Neuromorphic Solutions for UAS Collision Avoidance

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The poster will discuss how optic flow, the set of local motions between successive image frames captured by a camera, may contribute to the detection and avoidance of potential collisions in stationary, taxiing, and flying aircraft. A constructed virtual environment allows for the design and testing of a biologically inspired model that uses optic flow to estimate the level of collision danger present in various parts of the image field. This model performs a decomposition of the optic flow field into self- and object-motion based on the aircraft's known motion; these flow fields are then separately evaluated for potential collisions. Preliminary reinforcement learning results show that the model is able to minimize collisions based on these extracted high-level stimulus qualities.

We have also investigated how image filtering methods can quickly produce an accurate optic flow field for the online operation of this model in unmanned aerial systems. A number of sample flight videos have been recorded for model testing purposes; analysis of the optic flow computed from these videos suggests that the motion of nearby aircraft and camera rotations can both be detected for use in the model developed for this project. Finally, a closed-loop simulator between MATLAB and the FlightGear aircraft simulator communicates a simulated camera stream as well as standard flight information and commands for more realistic reinforcement learning paradigms.

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