

Zirui Li

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EDUCATION

University of Rochester

Bachelor of Science in Electrical and Computer Engineering

Rochester, NY

Expected May 2025

- **Cumulative GPA:** 3.95/4.00, **Major GPA:** 4.00/4.00
- **Relevant Courses**
 - **Mathematics:** Multidimensional Calculus, Linear Algebra, Differential Equations, Discrete Mathematics
 - **Computer Science:** Data Structure & Algorithm, C/C++ Programming, Deeping Learning
 - **Computer Engineering:** Logic Design, Mechatronics and Embedded Systems, Electronic Devices & Circuits, Signals, Mobile Robot Estimation, Mapping and Interaction
- **Honors:** Member of Tau Beta Pi - The Engineering Honor Society

RESEARCH EXPERIENCE

Updating Robot Safety Representations Online from Natural Language Feedback

Remote

Supervisor: Prof. Somil Bansal, Dept. of ECE, USC; Prof. Andrea Bajcsy, Robotics Institute, CMU

May 2024 - Present

- Aimed to use human language feedback coupled with the robot's high-dimensional observations to update the robot's representation of safety constraints
- Leveraged OWLv2 vision-language model (VLM) for constraint detection based on input prompt after empirical test on multiple VLMs
- Implemented a Model Predictive Path Integral (MPPI) planner to guide the robot toward its goals efficiently
- Integrated a Hamilton-Jacobi reachability safety controller that updates online to guarantee the robot's safety from detected constraints
- Evaluated the robot's performance both quantitatively and qualitatively through simulation experiments
- Contributed to the final paper *Updating Robot Safety Representations Online from Natural Language Feedback* which was submitted to ICRA 2025

Monocular Real-time Perception Package for Autonomous Driving

Rochester, NY

Supervisor: Prof. Tony Geng, Dept. of ECE, University of Rochester

Mar 2023 - Jul 2023

- Aimed to develop an integrated model addressing crucial tasks for autonomous driving, including object tracking, trajectory prediction, depth estimation, and road segmentation
- Successfully implemented a camera motion compensator for object tracking based on BYTE track, achieving state-of-the-art MOTA and IDF1 results on the MOT17 dataset
- Established an encoder-decoder framework for road segmentation, demonstrating top-tier performance with the highest mIOU value on the Cityscape dataset
- Efficiently connected tasks to a shared transformer backbone, resulting in a model operating at 29 FPS—555% faster than counterparts using mapping techniques for similar tasks
- Authored a paper titled *No Map Needed: Monocular Real-time Perception Package for Autonomous Driving*

COURSE PROJECTS

Mobile Robot Mapping, Estimation, and Interaction

Rochester, NY

Supervisor: Prof. Thomas Howard Dept. of ECE, University of Rochester

Jan 2024 - Apr 2024

- Developed a ROS-based software that enables the robot to dynamically choose and navigate to waypoints in partially known environments
- Implemented Extended Kalman Filter localization, occupancy grid mapping, input space sampling path planning and obstacle avoidance
- Tuned the program on a self-built simulator and GUI to ensure its functionality
- Tested the program on TurtleBot2 to ensure its robustness in real world

PID Controller

Supervisor: Prof. Thomas Howard, Dept. of ECE, University of Rochester

Rochester, NY

Nov 2023 - Dec 2023

- Developed a proportional-integral controller using C to precisely regulate the rotation of a gear motor to a specified angle
- Implemented the controller on an Explore 16/32 board, seamlessly interfacing with MATLAB through UART to receive and act upon target angle information
- Utilized PWM signals through an H-bridge to effectively manage both the direction and rotation speed of the gear motor, achieving a final steady-state error within the range of $\pm 0.5^\circ$

MIPS Emulator

Supervisor: Prof. Tony Geng, Dept. of ECE, University of Rochester

Rochester, NY

Feb 2023 - Mar 2023

- Developed an emulator in C that aim fetch and execute the binary MIPS instructions
- Built upon an existing register memory system, implement 60 MIPS instructions
- Construct a loop with program counter and that keeps fetching the correct instruction
- Gained a deeper understanding of how instructions and data are processed and passed around the registers, the arithmetic logic unit, and the memory

The “Lorenz 2022” Cipher Machine

Supervisor: Prof. William Moon, Dept. of ECE, University of Rochester

Rochester, NY

Apr 2022 - May 2022

- Developed a C++ program individually that acts as a cipher machine that encrypts and decrypts messages using dynamically generated keys

TEACHING EXPERIENCE

Mechatronics and Embedded Systems

Rochester, NY

Teaching Assistant

Sept 2024 - Present

- Led lab sessions and held office hours that guided students through lab coding assignments by explaining the underlying ideas and teaching them how to look up different datasheets
- Prepared and validated lab equipment such as explore boards and encoders
- Graded lab code, reports and exams, debugged and found out where the code went wrong, providing debug suggestions for students

Discrete Mathematics

Rochester, NY

Teaching Assistant

Aug 2022 - Dec 2022

- Provided both online and face-to-face office hours to ensure students received necessary assistance.
- Delivered timely feedback to students by grading over 100 assignments or exams weekly
- Summarized and reported students' feedback to the professor

WORKING EXPERIENCE

NR Electric

Nanjing, China

Embedded System Engineering Intern

Jul 2022 - Aug 2022

- Responsible for developing a Delayed Fluorescence-based thermometer as an embedded system engineer intern in the engineering team
- Acquired the theoretical foundation of the Thermometer within one week through extensive literature review and discussions with R&D colleagues
- Designed and programmed C-based software that interfaces with an optical sensor, applied noise reduction techniques to optical data, and converted the data to temperature values
- Achieved the performance with just a $\pm 2^\circ\text{C}$ error, exceeding the requirement

SKILLS

- **Programming Languages:** C/C++, Python, ROS, Java, MATLAB, MIPS assembly, Verilog
- **Software:** Rhino, Blender