Liuao Pei

Email: plaptq@gmail.com Phone: (+86) 18845771137
Homepage: liuaopei.com

EDUCATION BACKGROUND

Zhejiang University **Sep. 2022 — now**
FAST Lab, College of Control Science and Engineering Postgraduate Recommendation (Ranking: 3/84)
MEng of Control Science and Engineering Supervisor: Prof. Fei Gao

Harbin Institute of Technology **Sep. 2018 — Jun. 2022**
BEng of Control Science and Engineering Comprehensive Score: 94.03/100 (Rank: 1/25)

PUBLICATIONS

- **Collaborative Planning for Catching and Transporting Objects in Unstructured Environments**
  Liuao Pei, Junxiao Lin, Zhichao Han, Lun Quan, Yanjun Cao, Chao Xu, Fei Gao.
  IEEE Robotics and Automation Letters (RA-L), 2023.
  - Proposed an efficient collaborative car-like robot team planning method that enables the generation of safe trajectories in unstructured environments.
  - Modeled multiple essential collaboration relationships for real-time collaborative catching and transporting planning, we and implement them based on the above framework.
  - Conducted real-world collaborate catching and transporting tasks by implementing our algorithm on a car-like robotic team.
- **Learning to Plan Maneuverable and Agile Flight Trajectory with Optimization Embedded Networks**
  Zhichao Han*, Long Xu*, **Liuao Pei**, Fei Gao.
  Under Review, 2024.
  - Introduced an optimization-embedded neural network based on a compact trajectory library, integrating the strengths of both conventional methods and neural networks
  - Introduced a regularized trajectory library enables the method to efficiently capture the spatial distribution of optimal trajectories with minimal storage cost.
  - Conducted real-world flight experiments with a small onboard computer showcase the quadrotor's ability to navigate swiftly through dense forests.
- **An Efficient Spatial-Temporal Trajectory Planner for Autonomous Vehicles in Unstructured Environments**
  Zhichao Han, et al., **Liuao Pei**, Long Xu, Chengyang Li, Changjia Ma, Chao Xu, Shaojie Shen, Fei Gao
  IEEE Transactions on Intelligent Transportation Systems (TITS) , 2023.
  - Introduced a unified and efficient trajectory planning formulation tailored for car-like robots, incorporating four essential attributes: spatial-temporal joint optimization, convex-approximation-based static and dynamic obstacle avoidance, analytical constraint expression in flat space, and efficient trajectory representation.
  - Analyzed the characteristics of the constraints in the trajectory planning problem and reformulate the original optimization as an unconstrained one that can be effectively solved.
  - Deployed our algorithm on a commercial manned platform and conduct real-world experiments in complex environments to validate the practicality of our algorithm.
- **A Linear and Exact Algorithm for Whole-Body Collision Evaluation via Scale Optimization**
  Qianhao Wang*, Zhepei Wang*, **Liuao Pei**, Chao Xu and Fei Gao
  2023 IEEE International Conference on Robotics and Automation (ICRA), London, 2023.

COMPETITION EXPERIENCES

DJI UAV Intellisense Technology Competition ***Planning and Cotrol***
National Champion Jul. 2022 — May. 2022

- Achieving high-mobility racing flight using only onboard vision and IMU in complex and dynamic environments.
- Won the championship with a time of 22.0 seconds, less than half of the second-place time.

Robomaster AI Challenge of National University Robotics Competition ***Team Leader***
National Runner-up Jan. 2022 — May. 2022

- Came early to the FAST lab at Zhejiang University to lead the team of 8 members, which is the first year of participation.
- Based on the mechanical foundation of the official Infantry Robot, we choose sensors and computing platforms, design and develop the robot's localization, planning, visual servoing, decision-making and perception algorithms.
- Enable the robots to full-automatically complete the 2v2 shooting confrontation match, and ultimately obtain the national runner-up achievement.

National University Robotics Competition Robomaster Championship 2021 ***Team Leader***
National Runner-up Sep. 2020 — Aug. 2021

- Led a team of over 50 members for one year, focusing on the R&D of 7 different types of robots.
- Implementing a robot-versus-robot match similar to the League of Legends mechanism, with 4 iterative cycles during the one-year preparation phase.
- The final result was the preparation of a 12-agent robotic team for the national competition, achieving stable performance, strong team cohesion, and effective problem-solving skills, resulting in a national runner-up finish.

National University Robotics Competition Robomaster Championship 2020 ***Team Member***
National First Prize Sep. 2019 — Aug. 2020

- The competition lasted nearly a year and achieved National 6th. During this period, mainly responsible for the control algorithm and software of the Sentinel Robot.
- Gained expertise in control algorithms such as PID and sliding mode control, as well as communication protocols including CAN, USART, and SPI, and the use of the UCOS operating system.
- Implemented a fully automated multi-tasking function for the Sentinel robot, including automatic targeting of the dual gimbal launching mechanism, chassis movement, power control, communication, and decision-making.

Harbin Institute of Technology Annual Program - Musical Fountains ***Team Member***
First Prize Sep. 2018 — Jun. 2019

- Microcontroller-based C programming and hardware design, applying A/D sampling, digital logic implementation, and PWM output;
- Developed a system of musical fountain, earning the school-level first prize in the final defense.

HONOR AND AWARDS

- Sep. 2022, National Champion - DJI UAV Intellisense Technology Competition
- May. 2022, National Runner-up - ICRA 2022 Robomaster University AI Challenge
- Oct. 2021, Qiming Astronautics Scholarship (3/180) - Harbin Institute of Technology
- Aug. 2021, National Runner-up - National Robotics Competition RoboMaster University Championship
- Aug. 2021, Outstanding Team Leader (3/273) - Nationa Robotics Competition Robomaster University Championship
- May. 2021, Northern Quarter - National Robotics Competition Robomaster University Championship
- Aug. 2020, National First Prize - National Robotics Competition Robomaster University Championship
- Aug. 2020, National First Prize - National Robotics Competition Embedded Technology Category

SKILLS

- C ++ / C / Python / Matlab
- Linux, ROS, PyTorch, OpenCV, Carla, AirSim, MDK5, Solidworks
- ARM Cortex-M embedded development, ROS-based robotics system development
- Hobbies: Table Tennis, Photography, Driving