

Xinjie Liu

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RESEARCH INTERESTS	To enable intelligent, safe decision-making for autonomous agents in uncertain, interactive environments, my research focuses on (i) efficient model-based learning to align intention uncertainty between robotic systems and interacting agents, and (ii) optimization and learning algorithms that provably converge to performant solutions in smooth, non-cooperative games. My work leverages tools from dynamic game theory, machine learning, numerical optimization, and control theory.	
EDUCATION	The University of Texas at Austin , Austin, TX Ph.D. in Electrical and Computer Engineering Advisors: Ufuk Topcu and David Fridovich-Keil	Aug 2023 - present
	Delft University of Technology , Delft, Netherlands M.Sc. in Robotics, GPA: 9.04/10.0 (top 1.6%, <i>cum laude</i>) Advisor: Javier Alonso-Mora	Sep 2021 - Jul 2023
	Tongji University , Shanghai, China B.Eng. in Automotive Engineering, GPA: 88.9/100	Sep 2016 - Jul 2021
	Graz University of Technology , Graz, Austria Exchange Program	Jan 2020 - Jun 2020
PUBLICATIONS	<ul style="list-style-type: none">[5] X. Liu, J. Li, F. Fotiadis, M. O. Karabag, J. Milzman, D. Fridovich-Keil, and U. Topcu. Policies with Sparse Inter-Agent Dependencies in Dynamic Games: A Dynamic Programming Approach, under review, 2024.[4] K. Gupta, X. Liu, U. Topcu, and D. Fridovich-Keil. Second-Order Algorithms for Finding Local Nash Equilibria in Zero-Sum Games, under review, 2024.[3] X. Liu*, L. Peters*, J. Alonso-Mora, U. Topcu, and D. Fridovich-Keil. Auto-Encoding Bayesian Inverse Games, Algorithmic Foundations of Robotics XVI (WAFR), 2024.[2] 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.[1] X. Liu. On Game-Theoretic Planning with Unknown Opponents' Objectives, master's thesis, Delft University of Technology, 2023.	
TECHNICAL REPORTS	<ul style="list-style-type: none">[2] X. Liu and V. Atanassov. Safe Model Predictive Control Approach for Non-Holonomic Mobile Robots, Delft University of Technology, 2022. (Mentor: Sergio Grammatico)[1] X. Liu, R. M. Rodríguez, P. Féry, and Y. Zhang. Planning Algorithm for a Quadrotor Drone, Delft University of Technology, 2022. (Mentor: Javier Alonso-Mora)	

*indicates equal contribution.

HONORS AND AWARDS

Cockrell School of Engineering Fellowship , UT Austin	2023-present
Graduation <i>cum laude</i> , TU Delft (top 1.6% of MSc program)	2023
First Prize, Franka Emika Robot Hackathon Challenge , European Robotics Forum	2022
National Scholarship for Undergraduate Exchange Program (1% of department)	2020
Annual Excellent Student Award , Tongji University (top 5% of department)	2020
First Prize Academic Scholarship , Tongji University (top 3% of department)	2019
Winning Prize for Outstanding Innovative Projects , Tongji University Project: Autonomous Flight of UAVs Based on UWB Localization	2019
Third Prize Academic Scholarship , Tongji University (top 20% of department)	2018
Scholarship for Social Activities , Tongji University	2017, 2019

PROJECTS WEB | GITHUB

High-Precision Robot Assembly Challenge Team Member, Delft University of Technology (1/6)	Jun 2022 - Jul 2022
<ul style="list-style-type: none"> Developed a point cloud-based perception module and interactive imitation learning technique to tackle high-precision robot assembly tasks on a randomly positioned board Winner of the Franka Emika Challenge at the European Robotics Forum Hackathon 	
Autonomous Robotic Field Coverage Multidisciplinary Project with Lely, Main Contributor (1/5)	Apr 2022 - Jun 2022
<ul style="list-style-type: none"> Designed a robotic field coverage system with obstacle avoidance and battery management on a Husky robot, including modules for perception (top-view camera), task planning, path and trajectory planning, and control Project graded 9.7/10 (top 1 in the class) 	
MPC Approach for Non-Holonomic Mobile Robots in Dynamic Scenarios Model Predictive Control Course Project, Main Contributor (1/2)	Jan 2022 - Apr 2022
<ul style="list-style-type: none"> Proposed an MPC approach with linearized constraints in velocity space for dynamic obstacle avoidance of mobile robots, proved Lyapunov stability for time-varying regulation problems Project graded 10/10 (top 1 in the class) 	
RNN-Based Event Camera Data Processing Deep Learning Course Project, Main Contributor (1/3)	Jan 2022 - Apr 2022
<ul style="list-style-type: none"> Reproduced partial results of “High Speed and High Dynamic Range Video with an Event Camera” using a different dataset, reconstructing intensity images from event data with RNNs 	
Deep Reinforcement Learning Library Deep Reinforcement Learning Course Project	Jan 2022 - Apr 2022
<ul style="list-style-type: none"> Implemented a library including main policy gradient (REINFORCE, Actor-Critic, PPO, DDPG, TD3) and value function (DQN, Double DQN, n-step target, semi-gradients) based methods Graded 10/10 on the written exam (top 1 in the class) 	
Autonomous Quadrotor Delivery System Planning & Decision Making Course Project, Main Contributor (1/4)	Oct 2021 - Jan 2022
<ul style="list-style-type: none"> Developed a navigation pipeline for a quadrotor, including global path planning (RRT*), minimum-snap trajectory generation, and nonlinear MPC for tracking and obstacle avoidance Project graded 9.5/10 (top 3 in the class) 	
Multisensor Perception for Autonomous Vehicles Machine Perception Course Project	Oct 2021 - Jan 2022
<ul style="list-style-type: none"> Developed a self-driving car perception module, including pedestrian detection (CNN, SVM) and vehicle ego-motion compensation using iterative closest point (ICP) with LiDAR data Project graded 9.4/10 (top 2 in the class) 	

