Universal Control Barrier Functions for Agile, but Safe, Multi-Robot Control in Dynamic, Cluttered Environments

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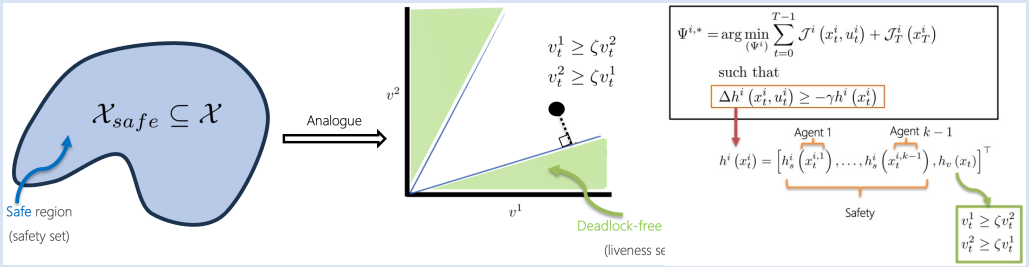
Motivation

Our longstanding goal as roboticists is to deploy intelligent and autonomous robots in complex human environments. To be successful, robots must be agile without sacrificing safety.

To be more specific, the dichotomy that prevents a balance between agility and safety is that when trying to be agile, robots often cannot guarantee safety and when trying to be safe, robot end up in deadlocks.

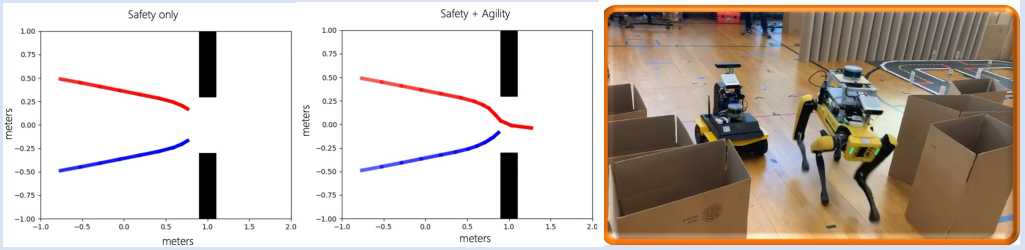
This poster presents a line of research towards developing "Universal Control Barrier Functions" , or UCBFs, that extend the notion of safety via set invariance to guaranteeing both safety as well as agility via deadlock prevention.

How do UCBFs work?



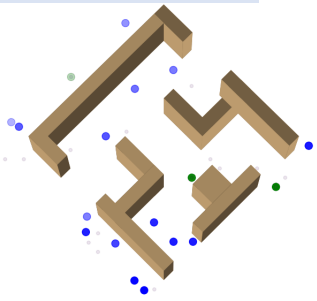
UCBFS extend traditional CBFs by creating an analog of safety sets called "**Liveness Sets**" that guarantee liveness

Preliminary Results

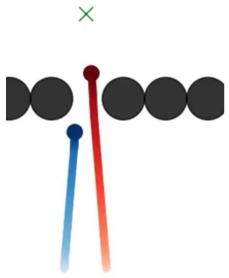


Extensions

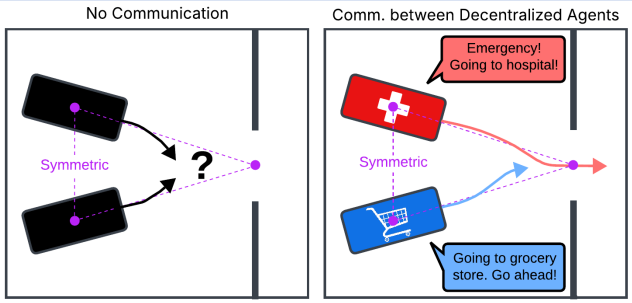
Limited actuation



Lidar-based UCBFs



Socially Optimal UCBFs



Neural UCBFs