

# Xinjie Liu

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## Education

- Delft University of Technology** - M.Sc. in Robotics Sep 2021 - Jul 2023
- GPA: **9.2/10.0** (top **1%**, rank: **1/150**)
- Tongji University** - B.Sc. in Automotive Engineering Sep 2016 - Jul 2021
- GPA: 4.39/5.0
  - Major GPA: **4.90/5.0** (top **3%**, rank: **8/240**)
- Graz University of Technology** - Exchange Programme Jan 2020 - Jun 2020

## Research Experience

**Research interests:** optimal control, dynamic game, numerical optimization, learning-based control, Bayesian inference, dynamical systems

- Game-Theoretic Planning** - Autonomous Multi-Robots Lab, TU Delft May 2022 - Present
- Advisor: Javier Alonso-Mora
- Development of game-theoretic planning techniques for safe interaction between non-cooperative agents. The work from June to September 2022 focused on inverse dynamic games and is summarized in a paper (**preprint available soon**)

## Project Experience

### Planning & Control:

- Robot Manipulation Challenge at Hackathon, European Robotics Forum 2022** Jun 2022 - Jul 2022
- [Winner](#) of Franka Emika challenge and champion of the Hackathon at [European Robotics Forum 2022](#)
  - Developed a pointcloud-based perception module (my part) and interactive imitation learning technique. Solved precise manipulation tasks on a randomly positioned [task board](#)

- Autonomous Robotics 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 UGV robot
  - Perception: top-view camera with OpenCV; path planning: travelling 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 in tracking task [1]
  - The project was graded as 10/10 in 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 main policy gradient (REINFORCE, Actor-Critic, PPO, DDPG, TD3) and value function (DQN, Double DQN, n-step target, semi-gradients) based methods; Implemented main techniques for exploration and off-policy RL
  - Graded as 10/10 in the written exam (**top 1** in the class)

### Autonomous Delivery Using Quadrotor Robots

Oct 2021 - Jan 2022

Course project of Planning & Decision Making (RO47005) | Main contributor (1/4)

- Developed 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) [2]
- 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 PID controller for vehicle lateral motion control; Employed PD controller and nonlinear geometric controller for multiple quadrotor tracking tasks
- The projects were graded as 10/10 (**top 1** in the class)

### Bachelor 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 [3]
- 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 Car

Oct 2021 - Jan 2022

Course project of Machine Perception (RO47004)

- Developed perception module for a self-driving car, including visual pedestrian detection (CNN, SVM) with LiDAR pointcloud as prior. Implemented iterative closest point (ICP) 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. The pipeline consists of data augmentation, feature extraction, dimensionality reduction and classification (random forest, SVM, neural network) modules

## Awards & Scholarships

- First Prize Scholarship for Outstanding Students at Tongji University (3% at TJU, 2019)
- CSC National Scholarship for Outstanding Undergraduate Exchange Program (3 students 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 Project at TJU (Autonomous Flight of UAV based on UWB Localization, 2019)

## Other Experience (TA/ Service/ Management)

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### Teaching Assistant of Deep Reinforcement Learning (CS4400)

Oct 2022 - Present

CS4400 is a research-oriented course at TU Delft for PhD and master's students. It mainly introduces modern model-free RL techniques.

### Consulting Intern at IQVIA (Shanghai)

Jul 2020 - Aug 2020

- Marketing project of drugs for rare diseases: conducted policy analysis, interviews with specialists and employees, business analysis for generating strategies for national negotiations 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 skills training sessions and five campus events with an audience of over 500 each. TJBA is among the most prominent student organizations at TJU and was rated as a five-star club many times

## Skills

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**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 KIT)

**Hobbies:** Workout training, Basketball (university team member, chief referee at TJU), Singing (third place in Tongji singing competition), Writing (part-time editor, reading quantity over 200,000)

## Publications

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

[2] **X. Liu**, R. M. Rodriguez, P. Féry, and Y. Zhang, "Planning Algorithm for a Quadrotor Drone," 2022.

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