

# LINGFENG SUN

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## EDUCATION

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**University of California, Berkeley** Aug. 2018 - April. 2024 (expected)  
Ph.D. Candidate in Mechanical Engineering GPA: 3.98/4.00  
Major: Control; Minor: Learning, Optimization  
Research Interest: Robotic skill learning, Behavior Prediction and Generation  
Research Advisor: Prof. Masayoshi Tomizuka

**University of Michigan** Sep. 2016 - April. 2018  
B.Sc. in Mechanical Engineering

**Shanghai Jiao Tong University (SJTU)** Sep. 2014 - Aug. 2018  
B.Sc. in Electrical and Computer Engineering; UM-SJTU Joint Institute

## PROFESSIONAL EXPERIENCE

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**Research Intern** May. 2023 – Sep. 2023  
*Mitsubishi Electric Research Laboratories* Cambridge, MA

**AI Resident** May. 2022 – Dec. 2022  
*Everyday Robots, Google X, the Moonshot Factory* Mountain View, CA

**Research Intern** May. 2021 – April. 2022  
*Horizon Robotics* Cupertino, CA

## SELECTED RESEARCH EXPERIENCE

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**Closed-loop Gain-tuning in Robotic Control with LLMs** Aug. 2023 - Present  
*Mechanical System Control Lab*

- Utilized pre-trained LLMs to closed-loop adapt control parameters sensitive to task and hardware settings. Designed experiments to verify the safe adaptation of control gains on manipulation and locomotion tasks.

**Large Language Models for Partial Observable Robotic Task Planning** May. 2023 - Present  
*Mitsubishi Electric Research Laboratories*

- Formulated environmental, execution, and task uncertainties into POMDP problems. Proposed a framework (LLM-POP) to utilize pre-trained and fine-tuned LLMs for partially observable robotic tasks.
- Designed prompt template for GPT-4 and a fine-tuned Llama2 (using self-instruct generated data) for partial observable tasks. Tested in simulation and on real robots. Working on extending to multi-modal reasoning.

**Distributed Multi-agent Interaction Simulating** May. 2022 - Dec. 2022  
*Everyday Robots, Mechanical System Control Lab*

- Worked with the *sim2real* team to model interactive 2D human behavior in arbitrary indoor scenarios useful for crowd-related tasks in robotics. Simulate human interactions and improve them with real-world data.
- Used imagined potential games (IPG) to model realistic cooperative behaviors in a distributed setting. Utilized Trajax and iLQR to solve trajectory optimization problems. Tested in various challenging indoor scenarios.

**Parameter-Compositional Multi-Task Reinforcement and Transfer learning** May. 2021 - April. 2022  
*Horizon Robotics, Mechanical System Control Lab*

- Designed a multi-task reinforcement learning algorithm using a parameter-space compositional framework (PaCo). Verified the SOTA performance in the *Meta-World* robotic manipulation benchmark.
- Utilizing compositional structure to extend pre-trained MTRL policies to unseen tasks via transfer learning.

**Interpretable Goal-Conditioned Interactive Trajectory Prediction** April. 2021 - Mar. 2022  
*Mechanical Systems Control Lab*

- Proposed a framework to incorporate human prior knowledge of traffic rules and interaction patterns as pseudo-labels into the goal-conditioned prediction models. Used a discrete VAE to capture multiple interaction types.
- Validated improvement of joint prediction on the Waymo Open Dataset Interaction Motion Prediction task.

## Diverse Critical Interaction Generation in Autonomous Driving

Oct. 2020 - Feb. 2021

*Mechanical Systems Control Lab*

- Proposed a generator framework routeGAN to simulate critical vehicle interactions by generating the reactive trajectories of ego vehicles condition on the controlled risk parameters. Validated the diversity of interaction styles on the Argoverse and INTERACT datasets.

## 6-DoF Contrastive Grasp Proposal Network

Mar. 2020 - Oct. 2020

*Mechanical Systems Control Lab*

- Proposed a contrastive grasp proposal network (CGPN) to infer 6-DoF grasps from a single-view depth image using contrastive learning and depth image style-transfer techniques to bridge the sim-to-real gap.
- Validated the algorithm with Fanuc LR Mate 200iD robot in cluttered scenes, demonstrated 3% improvement in grasp success rate and 75% in computation time compared with prior state-of-the-art (SOTA).

