Xinjie Liu

Phone: +31 613352911 | Email: x.liu-47@student.tudelft.nl
Address: Mekelweg 2, 2628CD, Delft, Netherlands
WebSite: https://xinjie-liu.github.io

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 | 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) | Main contributor (1/2)

- Developed an MPC approach with linearized dynamics and constraints for robot tracking and obstacle avoidance tasks. 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)

Teaching Assistant of Deep Reinforcement Learning (CS4490) Oct 2022 - Present

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

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

[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. Rodrıguez, 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.