

Xinjie Liu

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<https://xinjie-liu.github.io>

Education

The University of Texas at Austin - Ph.D. in Electrical and Computer Engineering	Aug 2023 - Jun 2028
<ul style="list-style-type: none">Advisors: Ufuk Topcu and David Fridovich-Keil	
Delft University of Technology - M.Sc. in Robotics	Sep 2021 - Jul 2023
<ul style="list-style-type: none">GPA: 9.04/10.0 (top 1.6%, Cum Laude)Advisor: Javier Alonso-Mora	
Tongji University - B.Eng. in Automotive Engineering	Sep 2016 - Jul 2021
<ul style="list-style-type: none">GPA: 88.9/100	
Graz University of Technology - Exchange Program	Jan 2020 - Jun 2020

Research Experience

Research keywords: optimization, machine (reinforcement) learning, dynamic games, controls, multi-agent interaction, motion planning, robotics
All projects are available on Xinjie's [personal website](#)

Second-Order Algorithms for Zero-Sum Games - UT-Austin	Oct 2023 - May 2024
<ul style="list-style-type: none">Developed second-order algorithms that provably guarantee convergence to local Nash equilibria in smooth zero-sum games [1]	
Auto-Encoding Bayesian Inverse Games - UT Austin	Nov 2023 - Feb 2024
<ul style="list-style-type: none">Developed a tractable approach for approximate Bayesian inference of unknown parameters in noncooperative games by embedding a differentiable game solver into a variational autoencoder [2]Assessed the proposed method for continuous, multi-modal distribution inference and interactive robot motion planning	
Differentiable Adaptive Game-Theoretic Motion Planning - Autonomous Multi-Robots Laboratory, TU Delft	Jun 2022 - Dec 2022
<ul style="list-style-type: none">Development of a differentiable, model-predictive game solver that jointly estimates unknown agents' objectives using gradient descent and solves for generalized Nash equilibrium strategies in non-cooperative dynamic games for safe multi-agent interaction [3, 4]Integration of the proposed differentiable solver with neural networks for computational accelerationSimulation evaluation and hardware demonstration	

Smaller Projects

Planning & Control:

High-Precision Robot Assembly Tasks Challenge	Jun 2022 - Jul 2022
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Member of the team *Delft University of Technology* (1/6)

- [Winner](#) of the Franka Emika challenge in the Hackathon at the [European Robotics Forum 2022](#)
- Developed a point cloud based perception module (my part) and interactive imitation learning technique, solved high-precision robot assembly tasks on a randomly positioned [task board](#)

Autonomous Robotic Solution for Field Coverage	Apr 2022 - Jun 2022
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Course project of *Multidisciplinary Project* (RO47007) with Lely I Main contributor (1/5)

- Developed a robotic system for covering a field with obstacle avoidance and battery constraints on a Husky robot
- Perception: top-view camera with OpenCV; path planning: traveling salesman problem + A*; trajectory planning & control: model predictive control (my part); task scheduling: finite state machine
- The project was graded as 9.7/10 (**top 1** in the class)

Safe MPC Approach for Non-Holonomic Mobile Robots in Dynamic Scenarios	Jan 2022 - Apr 2022
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Course project of *Model Predictive Control* (MPC) (SC42125) I Main contributor (1/2)

- Proposed an MPC approach with linearized constraints in velocity space for dynamic obstacle avoidance of mobile robots, proved Lyapunov stability of the system for time-varying regulation problems [5]
- The project was graded as 10/10 on the oral exam (**top 1** in the class)

Model-Free Deep Reinforcement Learning Algorithms Implementation	Jan 2022 - Apr 2022
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Course project of *Deep Reinforcement Learning* (Deep RL) (CS4400)

- Implemented the main policy gradient (REINFORCE, Actor-Critic, PPO, DDPG, TD3) and value function (DQN, Double DQN, n-step target, semi-gradients) based methods, implemented the main techniques for exploration and off-policy RL
- Graded as 10/10 on the written exam (**top 1** in the class)

Autonomous Delivery Using Quadrotor Robots	Oct 2021 - Jan 2022
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Course project of *Planning & Decision Making* (RO47005) I Main contributor (1/4)

- Developed a pipeline for autonomous navigation of a quadrotor drone in an unknown environment, including global path planning (RRT*), minimum snap optimization, and obstacle avoidance (nonlinear MPC) [6]
- The project was graded as 9.5/10 (**top 3** in the class)

Robot Dynamics & Control	Sep 2021 - Nov 2021
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Course project of *Robot Dynamics & Control* (RO47001)

- Implemented force and impedance controllers with singularity-robust control and task-priority control methods for a 2-DOF robot arm, implemented a PID controller for vehicle lateral motion control, employed a PD and a nonlinear geometric controller for multiple quadrotor tracking tasks
- The projects were graded as 10/10 (**top 1** in the class)

Bachelor's Thesis: Interactive Imitation Learning in Robotics

Oct 2020 - Jul 2021

- Worked on interactive imitation learning methods for various simulated robot tasks with reinforcement learning agents as baselines

Perception:

Reproduction of Event Camera Data Processing Project

Jan 2022 - Apr 2022

Course project of *Deep Learning* (CS4240) | Main contributor (1/3)

- Reproduced partial results of the project '[High Speed and High Dynamic Range Video with an Event Camera](#)' on a different dataset, reconstructed intensity images from event data using recurrent neural networks