## Interactive Prediction for Multiple Heterogeneous Traffic Participants

Nov. 2018 - March. 2019

*Mechanical Systems Control Lab*

- Proposed a multi-agent Hybrid Dynamic Bayesian Network (MHDBN) method to model state changes of multiple vehicles and pedestrians in a variety of traffic scenarios.
- Incorporated prior knowledge like map information and traffic rules into the graph structure and used the Particle Filter (PF) to track and predict the intentions and trajectories of the agents.

## SELECTED PUBLICATIONS

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**Lingfeng Sun**, Devesh K. Jha, Chiori Hori, Siddarth Jain, Radu Corcodel, Xinghao Zhu, Masayoshi Tomizuka, Diego Romeres. “LLM-POP: Large Language Model for Partially Observable Task Planning.” *in submission*

**Lingfeng Sun**, Pin-Yun Hung, Changhao Wang, Masayoshi Tomizuka. “Distributed Multi-agent Interaction Generation with Imagined Potential Games.” *in submission*

**Lingfeng Sun**, Haichao Zhang, Wei Xu and Masayoshi Tomizuka. “Efficient Multi-Task and Transfer Reinforcement Learning with Parameter-Compositional Framework.” *IEEE RA-L*

**Lingfeng Sun**, Haichao Zhang, Wei Xu and Masayoshi Tomizuka. “PaCo: Parameter-Compositional Multi-Task Reinforcement Learning.” *2022 Conference on Neural Information Processing Systems (NeurIPS)*

**Lingfeng Sun\***, Chen Tang\*, Yaru Niu, Enna Sachdeva, Chiho Choi, Teruhisa Misu, Masayoshi Tomizuka, Wei Zhan. “Domain Knowledge Driven Pseudo Labels for Interpretable Goal-Conditioned Interactive Trajectory Prediction.” *2022 IEEE International Conference on Intelligent Robots and Systems (IROS)*

**Lingfeng Sun\***, Xinghao Zhu\*, Yongxiang Fan and Masayoshi Tomizuka. “6-DoF Contrastive Grasp Proposal Network.” accepted by *2021 IEEE International Conference on Robotics and Automation (ICRA)*

**Lingfeng Sun\***, Zhao-Heng Yin\*, Liting Sun, Masayoshi Tomizuka, and Wei Zhan. “Diverse Interaction Generation for Planning and Planner Evaluation.” accepted by *2021 IROS*

**Lingfeng Sun**, Wei Zhan, Di Wang, and Masayoshi Tomizuka. “Interactive Prediction for Multiple, Heterogeneous Traffic Participants with Multi-Agent Hybrid Dynamic Bayesian Network.” accepted by *2019 IEEE Intelligent Transportation Systems Conference (ITSC)*

Xiang Zhang, Changhao Wang, **Lingfeng Sun**, Zheng Wu, Xinghao Zhu, Masayoshi Tomizuka. “Efficient Sim-to-real Transfer of Contact-Rich Manipulation Skills with Online Admittance Residual Learning.” *2023 CoRL*

Zhiqiang Jian, Songyi Zhang, **Lingfeng Sun**, Wei Zhan, Nanning Zheng, Masayoshi Tomizuka. “Long-Term Dynamic Window Approach for Kinodynamic Local Planning in Static and Crowd Environments.” *IEEE RA-L*

Zhao-Heng Yin, **Lingfeng Sun**, Hengbo Ma, Masayoshi Tomizuka, Wu-Jun Li. “Cross Domain Robot Imitation with Invariant Representation.” *2022 ICRA*

Xinghao Zhu, Yefan Zhou, Yongxiang Fan, **Lingfeng Sun**, Jianyu Chen, Masayoshi Tomizuka. “Learn to Grasp with Less Supervision: A Data-Efficient Maximum Likelihood Grasp Sampling Loss.” *2022 ICRA*

Chenfeng Xu, Tian Li, Chen Tang, **Lingfeng Sun**, K Keutzer, M Tomizuka, A Fathi, W Zhan. “PreTraM: Self-Supervised Pre-training via Connecting Trajectory and Map.” *2022 ECCV*