

Time-optimal Flying a VTOL Drone

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Topic and Motivation

- Minimum-time flight for VTOL-Drone
- Push platform to its limits
- Use Cases:
 - Rescue
 - Delivery
 - Transportation

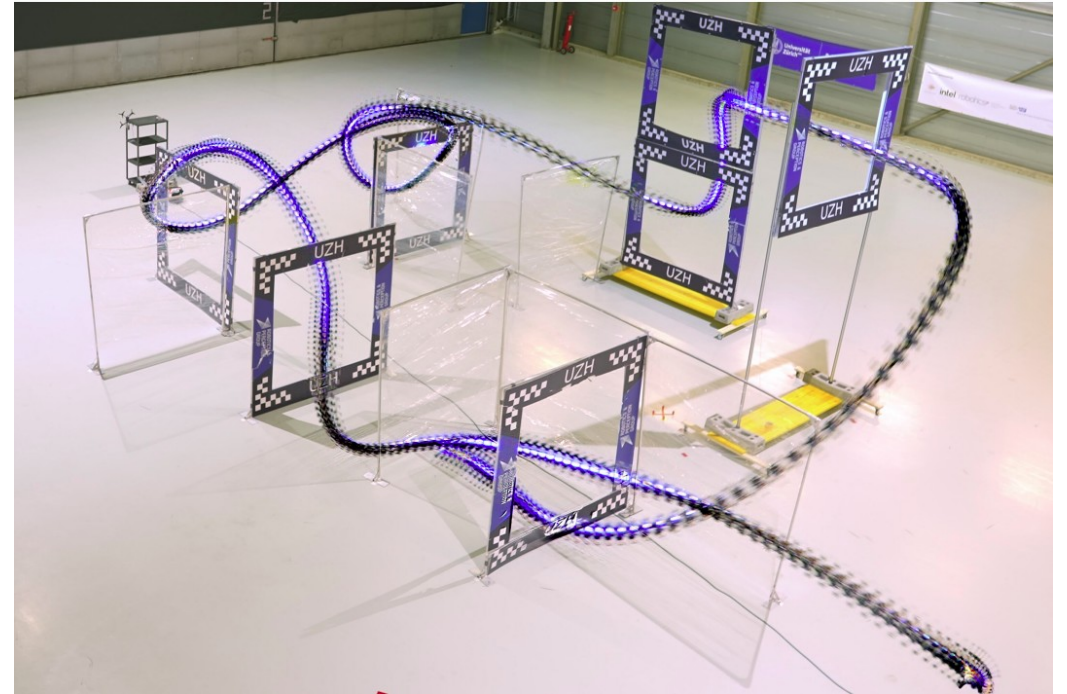
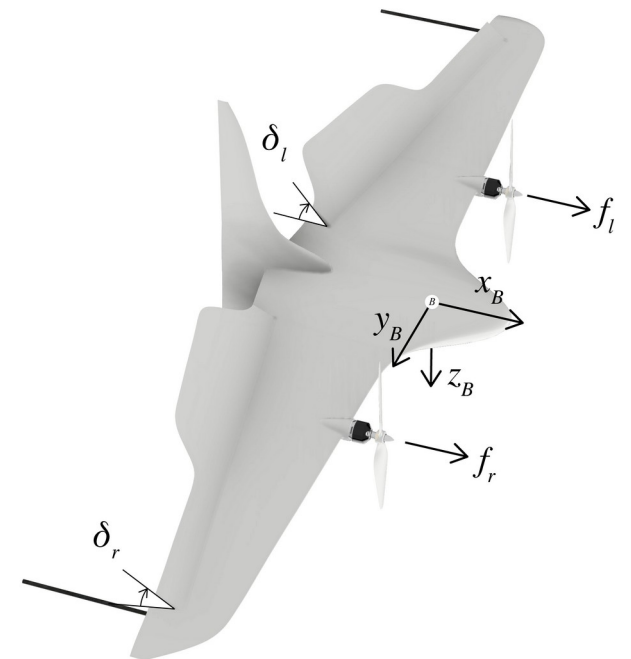
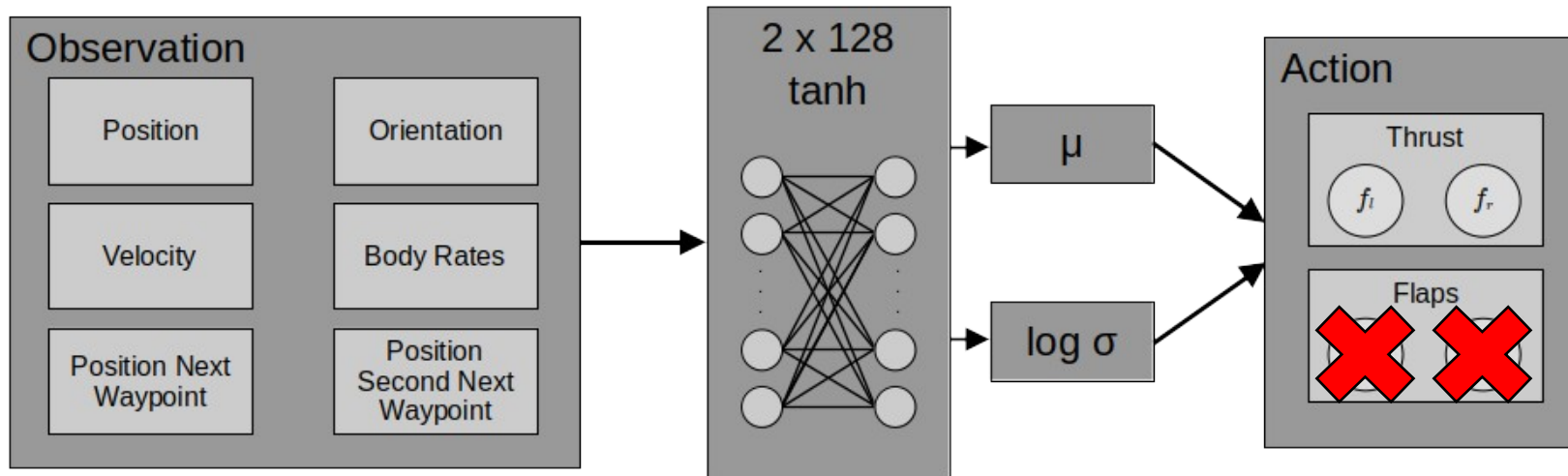