Multisensor Perception of Autonomous Driving Cars

Oct 2021 - Jan 2022

Course project of *Machine Perception* (RO47004)

- Developed a perception module for a self-driving car, including visual pedestrian detection (CNN, SVM) with LiDAR point cloud as prior
- Implemented the iterative closest point (ICP) method for vehicle ego-motion compensation
- The project was graded as 9.4/10 (**top 2** in the class)

Autonomous Car Racing by Learning from Pixels

Sep 2021 - Nov 2021

Course project of *Machine Learning for Robotics* (RO47002) | Main contributor (1/2)

- Designed a machine learning pipeline for learning driving policy from pixels, including data augmentation, feature extraction, dimensionality reduction, and classification (random forest, SVM, neural network) modules

🌟 Publications

[1] K. Gupta, **X. Liu**, U. Topcu, and D. Fridovich-Keil, "Second-Order Algorithms for Finding Local Nash Equilibria in Zero-Sum Games," under review, URL: <https://arxiv.org/abs/2406.03565>.

[2] **X. Liu***, L. Peters*, J. Alonso-Mora, U. Topcu, and D. Fridovich-Keil, "Auto-Encoding Bayesian Inverse Games," Workshop on the Algorithmic Foundations of Robotics (WAFR), 2024. URL: <https://xinjie-liu.github.io/projects/bayesian-inverse-games/>.

[3] **X. Liu***, L. Peters*, and J. Alonso-Mora, "Learning to Play Trajectory Games against Opponents with Unknown Objectives," *IEEE Robotics and Automation Letters (RA-L)*, 2023. URL: <https://xinjie-liu.github.io/projects/game/>.

[4] **X. Liu**, "On Game-Theoretic Planning with Unknown Opponents' Objectives," master's thesis, Delft University of Technology, 2023. URL: <https://repository.tudelft.nl/islandora/object/uuid%3A2b08061c-1777-4ce5-81e6-85ab261d0d92>.

[5] **X. Liu** and V. Atanassov, "Safe Model Predictive Control Approach for Non-Holonomic Mobile Robots," 2022. URL: <https://arxiv.org/abs/2207.12878>.

[6] **X. Liu**, R. M. Rodríguez, P. Féry, and Y. Zhang, "Planning Algorithm for a Quadrotor Drone," 2022. URL: https://www.researchgate.net/publication/375556760_Planning_Algorithm_for_a_Quadrotor_Drone.

🌟 Awards & Scholarships

- Cockrell School of Engineering Fellowship at UT Austin
- First Prize Scholarship for Outstanding Students at Tongji University (3% at TJU, 2019)
- CSC National Scholarship for Outstanding Undergraduate Exchange Programs (1% at School of Automotive Studies, 2020)
- Annual Excellent Student at Tongji University (5% at TJU, 2020)
- Third Prize Scholarship for Outstanding Students at Tongji University (20% at TJU, 2018)
- Scholarship for Social Activities at Tongji University (2 times, 2017, 2019)
- Winning Prize for Outstanding Innovative Projects at TJU (Autonomous Flight of UAVs Based on UWB Localization, 2019)

🌟 Recent Talks

- Lockheed Martin Corporation, Austin - November 2023
- International Conference on Intelligent Robots and Systems (IROS) 2023 - October 2023
- Texas Robotics Seminar - September 2023
- Control and Learning for Autonomous Robotics (CLeAR) Lab, UT Austin - July 2023
- Safe Robotics Laboratory, Princeton - January

📁 Other Experience (TA/ Service/ Management)

Reviewer Dec 2023 - Present

- IEEE Transactions on Robotics (T-RO)
- IEEE Robotics and Automation Letters (RA-L)
- 2025 International Conference on Learning Representations (ICLR)
- 2024 International Symposium on Robotics Research (ISRR)
- 2024 Conference on Decision and Control (CDC)
- 2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Outreach with Girlstart (Austin)

Sep 2023 - Present

- Outreach activities with the Girlstart organization, aiming to increase girls' interest and engagement in STEM education and careers

Consulting Intern at IQVIA (Shanghai)

Jul 2020 - Aug 2020

- Marketing project of drugs for rare diseases: conducted policy analysis, interviews with specialists and employees, and business analysis to generate strategies for national negotiation and local breakthrough of orphan drugs

Tongji University Basketball Association (TJBA)

Oct 2016 - Jun 2019

- Served as president of TJBA, with over 200 club members involved
- Organized referee training sessions and five campus events with an audience of over 500 for each. TJBA is among the most prominent student organizations at TJU and was rated as a five-star club many times

Skills

Programming language: Julia, Python, C++, Matlab

Version control: Git

Optimization toolbox: YALMIP, CasADi, CVX, FORCES Pro, IPOPT, OSQP

Machine learning package: PyTorch, JAX, TensorFlow, Keras, Zygote.jl / Flux.jl / ChainRules.jl (Julia auto-differentiation and deep learning tools)

Other software: Robot Operating System (ROS), Linux, LaTeX

Language: Mandarin (native speaker), English (C1, IELTS 7.5), German (B2, DSH 2 at Karlsruhe Institute of Technology)

Hobbies: workout training, basketball (university team member, chief referee at TJU), singing (third place in a singing competition at TJU), writing (part-time editor, reading quantity over 200,000)