Motivation

Due to their in-built sensors, smartphones have started being used as context detection tools for different forms of environment. One such case is distinguishing between indoor and outdoor spaces (IO detection).

Applications:
- Adaptation and personal assistants (eg. change volume, screen brightness, application shortcuts),
- power saving (eg. turn off GPS indoors, turn off WiFi outdoors),
- triggering indoor/outdoor localization services.

Current solutions

• GPS-based IO detection [1] is energy hungry and inefficient because the estimation inaccuracy is not a reliable separator between the two environments.

• IODetector [2] uses fixed thresholds for sensor features that are not appropriate across different environments.

Current solutions

Robust IO detection with semi-supervised learning

• Adaptive model for IO detection to learn changes in the characteristics of the ambient environment (weather, geography, seasons).

• Co-training uses two independent classifiers to assist each other to continuously learn the environment.

Evaluation

We collected more than 3800 samples of sensor data from three environments: university campus, city center and residential area. Volunteers participating in the data collection provided the ground-truth, to use for evaluation.

The best performance is achieved by co-training using the SVM features distribution and Naive Bayes classifiers.

Comparison with the other IO detection solutions:

Conclusions

• Current solutions for IO detection are too energy hungry (GPS) or fail to provide accurate results across a range of environments.

• Our novel approach performs IO detection using an adaptive model, transparent to the smartphone user.

References


* Full version of this work will appear in Proc. ACM SenSys Conference, Nov. 2014.