Compute different sizes of the vocabulary (100, 1000 and 5000).
Voluntary: Use other clustering technique.
6. Find the distribution of the vocabulary words in each image in the training and validation sets. This is done by a histogram with a bin for each vocabulary word. The histogram values can be either hard values, or soft values. Normalize the histograms.
Default task - Hard values: means that for each descriptor of a key point patch in an image, we add 1 to the bin of the vocabulary word closest to it in absolute square value.
Voluntary task - Soft values: means that each patch votes to all histogram bins, but give a higher weight to bin representing words that are similar to that patch.
(Something like HOG histogram - lect. 3)

Part C (5 pts) – Training

7. For each vocabulary size, use the Classification Learner App to train an SVM, naive Bayes and a classification tree models. Each histogram is a feature vector, with a label.

Part D (5 pts) – Scene classification

8. Compute the histograms for Linnaeus test set and Caltech categories:

Dalmatian (dog),

Flamingo, pigeon (bird),

Strawberry (berry),

Sunflower, waterlily (flower).

9. Use all trained models (9 = 3 vocabulary sizes x 3 classifiers) to classify the Linnaeus and Caltech images.

Part E (3 pts) – Final report

10. Describe your algorithm (specify whether you have followed the default or voluntary path).

11. Report Precision/Recall and Confusion matrix for each classifier.

12. Discuss the impact of the vocabulary size and classifier on the performance.

13. Discuss the quality of classification on the Caltech and Linnaeus sets. Did the quality drop or improve when using different data sources for training and testing?