CS556: HOMEWORK 1
due 01/24/2014

Please submit your homework reports to the TEACH website:

https://secure.engr.oregonstate.edu:8000/teach.php?type=want_auth

Download 365 training and test images of bicycles from:

http://lear.inrialpes.fr/people/marszalek/data/ig02/

1) (10pts) Detect Harris-affine corners in all training and test images;
2) (10pts) Show in Figure 1: three example images of bicycles, and their Harris-affine corners super-imposed onto the example images;
3) (10pts) Compute the SIFT descriptor of each Harris-affine corner you detected in all images. Save the descriptors in a file "SIFT-descriptors-filename". Submit the file in your homework report.
4) (10pts) Compute the HOG descriptor of each Harris-affine corner you detected in all images. Save the descriptors in a file "HOG-Harris–descriptors-filename". Submit the file in your homework report.
5) (20pts) Use K-means clustering with the Euclidean distance to compute $K = 300$ clusters of:
   5.1) (10pts) all SIFT descriptors from all images. Save the clusters of SIFT descriptors in a file "SIFT-clusters-filename". Submit the file in your homework report.
   5.2) (10pts) all HOG descriptors from all images. Save the clusters of HOG descriptors in a file "HOG-clusters-filename". Submit the file in your homework report.
6) (10pts) Report in Table 1: the mean descriptor vector of each cluster, i.e., the 300 cluster centers, for SIFT descriptors.
7) (10pts) Report in Table 2: the mean descriptor vector of each cluster, i.e., the 300 cluster centers, for HOG descriptors.
8) (20pts) Show in Figure 2 and Figure 3 two tables of image patches used for computing SIFT and HOG clusters, respectively, as illustrated below. Each table should have 10 rows and 10 columns. The rows correspond to the 10 largest clusters you computed using the K-means algorithm. The 10 columns of one row should contain 10 image patches that are the closest to the cluster center of that row. The image patches are image areas around the Harris-affine corners that are used to compute SIFT or HOG descriptors. The distance between image patches is computed as the Euclidean distance between the associated SIFT or HOG descriptors.

Report

Your homework report should consist of a PDF file, and 4 data files. The PDF file is to present the figures and tables. All figures and tables must have captions. Your report should also include a description of the code you used:

- If you used an open-source code, then clearly state the source, authors, and files.
- If you implemented your own code, then submit a printout of your well-commented code.

Each missing caption will be penalized with 5 points, and missing code description will be penalized with 20 points.
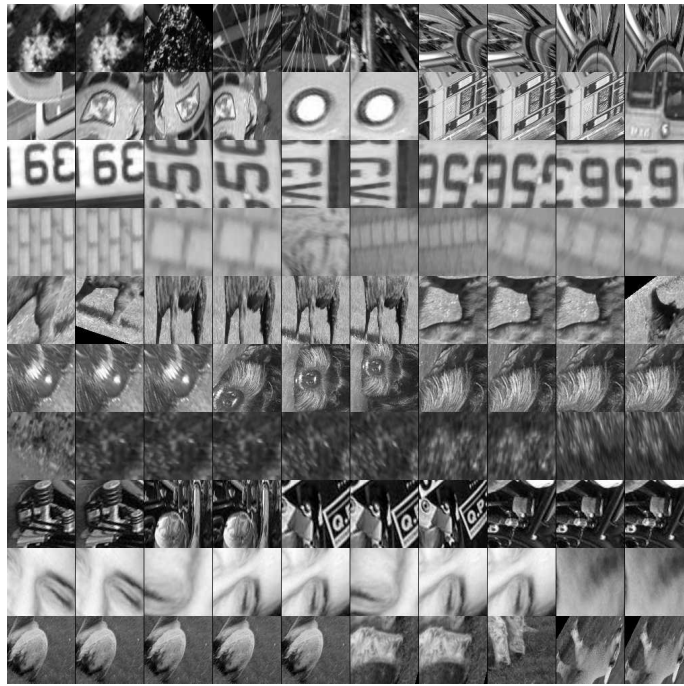
Fig. 1. An example of how to show the 10×10 table of image patches. The rows correspond to the 10 largest clusters you computed using the K-means algorithm. The 10 columns of one row should contain 10 image patches that are the closest to the cluster center of that row.

Suggested open-source code:

- `http://www.vlfeat.org/overview/tut.html`