
CAREER: Generalization and Safety Guarantees for Learning-Based Control of Robots

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Learning in robotics

- Increasing adoption of machine learning in the robotics pipeline
 - Power of learning: ability to handle rich sensory inputs (e.g., vision)

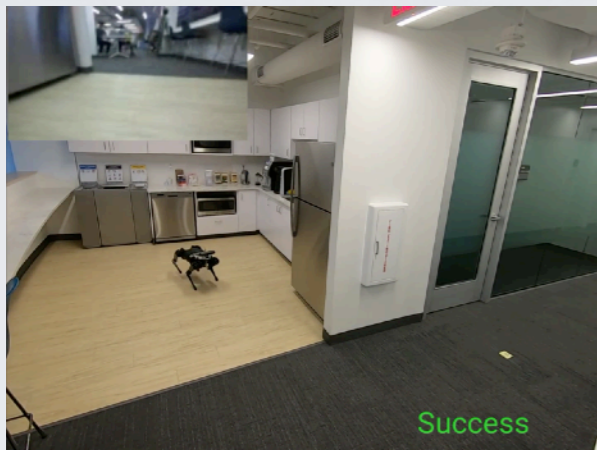
Question: How can we provide guarantees on safety and performance for learning-enabled robotic systems?

Technical challenge: Generalization to environments unseen during training

Research Highlights

Key technical idea: Generalization theory (e.g., PAC-Bayes theory) from theoretical machine learning

Learning policies with generalization guarantees



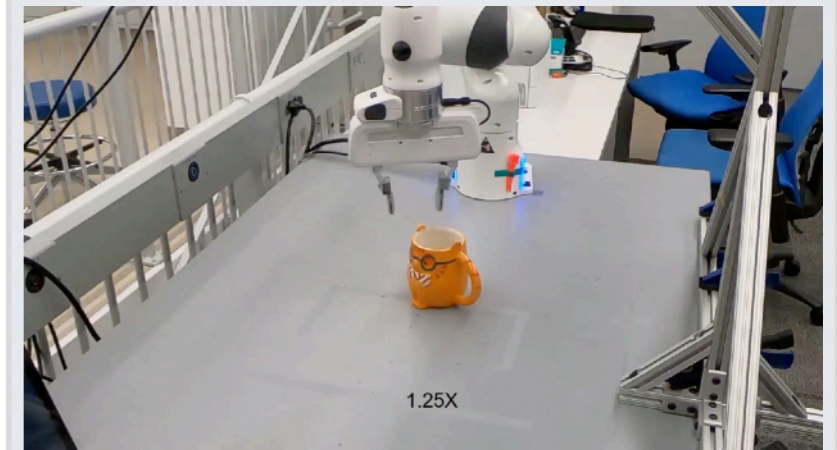
[Hsu et al., Under review '22]

Out-of-distribution detection and failure prediction



[Farid et al., CoRL '21]
[Farid et al., Under review '22]
[Farid et al., Under review '22]

Inductive biases for stronger generalization



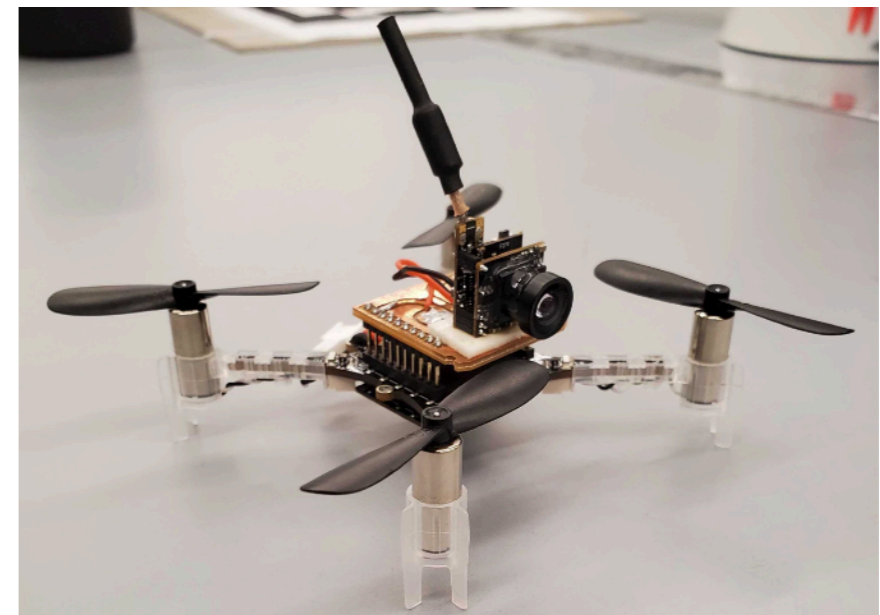
[Agarwal et al., ICRA '22]
[Farid et al., NeurIPS '21]

Broader Impacts

- Released open-source materials for undergrad course which uses hands-on labs with drones

<http://irom-lab.princeton.edu/intro-to-robotics>

- Partnered with Princeton **TeacherPrep** to help incorporate robotics into **K-12** curriculum
- Partnered with **AI4ALL** to engage high-school students



Foundational framework for guaranteeing safety and generalization for learning-based control of robots