A Vehicle Parking Detection Method Using Image Segmentation

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Abstract

The article was written by (Yamada and Mizuno 2001) on 2001. It was cited 41 times according to Google Scholar. The task performed was occupancy level detection using true positive rate over pre-annotated parking spots (stalls).

Hypothesis

Using features only from gray segments extracted from color histograms can achieve high true positive rate occupancy level detection.

Evidence and Results

Dataset

The training dataset consist of 129 images extracted during 3 days in intervals of 20 minutes from an outdoor camera. From those images a total of 5182 annotated cells were extracted. A threshold for the gray level was determined from those cells. The cells are marked as occupied or vacant.

The test dataset consist of 165 images extracted during 4 days at intervals of 20 minutes. 6733 cells then were used to evaluate the detection rate (true positive rate) and misdetection (false positive rate). Nighttime images from 2 days also were used.

Evidence

The authors variate the resolution per cell, night vs day and {rain, cloudy, clear} weather conditions. This results are presented in tabular form with a fixed gray threshold level or the optimal threshold level per day.

All the results are presented using detection rate that is assumed to be the same as true positive rate.

Contribution

The authors proved occupancy detection can be done with 98.7% TPR by training a threshold over gray level. Given that shape features are completely ignored, the algorithm is robust to different car shapes and weather conditions.

Weaknesses

The dataset consist solely of images from sunrise to sunset and nighttime, so the algorithm is not capable to learn a different set of gray thresholds for twilight conditions.

Likewise, a single TV camera was mounted on a neighboring building. Thus, there is still the need to test if the algorithm generalize well under different conditions, specially different altitudes and indoor environments.

Future Work

Yamada and Mizuno propose to extend the algorithm for nighttime detection by a suitable definition of the metric used.

References

Yamada, Keiichi and Morimichi Mizuno (2001). "A vehicle parking detection method using image segmentation". In: *Electronics and Communications in Japan (Part III: Fundamental Electronic Science)* 84.10, pp. 25–34. DOI: 10.1002/ecjc.1039. URL: https://doi.org/10.1002%2Fecjc.1039.