Fig. 1: Quadrotor races through a race track in the real world.

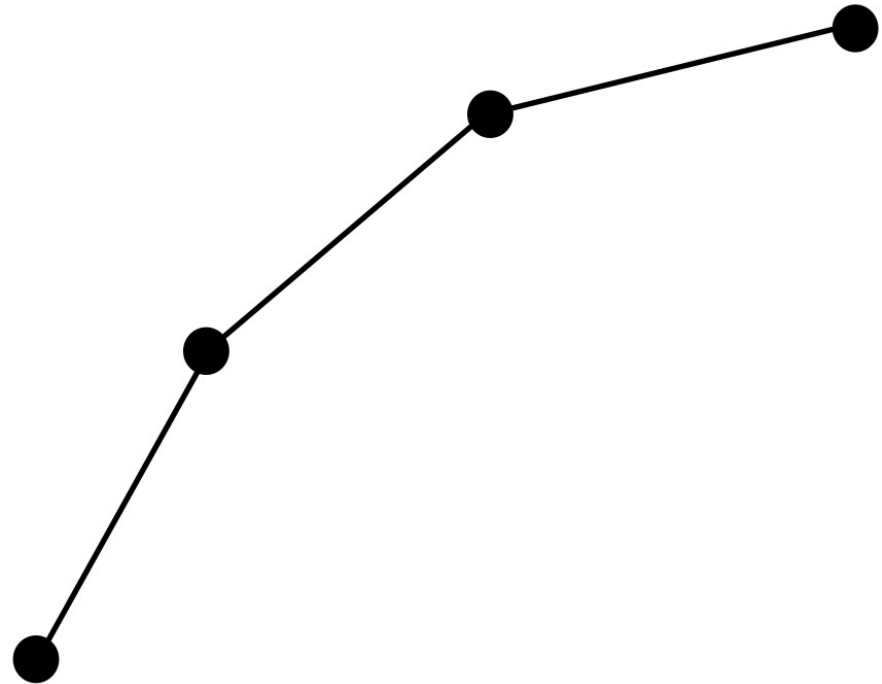
Our Approach

- Actor Critic
- Adam Optimizer



What has been done so far

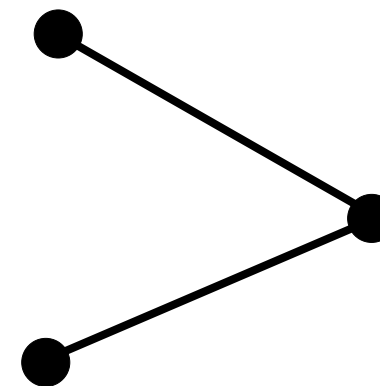
- Problem reduced to 2D
- Steer towards single points
- Fly along small random trajectories



