



CAREER: Distributionally Robust Learning, Control, and Benefits Analysis of Information Sharing for Connected and Autonomous Vehicles
 PI: Fei Miao, University of Connecticut, Award # 2047354, 06/2021-05/2026, http://feimiao.org/CAREER_CAV_MARL.html

Advance the foundations for integrated communication, learning, and control framework for networked CPS, to guarantee the safety, efficiency, robustness and security of the system

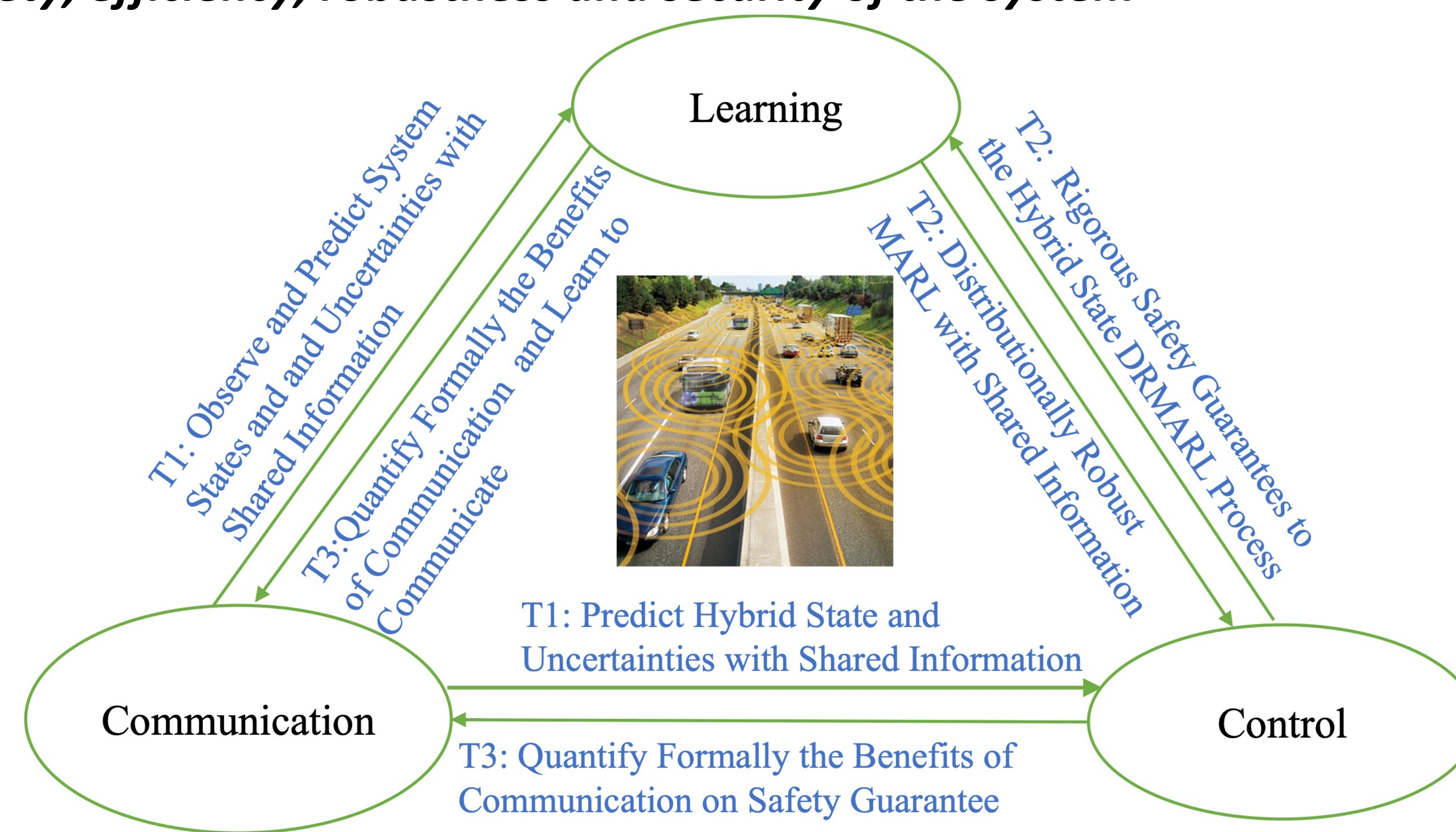
Challenge:

- 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:

