



CAREER: Distributionally Robust Learning, Control, and Benefits Analysis of Information Sharing for Connected and Autonomous Vehicles

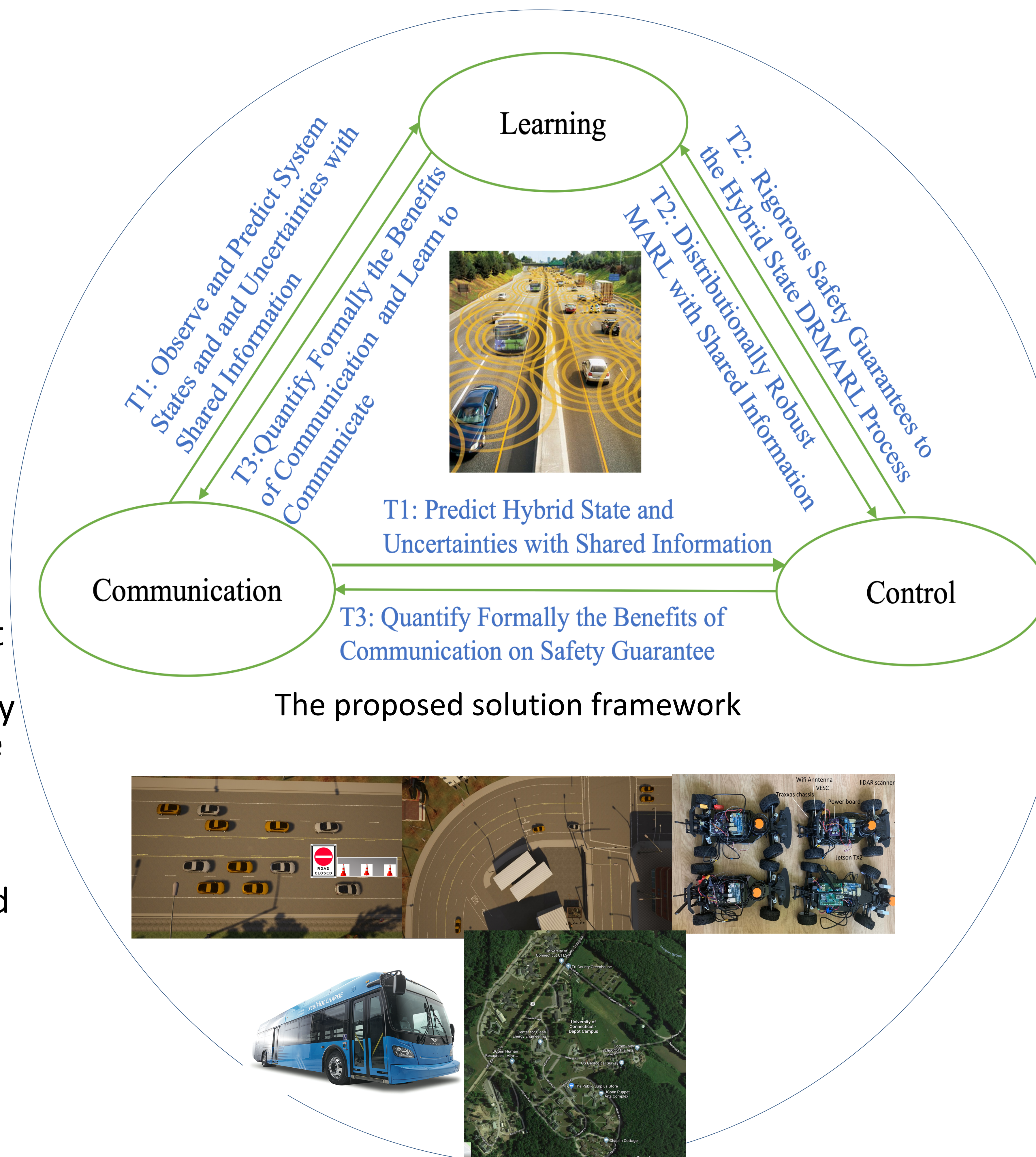
Award # 2047354, 06/2021-05/2026, PI: Fei Miao, University of Connecticut

Challenges:

- Understand the tridirectional relationship among communication, learning, and control of networked CPS
- Make safe and robust learning and control decisions with respect to the system model uncertainties
- Define formally, quantify and validate the benefits of communication

Solution:

- An integrated distributionally robust multi-agent reinforcement learning and control framework for coordination of CAVs, to prove rigorous safety guarantees and consider the hybrid system state uncertainties predicted with shared information
- Develop the scientific foundation for analyzing and quantifying formally the benefits of information sharing based on Shapley Value, and learn to communicate
- Validate using simulators, small-scale testbeds, and full-scale CAVs field demonstrations



Simulator, F1/10th racing car testbed in lab, full-size CAVs and Uconn campus testing ground

Scientific Impact:

The novelty of this project spans fundamental theory and algorithm principles, model designs, and validation methodologies that will emerge to form a new integrated communication, learning and control framework that are robust to system model uncertainties and improve the performance of networked CPS by rigorously guaranteeing on their **safety**, **efficiency** and **security**

Broader Impact:

- The PI will leverage resources at Uconn---- full-size CAVs and the testing ground under development and industry connection, to integrate proposed research with practice of intelligent networked CPS
- New interdisciplinary courses on learning and decision making for CPS, with the simulator and hardware platform of CAVs as education tools
- Outreach to the general public and K-12 students and teachers, involve high-school scholars, undergraduate and graduate students, especially minorities in research
- Quantify the broader impact: publication and citation; open-source data used by the research community; Number of students involved in education, outreach and research

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