Reward Function

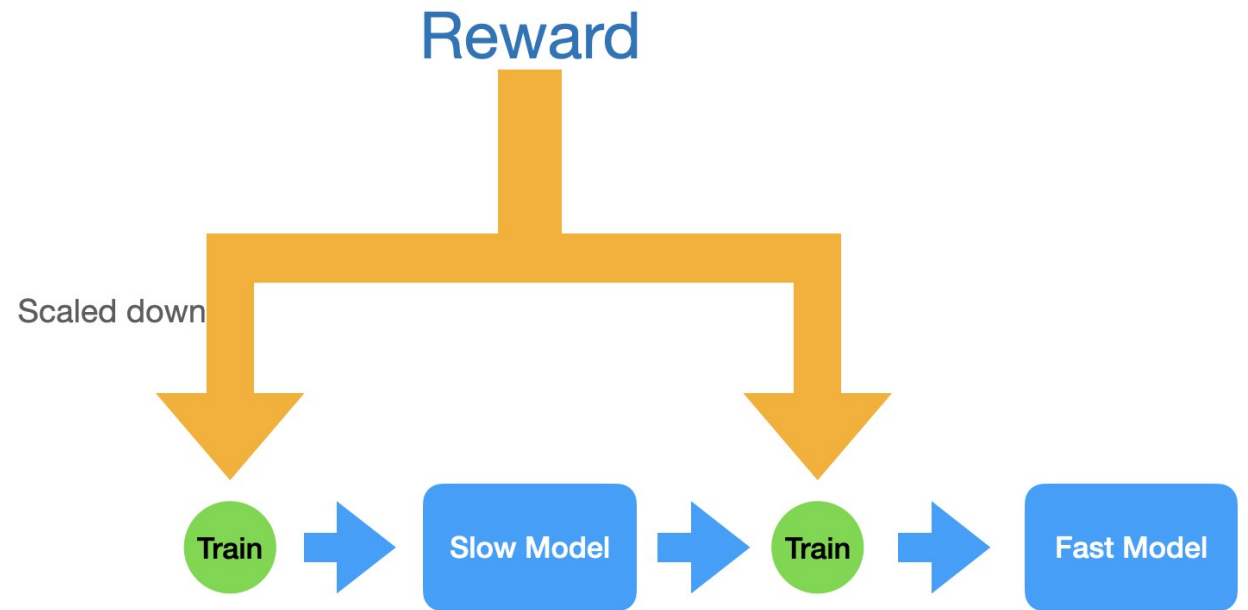
$$r(t) = k_p \cdot \Delta progress(t) + k_s \cdot progress(t) + k_{wp} \cdot r_{wp} - k_\omega \cdot \|\omega\| - fall$$

- Encourage line progression
- Encourage reaching points
- Penalize spinning
- Penalize inactivity

