HALO: Hazard-Aware Landing Optimization

(for Autonomous Systems)

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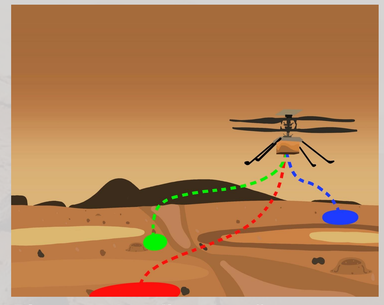
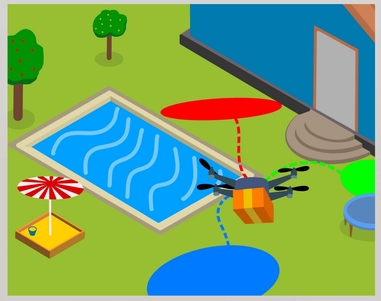
Motivating Applications



Planetary Landing: Landing on planets or moons where little to no *a priori* information is known about the environment and contingency landing sites are necessary.



Drone Package Delivery: Landing in uncertain scenarios where higher level-semantic knowledge on the current environmental state is necessary for a safe landing.

Introduction

Objective:
Develop a framework that enables autonomous aerial vehicles to land **safely** in **unknown** environments.

Contributions:
Two key algorithms developed and integrated (closed-loop) in the **AirSim** simulation environment:

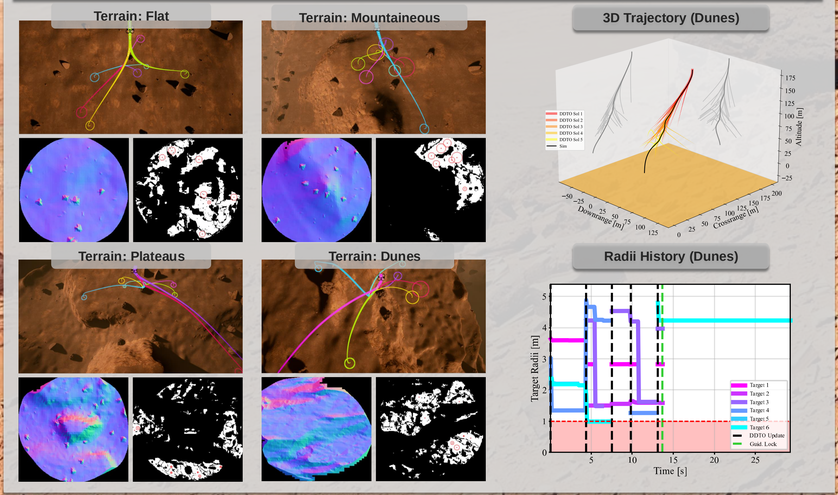
① **Adaptive Deferred-Decision Trajectory Optimization (ADDTO)**

