A Systematic Review on Computer Vision-Based Parking Lot Management Applied on Public Datasets

What is the problem?

- Urbanization increases the demand for efficient parking management.
- Traditional systems are manual, sensor-based, and often not scalable.
- Automated, camera-based systems are needed to manage parking lots effectively, but they face challenges like varying lighting conditions, camera angles, and environmental factors.

What has been done earlier?

- Traditional methods: Manual counting, sensors like magnetometers and ultrasonic sensors.
- Early computer vision methods: Simple image processing techniques were used for detecting and counting vehicles.
- Use of public datasets: **PKLot**, **CNRPark-EXT**, and **PLds** have been commonly used, offering varying conditions and challenges.
- Limitations: Existing methods often fail under diverse conditions (e.g., **nighttime**, **snow**), and many do not generalize well across different datasets or parking lots.

Detect parking lots (Demo code): Link

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What are the remaining challenges? What novel solution proposed by the authors to solve the problem?

- **Dataset Limitations**: Public datasets often lack variety in conditions like nighttime or snowy weather. They also rarely include video sequences, which are essential for real-time monitoring.
- **Accuracy and Generalization**: Systems struggle with varying camera angles, weather conditions, and dataset-specific biases, leading to poor generalization across different parking lots.
- **Reproducibility**: Many studies do not use standardized testing protocols, making it difficult to compare results and reproduce experiments

Solution Proposed:

- **Comprehensive Review**: The authors systematically review existing computer vision methods and public datasets, highlighting gaps and areas needing further research.
- **Benchmarking and Criteria**: They propose specific criteria for robust parking lot datasets, such as including images under diverse conditions (e.g., snow, nighttime) and offering standardized testing protocols.
- **Focus on Generalization**: Emphasis on creating methods that can generalize across different environments by using multiple datasets in training and testing.

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