Shiqi Liu

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Education

Carnegie Mellon University   **May 2024 – Present**
Doctor of Philosophy - Mechanical Engineering   *Pittsburgh, PA*

Carnegie Mellon University   **February 2021 – December 2022**
Master of Science - Mechanical Engineering | 3.96/4.0   *Pittsburgh, PA*

Beijing University of Technology   **September 2014 – May 2018**
Bachelor of Energy and Power Engineering | 3.88/4.0   *Beijing, China*

Research Interests

My research interests focus on robotics, robot learning, and reinforcement learning. I aim to develop more general-purpose agents that can adapt effectively to challenging, novel environments. In particular, I develop methods that combine geometric structure with learning theory to improve the generalizability and robustness of robotic systems.

Publications

(* indicates equal contribution)

1. Changyi Lin, Yuxin Ray Song, Boda Huo, Mingyang Yu, Yikai Wang, **Shiqi Liu**, Yuxiang Yang, Wenhao Yu, Tingnan Zhang, Jie Tan, Yiyue Luo, and Ding Zhao. LocoTouch: Learning Dynamic Quadrupedal Transport with Tactile Sensing. Conference on Robot Learning (CoRL), 2025.

2. Yuyou Zhang, Yihang Yao, **Shiqi Liu**, Yaru Niu, Changyi Lin, Yuxiang Yang, Wenhao Yu, Tingnan Zhang, Jie Tan, Ding Zhao. QuietPaw: Learning Quadrupedal Locomotion with Versatile Noise Preference Alignment. International Conference on Intelligent Robots and Systems (IROS), 2025.

3. Yuming Feng*, Chuye Hong*, Yaru Niu*, **Shiqi Liu**, Yuxiang Yang, Ding Zhao. Learning multi-agent loco-manipulation for long-horizon quadrupedal pushing. IEEE International Conference on Robotics and Automation (ICRA), 2025.

4. Xilun Zhang*, **Shiqi Liu***, Peide Huang, William Jongwon Han, Yiqi Lyu, Mengdi Xu, Ding Zhao. Dynamics as prompts: In-context learning for sim-to-real system identifications. IEEE Robotics and Automation Letters (RA-L), 2025.

5. Yihang Yao*, Zhepeng Cen*, Wenhao Ding, Haohong Lin, **Shiqi Liu**, Tingnan Zhang, Wenhao Yu, Ding Zhao. OASIS: Conditional Distribution Shaping for Offline Safe Reinforcement Learning. Advances in Neural Information Processing Systems (NeurIPS), 2024.

6. Jielin Qiu*, Jiacheng Zhu*, **Shiqi Liu**, William Han, Jingqi Zhang, Chaojing Duan, Michael Rosenberg, Emerson Liu, Douglas Weber, Ding Zhao. Automated Cardiovascular Record Retrieval by Multimodal Learning between Electrocardiogram and Clinical Report. Machine Learning for Health (ML4H), 2023.

7. **Shiqi Liu***, Mengdi Xu*, Piede Huang, Yongkang Liu, Kentaro Oguchi, and Ding Zhao. Continual Vision-based Reinforcement Learning with Group Symmetries. Conference on Robot Learning (CoRL), 2023. **(oral, 6.6%)**

8. Peide Huang, Xilun Zhang*, Ziang Cao*, **Shiqi Liu***, Mengdi Xu, Wenhao Ding, Jonathan Francis, Bingqing Chen, Ding Zhao. What Went Wrong? Closing the Sim-to-Real Gap via Differentiable Causal Discovery. Conference on Robot Learning (CoRL), 2023.

9. Hanjiang Hu, Baoquan Yang, Zhijian Qiao, **Shiqi Liu**, Jiacheng Zhu, Zuxin Liu, Wenhao Ding, Ding Zhao, Hesheng Wang. SeasonDepth: Cross-Season Monocular Depth Prediction Dataset and Benchmark under Multiple Environments, 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023.

10. **Shiqi Liu**, Yang Bin, Yaoyu Li, and Birgit Scheppat. Hierarchical mpc control scheme for fuel cell hybrid electric vehicles. IFAC-PapersOnLine, 51(31):646–652, 2018

11. **Shiqi Liu**, Yang Bin, Yaoyu Li, and Birgit Scheppat. Decentralized model predictive control for polymer electrolyte membrane fuel cell system. IFAC-PapersOnLine, 51(31):659–664, 2018

12. **Shiqi Liu**, Yang Bin, Yaoyu Li, and Birgit Scheppat. Hierarchical model predictive control for the fuel cell hybrid electric vehicles. In 2018 37th Chinese Control Conference (CCC), pages 3599–3605. IEEE, 2018

Preprints

1. Ziyi Xu*, Haohong Lin*, **Shiqi Liu***, Ding Zhao. Query-Centric Diffusion Policy for Generalizable Robotic Assembly. arXiv preprint arXiv:2509.18686, 2025

2. Mengdi Xu*, Peide Huang*, Wenhao Yu*, **Shiqi Liu**, Xilun Zhang, Yaru Niu, Tingnan Zhang, Fei Xia, Jie Tan, Ding Zhao. Creative Robot Tool Use with Large Language Models. arXiv preprint arXiv:2310.13065, 2023

Experience

Research Assistant **February 2023 – August 2023**
CMU Safe AI Lab *Pittsburgh, PA*

SafeBench: A Benchmark for Evaluating Autonomous Vehicles in Safety-critical Scenarios
- Implemented a simulation platform based on Carla to evaluate the safety of autonomous driving algorithms.
- Developed various driving scenarios to test algorithm performance under safety-critical circumstances.
- Designed various driving maps to test the performance and generality of different algorithms.

Equivariant Continual Reinforcement Learning in Robotic Manipulation
- Extended the previous continual reinforcement learning framework from group invariant actions to group equivariant actions, therefore increased the framework's flexibility and generalizability.
- Tested the proposed RL framework on various robotic manipulation tasks, each containing multiple variants with observations and actions belonging to different groups.
- The results demonstrate that the algorithm exhibits superior generalization capability over the baselines with significantly improved sample efficiency of the model.

Research Assistant **June 2022 – August 2022**
CMU Safe AI Lab *Pittsburgh, PA*

Continual Reinforcement Learning Framework with Group Symmetries in Traffic Manipulation
- Proposed continual RL framework with group symmetries grows a policy for each group of equivalent tasks instead of a single task, using a PPO-based RL algorithm with an invariant feature extractor and a novel task grouping mechanism based on invariant features.
- Tested the proposed RL framework is in realistic autonomous driving scenarios, where each group is associated with a map configuration.
- Results show that the algorithm assigns tasks to different groups with high accuracy and outperforms baselines in terms of generalization capability by a large margin. Reduced mean failure rate from **94%** to **41%** compared to other baselines.

Technical Skills

Languages: Java, Go, C/C++, Python, Scala,   **Frameworks**: NumPy, PyTorch, OpenCV
Tools: Git, Maven, PyCharm, VS Code, Eclipse