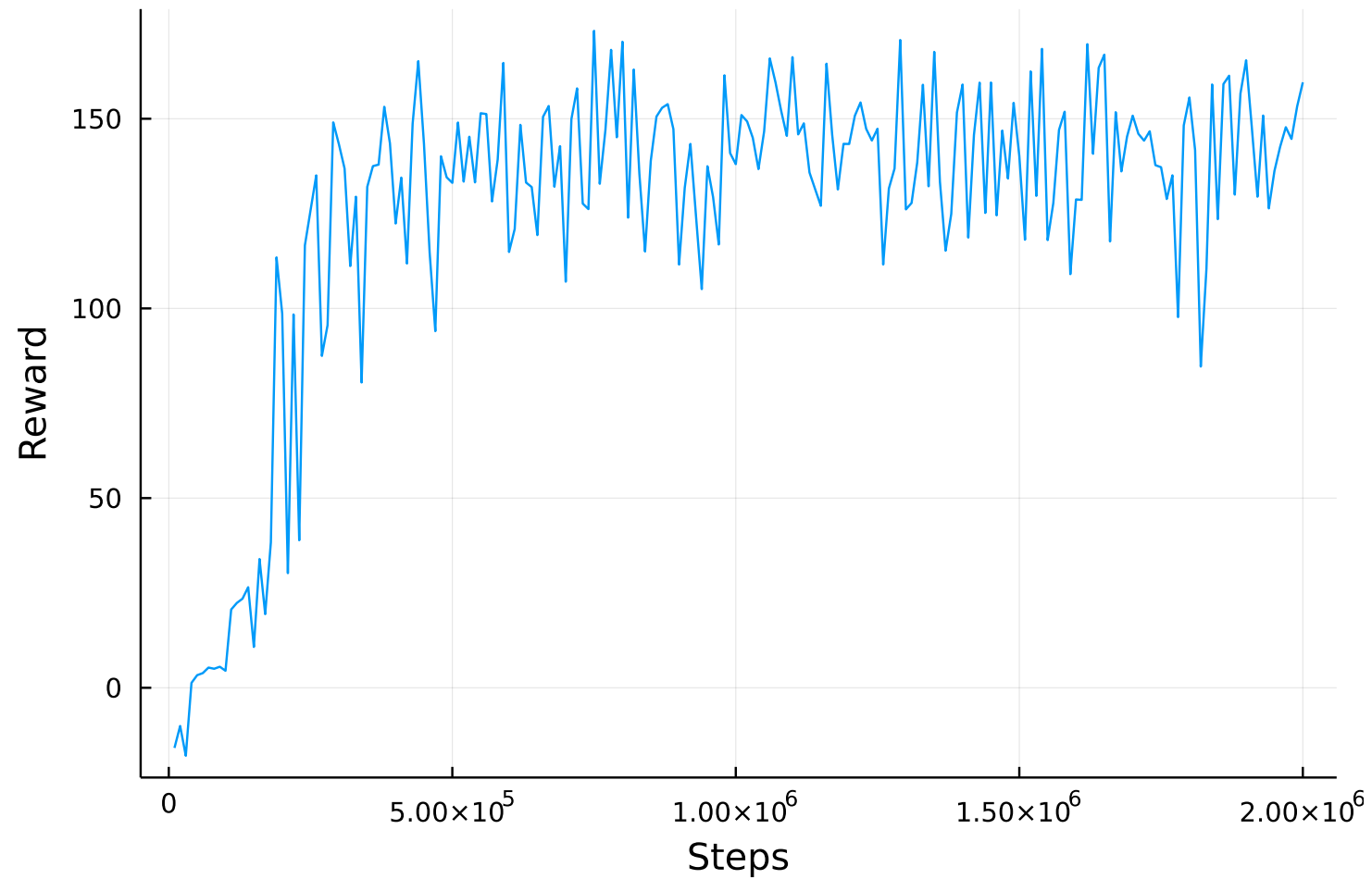


Training Strategy

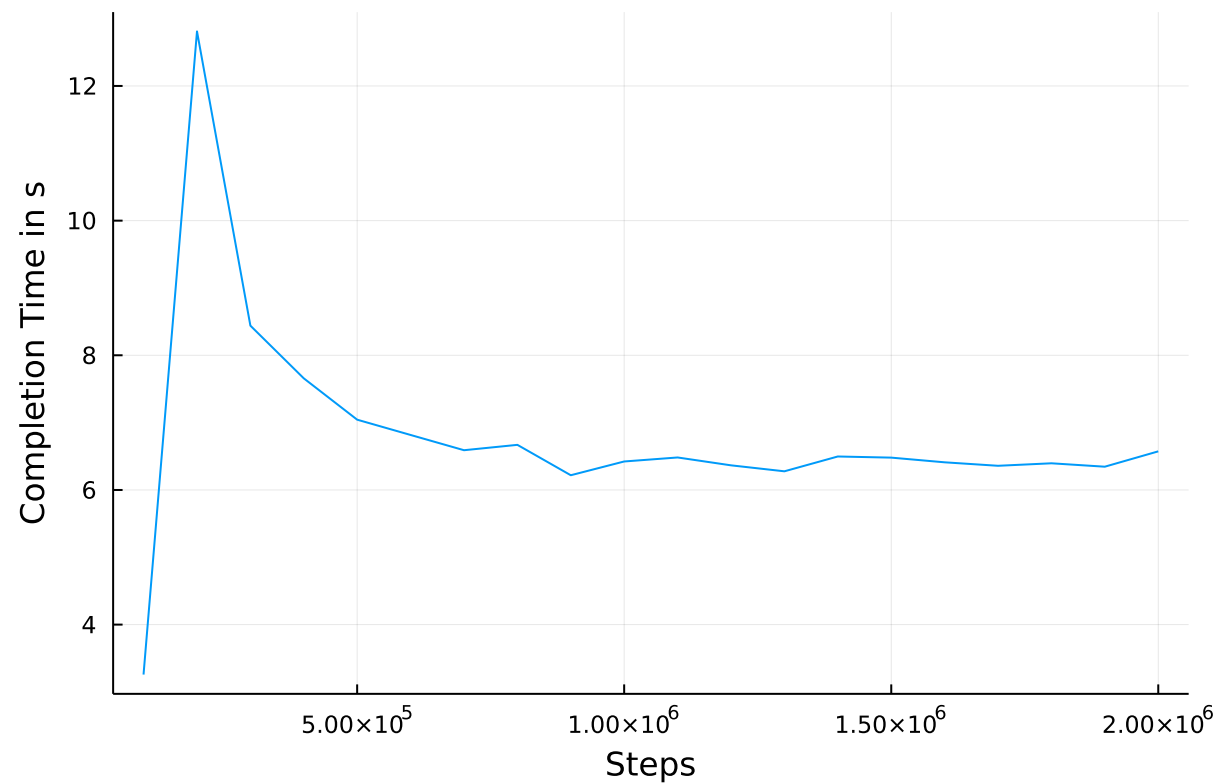
