



CPS: Small: Collaborative Research: Improving Efficiency of Electric Vehicle Fleets: A Data-Driven Control Framework for Heterogeneous Mobile CPS

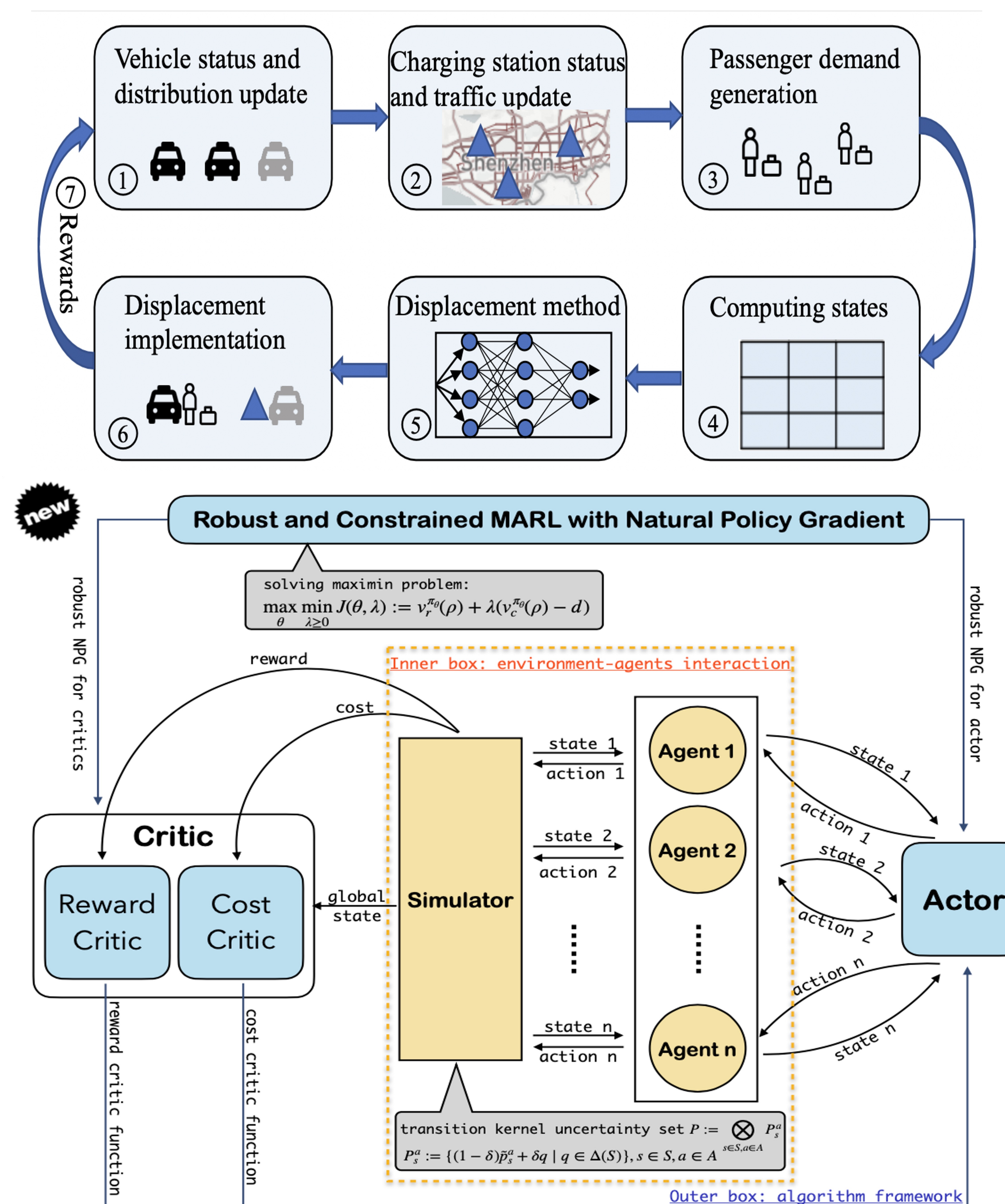
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Challenges:

- Heterogeneous mobile CPS data
- Real-time performance
- Real-world practical factors
- Efficiency vs. fairness
- Decision-making under model uncertainties

Solution:

- Graph neural network for prediction and Deep reinforcement learning for decision-making
- Robust optimization with multiple resource of model uncertainties (both demand and supply uncertainties)
- Robust multi-agent reinforcement learning theories and algorithms



Scientific Impact:

- Improved CPS service fairness and efficiency under model uncertainties
- Novel robust optimization and robust multi-agent reinforcement learning algorithms that can be generalized to solutions for improving efficiency, fairness, robustness of other CPS

Broader Impact:

Stakeholder Engagement

- Working with Rutgers EV Fleet Managers
- Collaborating with Scooter Company Veo for Potential Technology Transfer

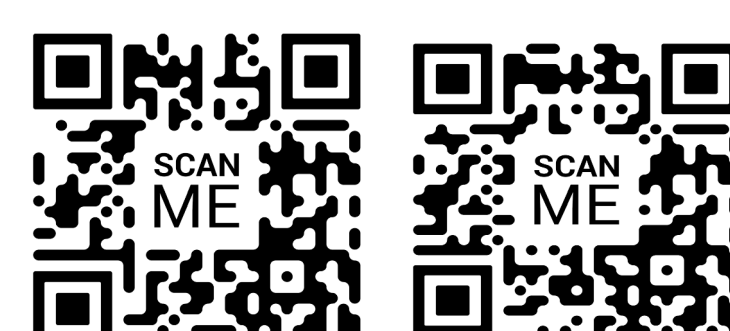
Education and Outreach

- K-12: Two High School Students
- Female: Support One Female PHD
- Minority: 2 REU Students

Research Impact for Community

- Releasing 5 GB of EV Data and Models
- Publishing 10+ Research Papers

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http://feimiao.org/RobustEV.html



- Sihong He, Lynn Pepin, Guang Wang, Desheng Zhang, Fei Miao, "Data-Driven Distributionally Robust Electric Vehicle Balancing for Mobility-on-Demand Systems under Demand and Supply Uncertainties", *IRIS20*.
- Sihong He, and Fei Miao et.al, "Data-Driven Distributionally Robust Electric Vehicle Balancing for Autonomous Mobility-on-Demand Systems under Demand and Supply Uncertainties", accepted, *IEEE Transactions on Intelligent Transportation Systems*, 2022.
- Sihong He, Yue Wang, Shuo Han, Shaofeng Zou, and Fei Miao, "A Robust and Constrained Multi-Agent Reinforcement Learning Framework for Electric Vehicle AMoD Systems", under review (ICRA-23), arXiv:2209.08230.