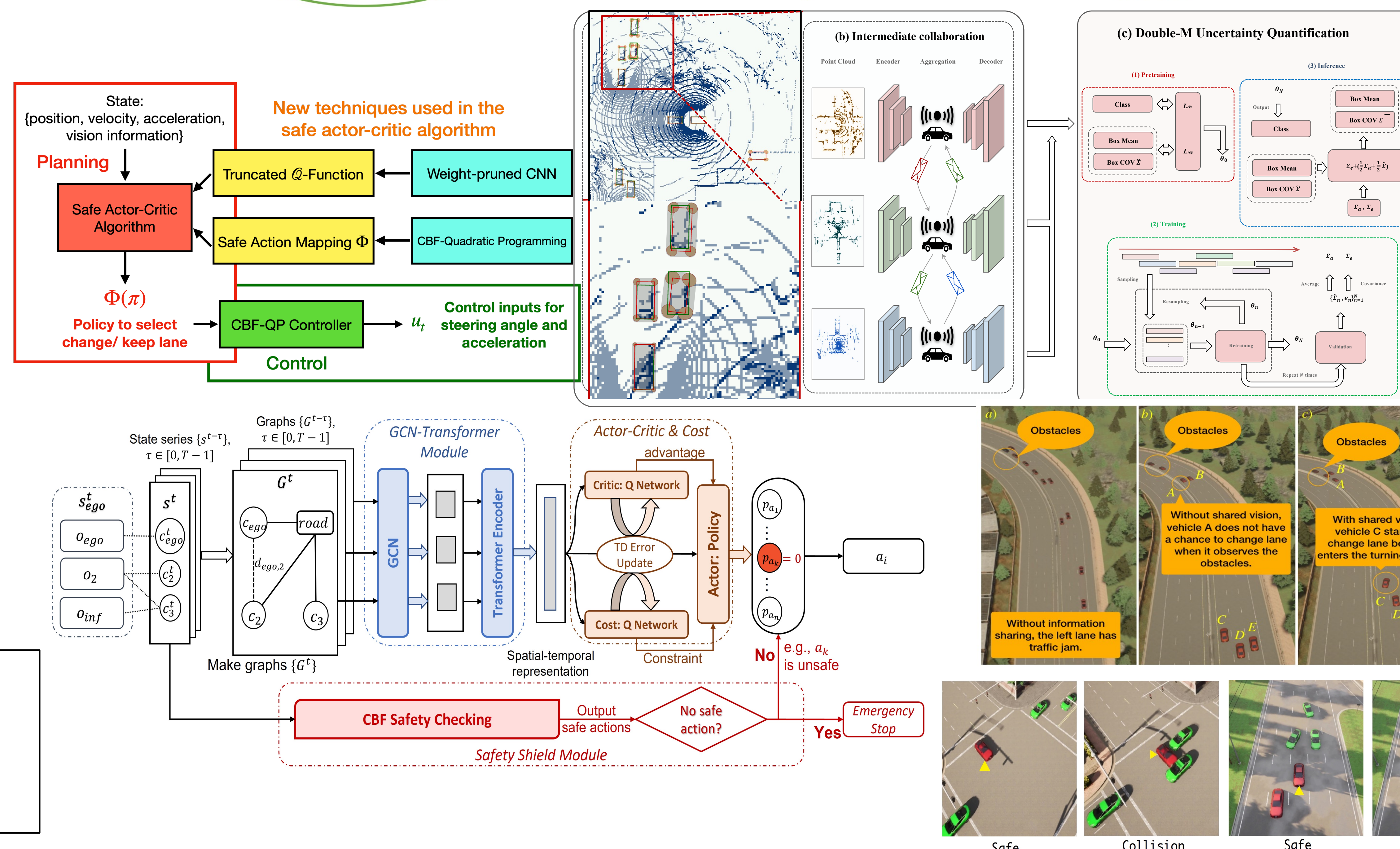
- Safe and Efficient Multi-Agent Reinforcement Learning (MARL) for Behavior Planning of CAVs
- Spatial-Temporal-Aware Safe MARL of CAVs in Challenging Scenarios
- Uncertainty Quantification of Collaborative Object Detection
- Stable and Efficient Shapley Value-Based Reward Reallocation
- Robust MARL, proved NE existence conditions, algorithms

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Scientific Impact:

- Advance fundamental problem formulations, theories, algorithm principles, and validation methodologies for integrated communication, learning and control framework of networked and multi-agent CPS
- Improve the performance of networked CPS under system model uncertainties and by rigorously guaranteeing on their **safety, efficiency, robustness and security**



Broader Impact:

- Full-size CAVs (buses) and the testing ground under development at Uconn with industry partners, will launch at Spring 23
- Open-source code and data
- K-12 students and under representative students participate research, F1/10th racing car experiments

