548 Project Proposal

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Papers:

- End-to-end safe Reinforcement Learning through Barrier Functions for Safety-Critical Continuous Control Tasks
- Safety-Critical Model Predictive Control with Discrete-Time Control Barrier Function

Goal:

- Implement either MPC or RL-based control with Control Barrier Functions.
- Demonstrate on a simple dynamical system using a simulation environment (gym - inverted double pendulum). The authors of the RL-CBF paper demonstrated their methods in an inverted pendulum gym environment.
- If working on the MPC-CBF, demonstrate on a 2D simulation, a bot safely navigating to a goal in a dynamic environment.
- My goal for this project is to understand the mathematical frameworks behind fusing CBFs with Optimal Control Techniques. Therefore, I am choosing simple simulation demonstrations.

Stretch Goal:

- Make an agent (car) using RL or MPC to do a driving maneuver, like safely changing lanes in a dynamic environment.

Backup Goal:

- Work on quantifying the performance difference of LQR, MPC, and MPPI.