

# Zhezhi Lei

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National University of Singapore, NUS

## SUMMARY

Research interests include robot control, optimization control, reinforcement learning, natural language processing and computer vision. Have a good foundation in mathematics and control theory. Skilled in Python, TensorFlow, PyTorch, and various ML libraries. Excellent problem-solving, research, and collaboration abilities. Seeking a challenging role to develop cutting-edge intelligent robot solutions.

## TECHNICAL SKILLS

**Programming Languages:** Python, C++, MATLAB

**AI related Libraries & Tools:** PyTorch, NumPy, Pandas, Scikit-learn, OpenCV, Git, Docker, PCL

**Robotics related Libraries & Tools:** ROS, Carla, Robosuite, NVIDIA Isaac, Keil MDK

## EDUCATION

**National University of Singapore**

*M.S. in Computer Engineering | GPA: 4.56/5*

Singapore

Aug 2023 – Present

**Harbin Engineering University**

*B.S. in Robotic Engineering, Automation | GPA: 89/100 | Ranking: 2/64*

P.R.China

Sep 2019 – Jun 2023

## RESEARCH EXPERIENCE

**Target Recognition and Robotic Grasp (On-going)**

*Robot Control | Deep Learning*

Jun 2024 – Present

*Python, NVIDIA Isaac*

- The project focuses on robotic arm manipulation of objects in complex environments, primarily revolving around target pose estimation based on 3D and 2D data fusion, and data generation in simulation environments.
- The project is expected to be completed by December 2024.

**Multi-Agent Motion Planning**

*Optimization Control*

Sep 2023 – July 2024

*Python, Matlab, Carla*

- Designed an innovative multi-agent motion planning algorithm under noise interference.
- Proposed an innovative chance-constraint solving method which overcame non-convexity and computational efficiency issues inherent in traditional chance-constrained solving algorithms.
- Used Carla for vehicle simulation, the results demonstrate that the computational efficiency of the algorithm in the same scenarios is an order of magnitude higher than when directly applying IPOPT.
- First-author paper submitted to IEEE Robotics and Automation Letters (RAL) in August.

**Human-Computer Dialogue System**

*Natural Language Understanding*

Jun 2022 – May 2023

*Python, PyTorch*

- Design a text-based human-computer dialogue system for the weather domain.
- Implemented from scratch a framework for tokenization, intent recognition, and entry extraction.
- The dialogue system achieved a 95% response accuracy on a custom test set.

**Intelligent Tracking Vehicle**

*Robot Control | Team Leader*

Oct 2020

*C, Python*

- Made a vehicle with Traffic-sign recognition.
- Utilized OpenMP to identify ground paths and adopted template matching algorithm to identify simple road signs.
- Applied PID to control the drive motor and then optimized the vehicle routing.

## COMPETITION EXPERIENCE

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### **The 21st China University Robot Competition (ROBOCON), First Prize (5th)**

Sep 2021 – Jul 2022

*Robot Control | Computer Vision | Leader of Visual Group*

*C++, OpenCV; PCL*

- Designed two semi-autonomous mobile robots able to launch, grasp, and palletize; responsible for target recognition algorithms and robot vision deployment.
- Applied OpenCV and PCL to extract morphological features of the targets and then classified the targets through SVM, with the target recognition rate reaching 95%.
- Used OpenMP for parallel acceleration after dividing the image into multiple blocks to ensure real-time performance.

### **The 11th National Ocean Vehicle Design and Production Competition, Second Prize**

Apr 2022 – Jul 2022

*Robot Control | Computer Vision | Core Member*

*C, Python, YOLOv5*

- Designed and manufactured an unmanned intelligent life-saving vehicle based on vector propulsion to realize the function of locating a drowning person and automatically driving to the target for rescue.
- Adopted a self-designed steering wheel as the propeller and designed a corresponding multi-steering wheel cooperative control algorithm to enable its flexibility on the water.
- Utilized YOLOv5 algorithm to identify drowning persons with the recognition rate under test environment reaching 90%. Recorded videos and wrote scripts to extract video frames in order to improve efficiency when creating data sets.

### **The 20th China University Robot Competition(ROBOCON), Second Prize**

Sep 2020 – Jul 2021

*Robot Control | Computer Vision | Main Member*

*C, C++, OpenCV*

- Devised two semi-autonomous mobile robots.
- Designed a set of multi-target recognition algorithms with a recognition rate reaching 93%.
- Deployed a chassis algorithm to control the four-wheel omnidirectional wheel chassis and ensured automatic drive on the pre-planned route.

## COURSE HIGHLIGHT

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Course	Grade	Course	Grade
Mathematical Analysis for Engineering	97/100	Electronic Technology	96/100
Components in Automatic Control Systems	90/100	Theroy of Automatic Control	86/100
Modern Control Theroy	95/100	Advanced Control Method	95/100
Computer Engineering Project	A+	Intelligent Autonomous Robotic Systems	A+
Evolutionary Computation and Application	A-	Deep Learning for Digitalization Technologies	A-