

Bike Parking Lot Management System

Project Proposal

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Topic

The proposed project aims to develop a machine learning and computer vision-based system for monitoring a bike parking lot, enabling users to track the duration of parked bikes, manage them efficiently, and remove bikes that exceed a specified time limit.

Abstract

In Hong Kong, bike parking lots often suffer from overcrowding caused by the presence of old and unused bikes. At HKUST's bike parking lot, which is relatively unknown to many school members, the situation is exacerbated as old bikes coexist with new ones, occupying valuable space and posing challenges for identification by the manager. The current approach involves periodic clearing of the parking lot every 2-3 months, during which there is a risk of inadvertently removing new bikes. To address these issues, this project proposes a machine learning and computer vision-based solution that aims to monitor the HKUST bike parking lot, accurately detect and classify bikes, track their parking durations, and provide a user-friendly interface for efficient management. By leveraging advanced technologies, the system intends to optimize space utilization, tackle the problem of old bikes, and minimize the unintended removal of used bikes during clearing operations. The insights provided by the system can contribute to future planning and decision-making processes, including identifying optimal parking durations, determining maintenance requirements, and enhancing overall efficiency in bike parking management at HKUST and potentially other locations in Hong Kong.

Related Works

Datasets

No bike-specific dataset is found but there are dataset for general vehicle or transportation dataset that can detect bike. This includes dataset Cityscapes Dataset[1], BikeNet Dataset[2], and KITTI Dataset[3].

Existing Solution

No specific systems, models, or research related to bike parking lot management were found. However, there has been extensive research conducted on vehicle parking lot management methods, which can also be applicable and useful. In P. Almeida's review [4], various methods for car detection and counting were discussed, and many of these methods utilized public datasets and custom CNN networks.

Expect Output

The primary objective of this project is to develop a model capable of detecting bikes in the HKUST bike parking lot. To achieve this, a custom dataset will be created and used to train the model. Additionally, the model will be designed to determine the duration for which each bike remains parked and issue a warning if a bike exceeds a predefined time threshold. The model will be implemented on a desktop computer and accompanied by a graphical interface. This interface will display the live video stream from the parking lot, provide information on detected bikes and their respective parking durations, and issue warnings when necessary.

Reference

- [1]M. Cordts et al., “The Cityscapes Dataset for Semantic Urban Scene Understanding,” arXiv:1604.01685 [cs], Apr. 2016, Available: <https://arxiv.org/abs/1604.01685>
- [2]R. Guo et al., “BikeNet: Accurate Bike Demand Prediction Using Graph Neural Networks for Station Rebalancing,” 2019 IEEE SmartWorld, Ubiquitous Intelligence Computing, Advanced Trusted Computing, Scalable Computing Communications, Cloud Big Data Computing, Internet of People and Smart City Innovation, Aug. 2019, doi: <https://doi.org/10.1109/smartworld-uic-atc-scalcom-iop-sci.2019.00153>.
- [3]Y. Liao, J. Xie, and A. Geiger, “KITTI-360: A Novel Dataset and Benchmarks for Urban Scene Understanding in 2D and 3D,” arXiv:2109.13410 [cs], Sep. 2021, Available: <https://arxiv.org/abs/2109.13410>
- [4]P. Lisboa De Almeida, J. Alves, R. Stubs Parpinelli, and J. Barddal, “A Systematic Review on Computer Vision-Based Parking Lot Management Applied on Public Datasets,” 2022. Available: <https://arxiv.org/pdf/2203.06463.pdf>