Master Thesis

Employing Synthetic Data for Drone vs. Bird Detection

Keywords: Deep Learning, Object Detection, Drone vs. Bird, Synthetic Data, Simulation-Reality Gap

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Motivation

Detecting drones in images or video sequences using *deep learning (DL)* algorithms is an important yet challenging *computer vision* task. Their small size and fast maneuvers make drones a difficult target, especially in the presence of birds and other distractor objects (e.g., airplanes). At long distances, drones can be easily mistaken for birds. Therefore, a robust discrimination between drones and birds requires effective algorithms that can operate under unfavorable conditions. However, limitations in data availability and high labeling costs tend to keep current detection approaches from considering birds in a supervised manner (i.e., the training data usually do not include annotations for birds). Thus, employing synthetic data for training drone-vs-bird detectors offers great potential (e.g., due to automatic labeling and the possibility of high data diversification) and constitutes an important research topic.

Objective & Method

The objective of this work is the analysis of the applicability of synthetic data for DL-based drone vs. bird detection and the benefits of considering birds in a supervised manner. This comprises the game engine-based generation of synthetic data and the realistic simulation of birds (or other flying objects), on the one hand, and the enhancement of state-of-the-art algorithms for drone detection in the presence of birds, on the other hand. The thesis is based on existing preliminary work, upon which further aspects will be explored.

Work Content

- Game engine-based simulations with special focus on birds (e.g. flight path planning, realistic displays, etc.) and generation of synthetic data
- Training state-of-the-art object detection models for drone vs. bird detection using different training strategies
- Evaluation of the usability and quality of the generated synthetic data / comparison with existing approaches

Requirements

- Currently enrolled as a Master student in computer science, mathematics, optical engineering or similar major
- Experience in working with Unreal or Unity (or something comparable), experience with *Microsoft AirSim* advantageous but not required

- Interest in deep learning, image processing, and object detection
- Basic Python skills (ideally w.r.t. deep learning applications, e.g., *Pytorch* or *Tensorflow*)