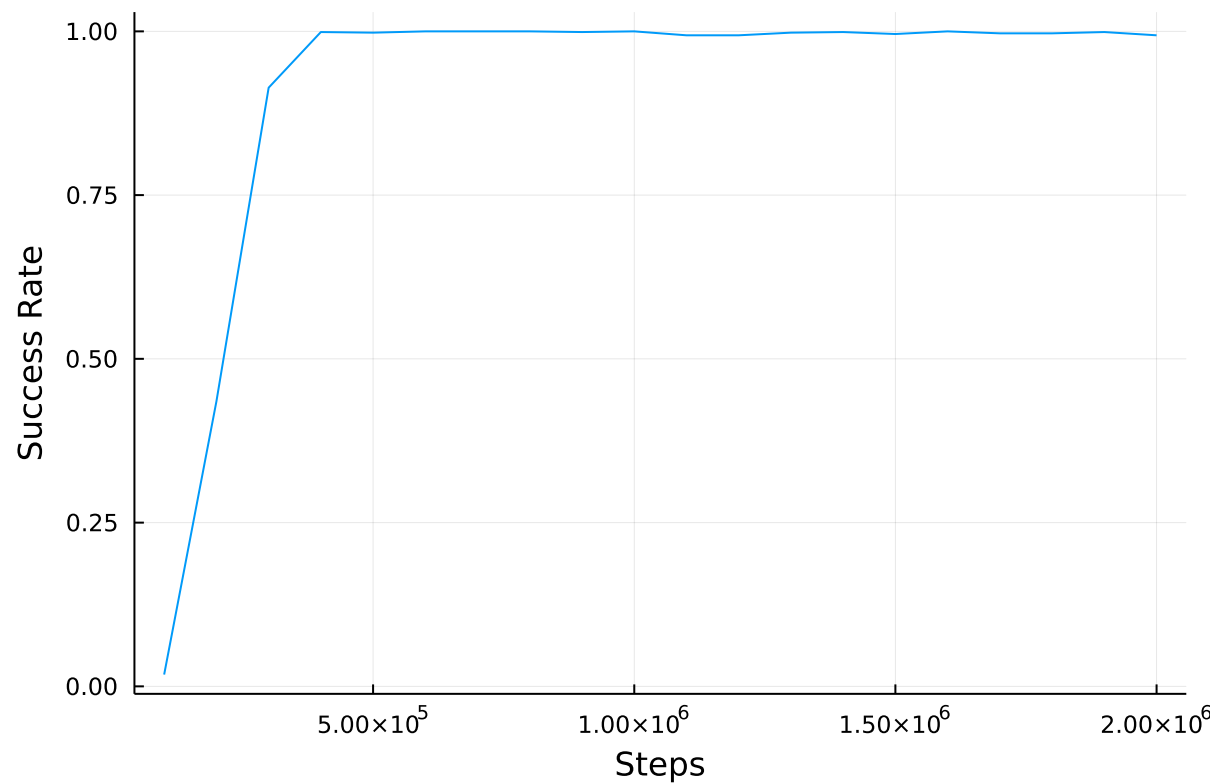
- Two Phases: Slow and Fast
- Slow: Learn to follow path
- Fast: Time optimality



