

Laboratory Experience 1 - Optional

Task Goal of this experience is to experiment with the problem of scene recognition, from a robot vision perspective and to get familiar with its differences w.r.t. its computer vision counterpart.

We will focus on one new dataset:

Visual Place Categorization (VPC) [3]. It consists of images captured using a rolling tripod and a camcorder (to mimic a robot) and it's composed of 6 different home environments, containing 11 room-categories, plus a category for difficult scenes.

and one algorithm:

Pyramid Histogram of Visual Words [1]. The basic scene recognition algorithm implemented for the first mandatory experience

Experiments - Robot vision

1. Download the VPC dataset:
<http://categorizingplaces.com/dataset.html>
2. We are interested only in the 5 categories that are common to all environments: bedroom, bathroom, kitchen, living-room and dining-room
3. Extract PHOW features and compute χ^2 kernels, as done for the ISR dataset [2], in the mandatory experience.
4. Using an SVM with $C = 100$ and considering in turn a different home for testing, repeat the experiments in TABLE III of [3]. Compare and comment the results w.r.t. the performance of the CENTRISTS and the SIFT features, reported in TABLE IV. Report also the average confusion matrix.

Experiments - Domain comparison 1

1. Repeat the experiments considering only 16 training samples per category and home, so that in total you'll have $16 \text{ images} \times 5 \text{ homes} = 80$ training samples / class. Run the experiment 6 times, considering in turn a different home for testing.
2. In the ISR dataset you can find the same 5 categories: bedroom, bathroom, kitchen, living-room and dining-room. You already have the PHOW features for them. Sample randomly 80 images/class for training (keeping the remaining for testing) and repeat the classification experiments 6 times.

3. Calculate the class recognition rate, the multiclass accuracy (as the mean class recognition rate) and confusion matrix for the two experiments. Report the results in terms of mean \pm std and compare them, considering that you have used the same features and classifiers.

Experiments - Domain comparison 2

1. Test one or more of the 6 classifiers that you trained on the ISR dataset in the previous experiment, on each of the VPC homes.
2. Test the 6 classifiers that you trained on VPC (in the previous experiment) on one or more of the ISR testing sets defined in the previous experiment.
3. Calculate the class recognition rate, the multiclass accuracy (as the mean class recognition rate) and confusion matrix for the two experiments. Report the results in terms of mean \pm std and compare them to the results obtained in the previous experiment.

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.
- [3] J. Wu, H.I. Christensen, and J.M. Rehg. Visual place categorization: Problem, dataset, and algorithm. In *Intelligent Robots and Systems, 2009. IROS 2009. IEEE/RSJ International Conference on*, pages 4763–4770. IEEE, 2009.