

# Jiarui Li

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## EDUCATION

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**Peking University (PKU)**

Beijing, China

**B.E. in Robotics Engineering (Rank 1 in 2023, GPA 3.7 / 4.0)**

Sep 2020 – Jul 2024 (expected)

- **Relevant Curriculum:** Introduction to Machine Learning (94), Swarm Intelligence (99), Principles of Automatic Control (90), Computer Vision (91.2), Robotics Experiments (III) (93), Set Theory and Graph Theory (91), Practice of Programming in C and C++ (93), Robotics Experiments (I) (91), Introduction to Computation (A) (91), Theoretical Mechanics (91), Electromagnetism (96), Social Statistics (91)
- **Technical Skills:**
  - Programming Skills: Python, C/C++, MATLAB & Simulink, Embedded System (Arduino, STM32)
  - AI & Robotics: PyTorch, ROS, Gazebo, PyBullet, Webots, SolidWorks, Moveit!, OpenCV, UR & Kinova manipulator programming

## PUBLICATIONS

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(\*indicates joint first authors, **red** indicates representative papers)

- [C3] Yao Su\*, **Jiarui Li\***, Ziyuan Jiao\*, Meng Wang, Chi Chu, Yixin Zhu, Hangxin Liu, “Planning Sequential Aerial Manipulation for Over-actuated UAMs”, in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023.
- [C2] Meng Wang\*, Yao Su\*, Hang Li, **Jiarui Li\***, Jixiang Liang, Hangxin Liu, “Aggregating Single-wheeled Mobile Robots for Omnidirectional Movements”, in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2023.
- [C1] Yao Su\*, Chi Chu\*, Meng Wang, **Jiarui Li**, Yang Liu, Yixin Zhu, Hangxin Liu, “Downwash-aware Control Allocation for Over-actuated UAV Platforms”, in *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2022.
- [J1] Wanlin Li\*, Meng Wang\*, **Jiarui Li**, Yao Su, Devesh K. Jha, Xinyuan Qian, Kaspar Althoefer, Hangxin Liu, “ $L^3$  F-TOUCH: A Light-weight, Low-cost and WireLess GelSight Sensor with Extended Three-axis Force Sensing”, *IEEE Robotics and Automation Letters (RA-L)*, 2023.

## HONORS & AWARDS

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- **National Scholarship** from Peking University (Highest Scholarship for Chinese Students) 2023
- **Pacemaker to University Merit Student** from Peking University 2023
- **Intern Outstanding Contribution Award** from BIGAI 2023
- **University Merit Student** from Peking University 2022
- **Schneider Scholarship** from College of Engineering, Peking University 2022

## APPOINTMENTS

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**Computational Robotics Lab, SEAS, Harvard University**

Boston, MA

Undergraduate Visiting Researcher, Advisor: Prof. Heng Yang

Jul 2023 - present

**State Key Laboratory for Cross-Media AGI (BIGAI)**

Beijing, China

Research Assistant in Robotics Lab, Advisor: Dr. Hangxin Liu

Jan 2022 - Jun 2023

## RESEARCH EXPERIENCES & SELECTIVE PROJECTS

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### **Data-Driven Optimal Control for Non-linear Systems**

*Computational Robotics Lab, SEAS, Harvard University*

Boston, MA

*Jul 2023 – present*

*Supervisor: Prof. Heng Yang*

- Explored theory-based data-driven optimal control. Used Hamilton-Jacobi-Bellman Equation together with modern machine learning techniques to seek trustworthy and efficient continuous time and state, action (control) space optimal control for non-linear systems such as pendulum with control saturation.
- Accumulated experience in PyTorch and machine learning, theoretical optimal control, and corresponding mathematics theory (such as functional analysis and differential equation analysis)

### **Aerial Robotics: UAV & UAM's Design, Control and Planning**

*Beijing Institute for General Artificial Intelligence (BIGAI)*

Beijing, China

*Jan 2022 – Jun 2023*

*Supervisor: Dr. Yao Su, Prof. Yixin Zhu, Dr. Hangxin Liu, Prof. Song-Chun Zhu*

- Designed and built a fully-actuated UAV platform; Implemented an optimal controller to avoid the downwash disturbance during flipping motion; Further designed a lightweight manipulator, integrated it into the UAV platform, implemented the planning and control algorithms to install a spare part on the ceiling.
- Accumulated experience in mechatronic design and the implementation of control and planning algorithms. These hardware-related experiences can help me deal with problems like algorithm implementation efficiently.
- The results of these works have been concluded in a few papers in IROS 2022 and IROS 2023.

### **Collective Intelligence: Evolutionary Game Theory, Game & Cooperation on Complex Network**

*Peking University, Supervisor: Prof. Aming Li, Dr. Lecheng Ruan, Prof. Long Wang*

Beijing, China

*Sep 2022 – Jun 2023*

- Used Monte Carlo Simulation to explore game strategy's evolution on complex networks, including Scale-Free network and Erdős-Rényi network, aimed to explain the emergence of cooperation in the sizeable structured group. Compared the effects of different parameters and try to explain this phenomenon clearly.

### **Computer Vision: Image Processing, Classification, Object Detection, Segmentation, etc.**

*Peking University, Supervisor: Prof. Yixin Zhu, Dr. Siyuan Huang*

Beijing, China

*Sep 2022 – Jan 2023*

- Used a transformer-based model to deal with transparent object segmentation problems. This task aims to develop a vision-based biological experiment monitoring system where transparent objects are pervasively used.
- Accumulated experiences in image processing, OpenCV, and PyTorch-based deep learning, including image classification, object detection, semantic segmentation, and other aspects during this final project and other course projects.

### **Machine Learning: Image and Video Classification, RL for manipulator's motion planning**

*Peking University*

### **Force sensor with Gelsight: Novel Sensor design and application with manipulator**

*Beijing Institute for General Artificial Intelligence (BIGAI)*

Beijing, China

*Jun 2022 – Feb 2023*

*Supervisor: Dr. Wanlin Li, Dr. Meng Wang, Dr. Hangxin Liu*

- Designed and built the  $L^3$  F-TOUCH sensor, an enhanced version of the classic GelSight sensor, to acquire a much better three-axis force sensing capability while being light-weight, low-cost and wireless for the ease of replication and deployment.
- Learned how to design and carried out persuasive experiments. Accumulated rich experience in hardware design and manipulator programming (sensing, planning, and actuating) with Moveit! and ROS.
- The results of this work has been concluded in a paper in RA-L 2023.

### **Modular Robotics: Modular UAV & Modular WMR**

*Beijing Institute for General Artificial Intelligence (BIGAI)*

Beijing, China

*Dec 2022 – Jun 2023*

*Supervisor: Dr. Yao Su, Dr. Meng Wang, Dr. Hangxin Liu*

- Explored ground- and air-based modular robotics. Used graph theory related method to determine the optimal structure of our self-built novel multi-UAV system, and pave the way for building a multifunctional agile multi-UAV system.
- Designed and constructed an omni-wheeled dockable Wheel Mobile Robot (WMR). we investigated the docking issue and carried out the group transportation with our multi-WMR system.