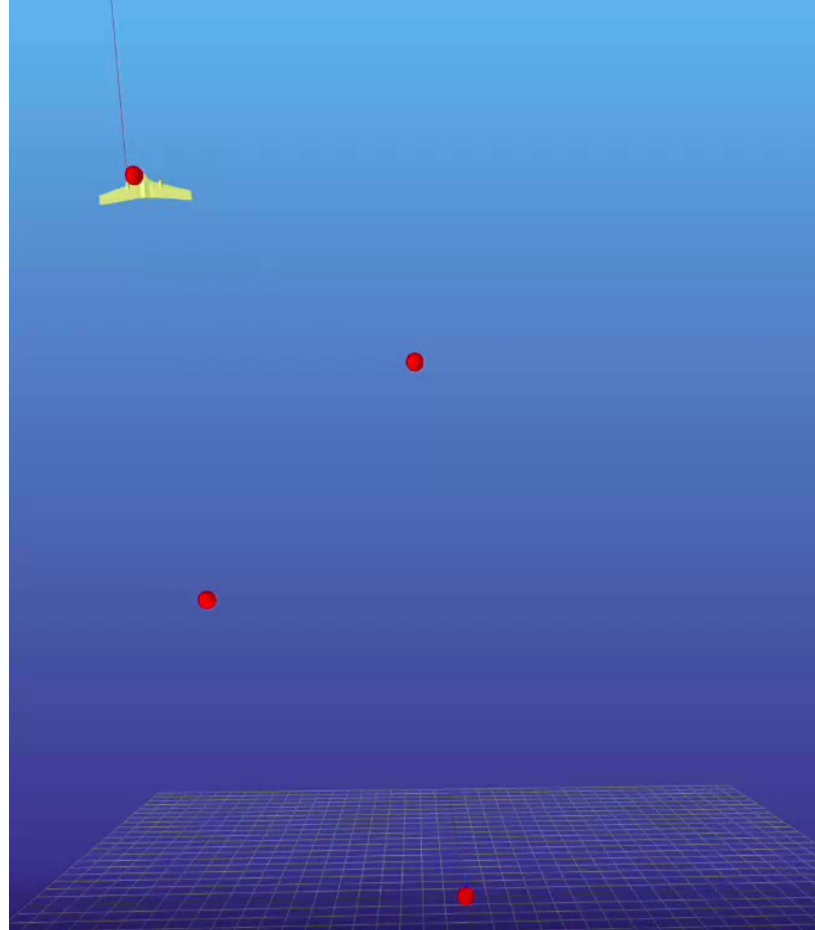
SLOW PLOTS



SLOW PLOTS

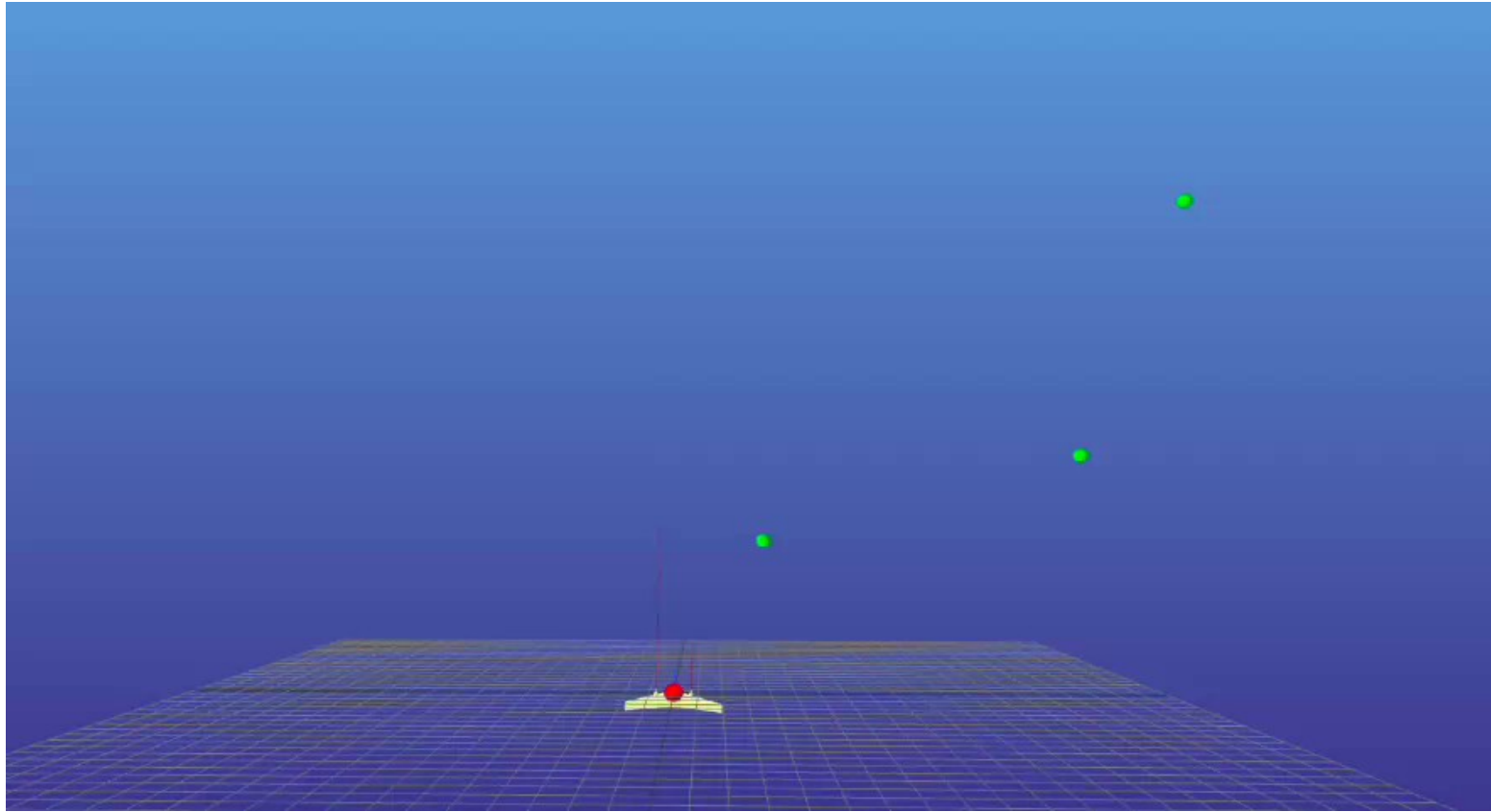


SLOW VIDEO



<https://youtu.be/jzqBFTEnowo>

FAST VIDEO



<https://youtu.be/IRfzMXrSIUQ>

