Laboratory Experience 1 - Mandatory

Task Goal of this experience is to get familar with the problem of scene recognition and the basic computer vision machinery that is used to adress it.
We will focus on two problems:

15 Scenes dataset [1]. A general scene recognition task, composed by a mixture of natural, artificial, indoor and outdoor categories.

ISR dataset [2]. The indoor scene recognition task, dealing only with indoor environments

Code

1. Download vlfeat (binary), an open source library for computer vision:
   http://www.vlfeat.org/

2. Download libsvm, a free implementation of Support Vector Machines:
   http://www.csie.ntu.edu.tw/∼cjlin/libsvm/
   You need to compile the matlab interface; from the matlab prompt execute:

```
>> cd /path/to/libsvm-3.12/matlab/
>> make
```

3. Download the PhowExperience Matlab class:
   http://www.idiap.ch/ftp/courses/EE-700/material/experience1/PhowExperience.m
   Open the file and modify the paths of the libsvm-mat and vlc libraries:

```
>> VLFEATPATH='/path/to/vlfeat';  %path to the vl-feat library
>> LIBSVMPATH='/path/to/libsvm';  %path to the lib-svm solver matlab interface
```

   Inside the class you will also find an example of usage

4. Complete the code where necessary

15 Scenes Problem

1. Download the 15 Scenes dataset:
   http://www-cvr.ai.uiuc.edu/ponce_grp/data/

2. Repeat the scene recognition experiments described in Table 1 of [1], using C=100 (pay attention also to the feature parameters). Run each experiment twice, with different training/testing splits and report the results as (mean $\pm$ std). In particular, calculate:

   - the confusion matrix
   - recognition rate per class
   - average recognition rate

3. Using the outcomes of the previous step select two combinations of feature parameters (L and K), according to a criteria of your choice (e.g. efficiency, performances, etc.)

4. Using the selected settings, perform experiments also with the linear, the gaussian and the exponential χ^2 kernels. Run each experimens twice, report the average recognition rate / standard deviation and comment the results.

Indoor Scene Recognition

1. Download the ISR database:
   http://web.mit.edu/torralba/www/indoor.html

2. Taking into account the results obtained on the 15 Scenes, select an experimental configuration (K, L and the kernel function) suitable for the problem.

3. Using 80 training images per class and the remaining for testing, run experiments with:

   - 5 classes: bookstore, bathroom, inside-bus, buffet, greenhouse;
   - 5 classes: bookstore, videostore, shoeshop, grocerystore, clothingstore;
   - 10 classes: bookstore, videostore, bathroom, kitchen, inside-bus, inside-subway, buffet, restaurant, greenhouse, florist;
   - 20 classes: bookstore, videostore, shoe shop, grocerystore, bathroom, kitchen, bedroom, childrenroom, inside-bus, inside-subway, subway, train-station, buffet, reaturant, bar, fast-food, hospital room, operating room, greenhouse, florist;
   - 30 classes: bakery, deli, bookstore, videostore, shoe shop, grocerystore, bathroom, kitchen, closet, pantry, bedroom, childrenroom, inside-bus, inside-subway, subway, train-station, waiting-room, airport-inside, buffet, reaturant, concert-hall, movie-theatre, bar, fast-food, hospital room, operating room, greenhouse, florist, office, meeting-room.
   - all the 67 classes

Run each experiment twice (with different training/testing splits) and report the results as (mean ± std). In particular, calculate:

- the confusion matrix
- recognition rate per class
- average recognition rate

and comment the results.

References

[1] S. Lazebnik, C. Schmid, and J. Ponce. Beyond bags of features: Spatial pyramid matching for recognizing natural scene categories. In *Computer Vision and Pattern Recognition, 2006 IEEE Computer Society Conference on*, volume 2, pages 2169–2178. IEEE, 2006.

[2] A. Quattoni and A. Torralba. Recognizing indoor scenes. In *In Proc. Computer Vision and Pattern Recognition*. IEEE, 2009.