	Learning Autonomous Car Racing from Pixels Machine Learning for Robotics Course Project, Main Contributor (1/2) <ul style="list-style-type: none"> Developed a pipeline for learning driving policies from pixels, including data augmentation, feature extraction, dimensionality reduction, and control (random forest, SVM, neural networks) 	Sep 2021 - Nov 2021
	Robot Dynamics & Control Robot Dynamics & Control Course Project <ul style="list-style-type: none"> Implemented force and impedance controllers with singularity-robust and task-priority control for a 2-DOF robot arm; implemented PD and nonlinear geometric controllers for quadrotor tracking tasks Project graded 10/10 (top 1 in the class) 	Sep 2021 - Nov 2021
	Interactive Imitation Learning in Robotics Bachelor's Thesis Project <ul style="list-style-type: none"> Investigated interactive imitation learning methods using human feedback for various simulated robotic tasks, demonstrating improved task performance and data efficiency compared to reinforcement learning baselines 	Oct 2020 - Jul 2021
SOFTWARE	AutoEncodingBayesianInverseGames.jl : Embeds a differentiable Nash game solver into a generative model for amortized inference of continuous distributions in multi-agent interactions NumericalOptimizationAlgorithms : Numerical optimization algorithms for unconstrained and constrained problems accelerated using JAX DifferentiableAdaptiveGames.jl : A differentiable Nash equilibrium solver and an inverse game solver for equilibrium-constrained bilevel optimization problems SafeMPCObstacleAvoidance : MPC planner for non-holonomic robots with linearized dynamic obstacle avoidance constraints in the velocity space QuadrotorPlanningControl : Navigation pipeline for a quadrotor robot with a global path planner, minimum-snap trajectory generator and MPC controller for obstacle avoidance	
MEDIA	Franka Emika Challenge winner at the European Robotics Forum	Franka Robotics, Jun 2022
INVITED TALKS	Center for Autonomy Seminar , UT Austin Inferring Multimodal Uncertainty for Game-Theoretic Interactions Computing Sparse Policies for Noncooperative Dynamic Games Texas Robotics Seminar , UT Austin On Game-Theoretic Planning with Unknown Opponents' Objectives Lockheed Martin Corporation On Game-Theoretic Planning with Unknown Opponents' Objectives Princeton University Learning to Play Trajectory Games Against Opponents with Unknown Objectives	2024 2023 2023
ACADEMIC MENTORSHIP	Ryan Park, Undergraduate student, Computer Science Honors & Aerospace Engineering, UT Austin	
OUTREACH	STEM Muse Mentorship Program , Austin Mentoring to provide individualized professional development and career support for women Girlstart Texas , Austin Organizing innovative workshops to increase girls' interest and engagement in STEM fields	Sep 2024 - present Sep 2023 - present

PROFESSIONAL ACTIVITIES	Reviewer for Journals <ul style="list-style-type: none"> • IEEE Transactions on Robotics (T-RO) • IEEE Robotics and Automation Letters (RA-L) Reviewer for Conferences <ul style="list-style-type: none"> • International Conference on Learning Representations (ICLR) 2025 • IEEE International Conference on Robotics and Automation (ICRA) 2025 • International Symposium on Robotics Research (ISRR) 2024 • IEEE Conference on Decision and Control (CDC) 2024 • IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2024
GRADUATE-LEVEL COURSES	Analysis: Real Analysis, Functional Analysis (basics) Probability: Probability and Stochastic Processes Optimization: Convex Optimization, Nonlinear Programming Machine Learning: Deep Reinforcement Learning, Deep Learning, Machine Learning for Robotics Control & Game Theory: Game-Theoretic Modeling of Multi-Agent Systems, Model Predictive Control Robotics: Human-Robot Interaction, Machine Perception, Planning & Decision Making, Robot Dynamics & Control, Robot Software Practicals Software: Object-Oriented Scientific Programming with C++
SKILLS	Programming Languages: Python, Julia, C++, Matlab Version Control: Git Machine Learning & Numerical Computation: PyTorch, JAX, Zygote.jl, Flux.jl, ChainRules.jl, TensorFlow, Keras Optimization: PATH Solver, JuMP.jl, YALMIP, CasADi, CVX, FORCES Pro, IPOPT, OSQP Other: Robot Operating System (ROS), Linux, LaTeX Languages: Mandarin (native), English (C1, IELTS 7.5), German (B2, DSH 2)
MANAGEMENT EXPERIENCE	Business Consulting Intern, IQVIA Shanghai Jul 2020 - Aug 2020 Marketing project for rare disease drugs: conducted policy and business analysis to develop strategies for national negotiations and local market entry of orphan drugs