Real-time People and Vehicle Detection from UAV Imagery

Anna Gąszczak, Toby P. Breckon, Jiwan Han
School of Engineering
Cranfield University

UAV Platform and Imagery

Images are acquired by optical and thermal cameras onboard an Unmanned Aerial Vehicle (UAV) operating at an altitude of 60m. Images are sampled at 1fps in order to maximize available image quality for detection within the limitations of available transmission bandwidth.

Vehicle detection

Detection routine relies primarily on optical imagery as vehicle thermal signatures are unstable under varying conditions.

The optical image is scanned with a set of multiple cascaded Haar classifiers trained for different vehicle orientations which are then combined to produce a coherent set of detections.

Thermal imagery - signatures of cars

Optical imagery - example detections of vehicles

People Detection

People are generally more visible and distinguishable in the infrared spectrum than in the visible spectrum thus our primary source for the people detection is thermal imagery. Our approach is a combination of multiple cascaded Haar classifiers with additional shape matching techniques for secondary confirmation.

Although some factors limit object visibility in IR (e.g. atmospheric conditions - fog, direct sunlight, temperature) we can still detect people under varying conditions using this approach (examples below).

Thermal imagery - Direct sunlight

Thermal imagery - Fog

Results

Performance of the detector is optimized to reduce the overall false positive rate by aiming at the detection of each object of interest (vehicle/person) at least once in the environment (i.e. per flight) rather than every object in each frame. Currently the detection rate for people is ~70% and cars ~80% although the overall episodic object detection rate for each flight pattern exceeds 90%.

With thanks to Stellar Team member organizations: