EE368 / CS 232 Digital Image Processing
Project Proposal

Video Detection and Enhancement of Small Unmanned Aircraft

Adrien Perkins, adrienp@stanford.edu
Steven Krukowski, spk170@stanford.edu

This project is aimed at being able to successfully detect, track, and highlight the motion of a small unmanned aerial vehicle (UAV) in real time on an Android phone. We would like to explore both a ground based observer location and an in-flight observer location. The work for this project partially builds off of a previous EE 368 project, Automatic Aircraft Detection and Classification in Cluttered Environments by Padial and Hammond. While their project focused on target detection and classification of full scale aircraft [1], our focus is on the detection of much smaller aircraft (UAVs). Also to differentiate, instead of classification, we would like to improve aircraft tracking ability and enhance the user experience through the use of augmented reality.

A proposed starting point for a ground based observer method is the through a technique called sky segmentation, which splits sky and ground elements in the frame and looks for non-sky elements in the sky portion [2]. This would assist us in the detection of an aircraft on a near static background, as there is a good probability that the UAV will be in the sky portion of the video. For an in-flight observer viewing from above the aircraft, there entire field of view will be non-sky requiring a different approach. Here we can start to leverage techniques that compare the velocity of different elements of the video (by comparing sequential frames) and looking for elements that are traveling at different rates than the background. UAVs pose an additional problem that some types of vehicles have the ability to hover and therefore move along with the background. To address this issue, we plan on using a navigation-like approach, similar to the approach in [3], where a Kalman Filter was used. Using a statistical model of the dynamics of a UAV and measured dynamics information from the video, we plan on decreasing the false positive results and improve tracking performance. After detection, we would like to use image processing techniques in class to process aircraft and background pixels separately to highlight the aircraft and display its path in the video for an enhanced user experience

References

Previous work
[1]
https://stacks.stanford.edu/file/druid:my512gb2187/Hammond_Padial_Obstacle_Classification_and_Segmentation.pdf

Sky segmentation
[2] http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=1570842

Distance and Velocity determination
[3] http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=6205034