Real-time vision based landing via optimality principles

Stage topic Description

The combined used of time-to-contact and ventral optic flow can lead spacecrafts/drones to successful landings [1] without the need of an altimeter and with a reduced mass penalty. In most situations, though, the information on the altitude is known and can thus be used to track the optimal descent path. Optimal descents are typically generated off line and then tracked via LQR types of controllers (cf. [2]).

Another approach is to have the spacecraft/drone generate its own optimal descent path on-board (and in real time) and with limited CPU usage. The drone would then update in real time the descent path and thus be robust to deviations from the planned trajectory.

Candidate's tasks

- The candidate will implement a fast and efficient solver for the drone optimal descent problem under the supervision of the ACT experts. He will use a simplified model of the drone body and of its descent and will use interior point methods to find the optimal descent paths.

- The candidate will study the effect of the developed method on the descent optimality and find the correct trade off between speed and accuracy. The algorithm is expected to be running minimally at a 10hz frequency.

- The candidate will port and test the algorithm on a real quadrotor

The ideal candidate

The candidate may have a background in aerospace, control systems, or robotics and must have strong programming skills (C / C++).

References

[1] (2012), Izzo, D., and de Croon, G.C.H.E. de Croon, "Landing with time-to-contact and ventral optic flow estimates", in Journal of Guidance, Control, and Dynamics, Volume 35, Issue 4, pages 1362-1367.

[2] (2012), M. Hehn, R. Ritz, and R. D'Andrea, "Performance benchmarking of quadrotor systems using time-optimal control", Autonomous Robots,33, 69-88