Quadrotor Control Using RL

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1 Proposal

While the problem of quadrotor control has been greatly explored, more work is still needed to expand the payload carrying capability of the quadrotor. If the payload is unstable or fragile, a more powerful controller is needed to ensure the quadrotor is able to deliver the payload safely. To model this, we now consider the problem of balancing an inverted pendulum on top of a quadrotor.

Our group aims to design controllers to first (a) be able to swing up an inverted pendulum on top of a quadrotor, and (b) track desired trajectories. The controller needs to be robust enough to withstand external disturbances acting on the body such as external wind. We will start by benchmarking LQR and MPC controllers to solve this problem as done by Hintz et al [1]. Since this paper does not consider external disturbances, we will then develop an RL based controller with a Proximal Policy Optimization or Advantage Actor Critic methods to compare with the MPC controller. Model-free RL methods can capture more complicated interactions such as aerodynamic effects that are difficult to model, and make the controller more robust. In order to simplify the dynamics of quadrotor and allow us to focus on developing control algorithms without deviating too much from reality, we decided to simulate a planar quadrotor for the above two tasks. Lastly, we will evaluate the performance of our RL based controller against the baseline MPC model, comparing the success rate, robustness and required control effort.

References

[1] Christoph Hintz, Shakeeb Ahmad, Joseph Kloeppel, and Rafael Fierro. Robust hybrid control for swinging-up and balancing an inverted pendulum attached to a uav. In *2017 IEEE Conference on Control Technology and Applications (CCTA)*, pages 1550–1555, 2017.