Next Steps

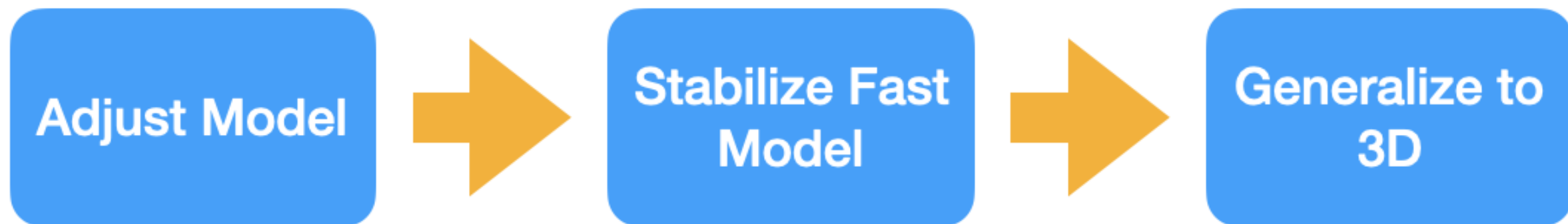


Image Sources

From <https://arxiv.org/pdf/2203.15052v1.pdf>

- Fig. 1: Our quadrotor races through a complex race track in the real world.