

# Xinjie Liu

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## Education

**Delft University of Technology** - M.Sc. in Robotics

Sep 2021 - Jul 2023

- GPA: **9.08/10.0** (top **1%**, rank: 1/120)
- Advisor: Javier Alonso-Mora

**Tongji University** - B.Eng. in Automotive Engineering

Sep 2016 - Jul 2021

- GPA: 88.9/100
- Major GPA: **97.2/100** (top **5%**, rank: 12/246)

**Graz University of Technology** - Exchange Program

Jan 2020 - Jun 2020

## Research Experience

**Research interests:** planning & decision-making under uncertainty, human-robot interaction, dynamic games, optimal control, (reinforcement) learning for control

All projects are available on Xinjie's [personal website](#)

**Safe Multi-Agent Interaction** - Autonomous Multi-Robots Laboratory, TU Delft

Nov 2022 - Present

The second project of Xinjie's master's thesis

- Developing an uncertainty-aware framework for safe multi-agent interaction

**Adaptive Game-Theoretic Planning** - Autonomous Multi-Robots Laboratory, TU Delft

Jun 2022 - Oct 2022

The first project of Xinjie's master's thesis

- Development of a model-predictive, adaptive game solver that jointly estimates agents' objectives using gradient and solves for generalized Nash equilibrium strategies in non-cooperative dynamic games for safe interaction [1]
- Integration of the proposed differentiable solver with neural networks for computational acceleration
- Simulation evaluation and hardware demonstration

## Project Experience

**Planning & Control:**

**High-Precision Robot Assembly Tasks Challenge**

Jun 2022 - Jul 2022

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

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

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 [2]
- 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

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

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) [3]
- The project was graded as 9.5/10 (**top 1** in the class)

**Robot Dynamics & Control**

Sep 2021 - Nov 2021

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

- Developed interactive imitation learning algorithms for various simulated robot tasks with reinforcement learning agents as baselines [4]
- The thesis was rated as an *Outstanding Bachelor Thesis* at Tongji University

## 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] **X. Liu\***, L. Peters\*, and J. Alonso-Mora, "Learning to Play Trajectory Games against Opponents with Unknown Objectives," submitted to *IEEE Robotics and Automation Letters (RA-L)*, 2022. URL: <https://arxiv.org/abs/2211.13779>.

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

[3] **X. Liu**, R. M. Rodríguez, P. Féry, and Y. Zhang, "Planning Algorithm for a Quadrotor Drone," 2022. URL: [https://www.researchgate.net/publication/358573208\\_Planning\\_Algorithm\\_for\\_a\\_Quadrotor\\_Drone](https://www.researchgate.net/publication/358573208_Planning_Algorithm_for_a_Quadrotor_Drone).

[4] **X. Liu**, "Interactive Imitation Learning in Robotics Based on Simulations," bachelor's thesis, Tongji University, 2021. URL: <https://arxiv.org/abs/2209.03900>.

## 🌟 Awards & Scholarships

- 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)
- Outstanding Student Leader at Tongji University (3 students at School of Automotive Studies, 2019)
- 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)

## 📅 Other Experience (TA/ Service/ Management)

### Teaching Assistant of Robot Dynamics & Control (RO47001)

Sep 2022 - Nov 2022

### 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

### Consulting Intern at Boston Consulting Group (BCG Shanghai)

Mar 2020 - May 2020

- Strategic digitalization project for a capital insurance enterprise: conducted qualitative and quantitative analysis of competitors, operation diagnosis, and customer journey survey for effective digitalization of business

### 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, C++, Python, Matlab

**Version control:** Git

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

**Machine learning package:** PyTorch, 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)