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Video-Based Drone Detection for Collision Avoidance Purposes

We are headed for a world in which the skies are occupied not only by birds and planes but also by unmanned drones ranging from relatively large Unmanned Aerial Vehicles (UAVs) to much smaller consumer ones. Some of these will carry transponders that make them easy to detect but not all. In addition to these unequipped drones, one must also account for other flying objects such as paragliders, blimps, and even large birds that all constitute potential collision threats.
To allow aircrafts to safely navigate such a crowded environment without requiring heavy or expensive equipment, we will develop a lightweight videobased system that can detect threats and alert the pilot to it.

We have begun developing video-based algorithms that rely on classifying descriptors extracted from spatio-temporal image cubes. These cubes are formed by stacking motion-stabilized image windows over several consecutive frames, which gives more information than using a single image. What makes this approach both practical and effective is a learning-based motionstabilization algorithm. Unlike those relying on optical flow, it remains effective even when the shape of the object to be detected is blurry or barely visible. This arises from the fact that learning-based motion compensation focuses on the object and is more resistant to complicated backgrounds.

Our current results are encouraging but our algorithms are not yet reliable enough, in large part because rely on Statistical Machine Learning, and more specifically on Deep Nets that require very large training databases to reach their full potential. Since such databases do not yet exist, the main goal of this project will be to build them and then exploit them to the full to achieve the required detection reliability

Summary

We have begun developing video-based algorithms that rely on classifying descriptors extracted from spatio-temporal image cubes for Collision Avoidance Purposes. These cubes are formed by stacking motion-stabilized image windows over several consecutive frames, which gives more information than using a single image.

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