② **Hazard-Aware Landing Site Selection (HALSS)**

Click for link

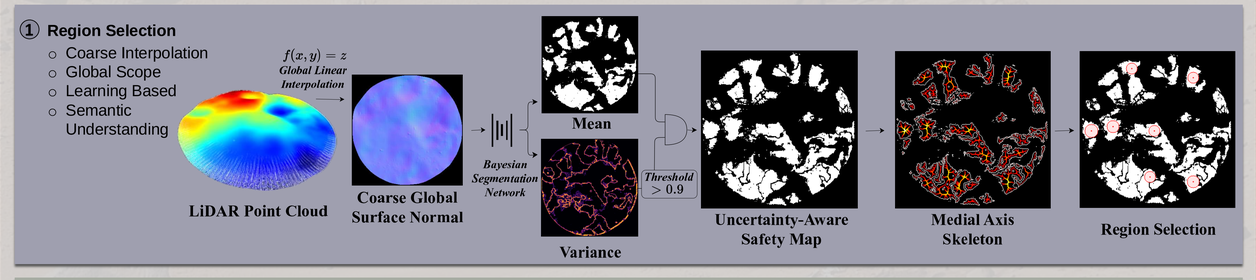
Video (YouTube) **GitHub**

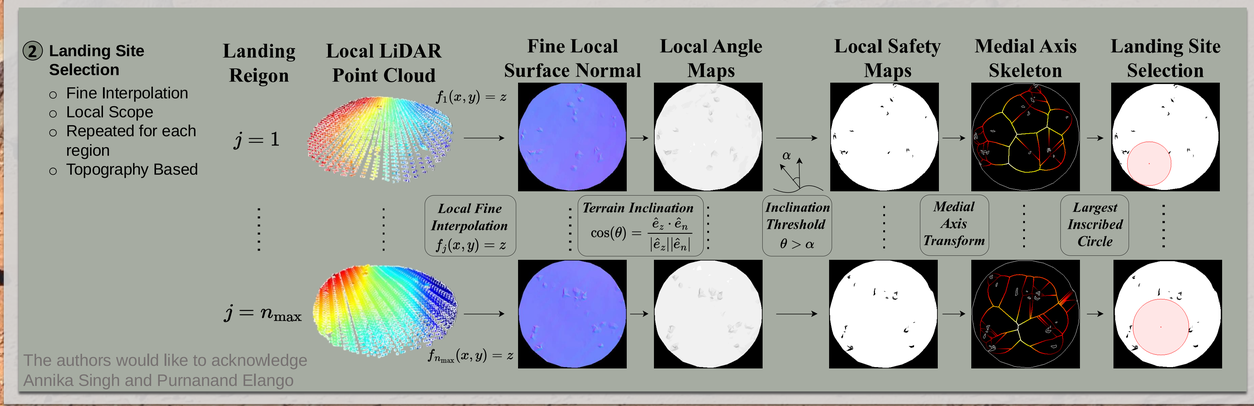
Simulation Results



Perception

HALSS: Hazard-Aware Landing Site Selection





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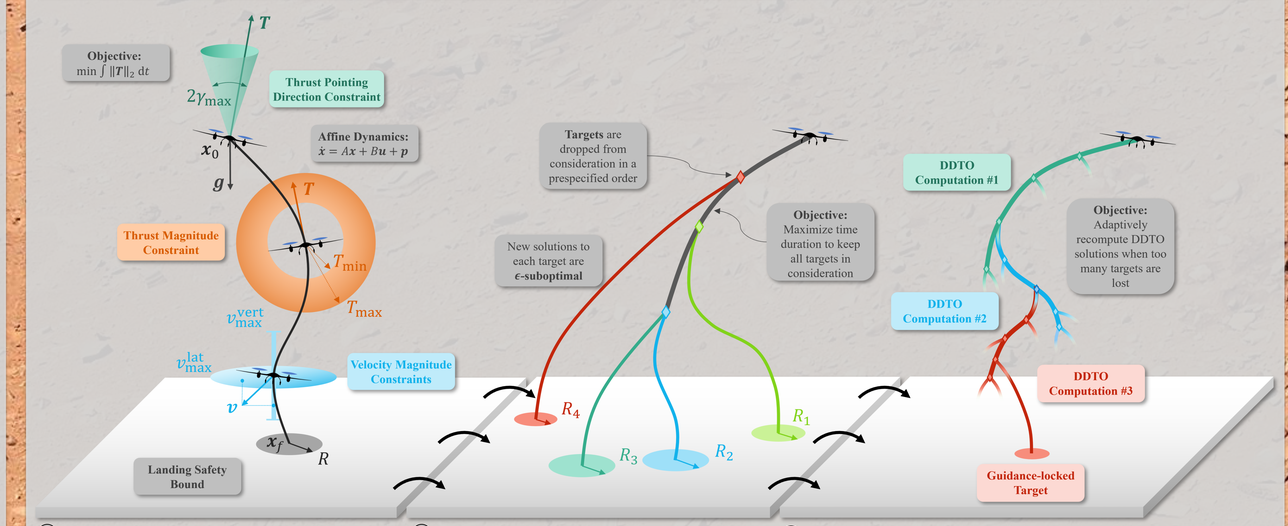
Path Planning

ADDTO: Adaptive Deferred-Decision Trajectory Optimization



① **Baseline Trajectory Optimization Problem**
- 3 Degrees of Freedom
- Double integrator dynamics
- Convexified via lossless convexification
- Time-optimized via bisection search

② **Deferred-Decision Trajectory Optimization (DDTO)**
- Embeds Baseline Problem
- Keeps multiple targets in consideration
- ϵ-suboptimal

③ **Adaptive-DDTO**
- Embeds DDTO
- Adaptive recomputations when targets are lost
- Decision functions encode desirable landing behaviors