CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Francisca Vasconcelos

Project Number

35252

Project Title

Object Recognition Based UAV Control

Abstract

Objectives/Goals

The goal of the project is to have an AR Parrot Drone follow a person using computer vision techniques to recognize an object that he or she is wearing or holding.

Methods/Materials

Objects are detected using a UAV mounted camera. The distance between the object center of mass, in the image plane, and the image center is measured. This distance is used as an error signal to control the UAV velocity. The feedback loop is implemented with a proportional-integral-derivative (PID) controller. The computer vision techniques used for object detection are inspired by the attention mechanisms of human vision, exploiting a combination of bottom-up and top-down saliency cues to speed up recognition. The saliency mechanisms are implemented with a combination of the Harris interest point detector and an object detector cascade. They enable recognition at video frame rates.

Results

Experimental evaluation has shown that the goal of the project is feasible. The drone is currently able to recognize, follow, and stay a specified distance away from a patterned patch. It was found that, for the drone to achieve real time performance, a trade-off must be implemented between recognition accuracy and speed.

Conclusions/Discussion

Although computer vision has previously been used in UAV literature, the emphasis has been on motion computations (optical flow) for navigation and obstacle avoidance. The techniques now introduced enable the UAV to recognize specific objects and react to them. In particular, the UAV can track a person wearing an object, such as a piece of clothing or patch. Unlike current GPS-based methods, the behavior of the UAV can vary according to the object being tracked. UAV programming thus becomes as simple as changing your clothes (or pattern). The UAV is also much more precise in its interaction with the user and works both in and outdoors. Many applications could follow from this technology, including a UAV that behaves as an older brother that watches a child from above, a personal cameraman that follows an athlete on the field, an additional pair of eyes that allow a bike rider to "look around the corner," or a sitter that watches a pet as it roams around the park.

Summary Statement

The project is about the use of computer vision techniques to enable a UAV to follow a person and react to what he/she is wearing/holding.

Help Received

I used open source code for the low-level infrastructure of communicating with the drone and OpenCV for some of the computer vision functionality.