REAL-TIME MICRO AIR VEHICLE VIDEO STABILIZATION

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BACKGROUND

The proliferation of micro air vehicles (MAVs) which may be tasked by individual warfighters in the field provides immediate situation awareness, but limitations remain that present significant challenges for their effective use. Video imagery obtained from these platforms is difficult to exploit due to poor visual quality, moderate to extreme jitter, and noise in video transmission. Operational constraints often limit the availability of auxiliary metadata, such as platform position and pose, that is typically available on larger unmanned aerial vehicle (UAV) platforms. Traditional methods for recovering ego-motion parameters for stabilization purposes do not perform well for MAVs due to poorly constrained platform motion and poor video quality. General purpose techniques, independent of specific sensor and operational constraints, are necessary to provide enhanced real-time situation awareness from MAV-based video.

APPROACH

We have developed a real time stabilization algorithm that addresses operational concerns for the MAV scenario. Stabilization is performed without reliance on platform metadata. The design accounts for diversified scene content without *a priori* assumptions regarding the availability of specific features (such as the horizon) in the frame or kinematic models of the MAV platform. The approach is general in nature, resulting in a sensor agnostic system that may be interfaced with video streams from various sensor platforms. Robust feature extraction and tracking, image transformation, and novel rapid interpolation have been incorporated to provide real-time stabilization and mosaicking for warfighter exploitation. The current system operates on a commercial off the shelf (COTS) PC platform and has been interfaced with multiple sensor platforms (including Raven and Wasp) during field tests. Operational constraints, such as the presence of annotation on the video, have been addressed, and we have demonstrated effective stabilization and mosaicking in the presence of annotated video. On-line user selectable modes are available to perform reverse or forward image frame mapping (to a prior reference frame or to the current image reference frame), or to reset the reference frame.

OPERATIONAL RESULTS

We have demonstrated real-time operation on live video streams from MAV platforms. A sample mosaic is shown in Figure 1. For 320x240 resolution video, system throughput for full resolution display is 47 frames per second (fps) with 52% CPU utilization on a Dell Latitude D820 PC with a Centrino Duo 2.16 GHz processor. Options for enhancing throughput by reducing resolution have been incorporated as well. The presentation will include a live demonstration of our system processing MAV video in real-time on a COTS laptop computer.

Figure 1: *Sample mosaic from MAV stabilization system, with the current image frame outlined in red.*