

Runhao (Rain) Li

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EDUCATION BACKGROUND

Bachelor of Applied Science in Engineering Science: Major in Robotics Engineering

Expected in Dec 2025

University of Toronto

Toronto, Canada

- **cGPA:** 3.85 / 4.00
- **Academic Accolades:** Dean's Honour List (Fall 2021, Winter 2022, Winter 2023, Fall 2023, Winter 2024), Mathematical & Computational Sciences Research Award (MCSRA)
- **Notable Coursework:** Introduction to Learning from Data (A+), Mathematics for Robotics (A), Artificial Intelligence (A), Control Systems (A+), Electronics for Robotics (A+), Probability and Statistics (A), Electricity and Magnetism (A+)

RESEARCH AND PROFESSIONAL EXPERIENCES

Student Researcher

May 2025 - Present

Toronto Robotics and AI Lab (TRAILab), UTIAS

Toronto, Canada

- Contributed in an **LLM-based agentic workflow** for robotic navigation with long-term memory, enabling scalable task-conditioned retrieval for long-horizon multimodal robot memory. The resulting paper was submitted to **Robotics and Automation Letters**.
- Successfully deployed the OpenNav algorithm on Husky robot, resolving multi-sensor fusion instability through precise time alignment across sensors and enabling consistent performance in extended tasks.
- Developing the undergraduate thesis that extends **Vision Language Navigation (VLN)** with scene-graph memory module that enables solving long-horizon VLN tasks. **Developed locomotion RL policies** for the Husky robot to support long-horizon VLN navigation, incorporating collision avoidance and robustness in dynamic environments.

Student Researcher

May 2025 - Sept 2025

Robotics Vision & Learning (RVL) Lab, University of Toronto Robotics Institute

Toronto, Canada

- Developed a **sparse view 4D Gaussian Splatting** reconstruction algorithm for use in real-world robot tasks by extending existing single-view 4DGS to multi-view. The algorithm introduced a 3D motion-tracklet fusion strategy and incorporating inter-camera attention to jointly optimize geometry.
- The algorithm achieved superior reconstruction quality under minimal camera setups, cutting the number of input views needed for reconstruction from ~ 20 to ~ 4 . This work will be integrated into the group's adversarial study on iterative-policy-learning and will be submitted to **RSS 2026**.
- Conducted real-world experiments that demonstrated improved geometric and photometric quality, along with stronger temporal adaptability, validating the system's effectiveness beyond simulation

Co-op Assistant Researcher for Autonomous Driving

May 2024 - May 2025

Noah's Ark Lab, Huawei Canada

Markham, Canada

- Focused on the enhancement and refinement of **relightable 3D Gaussian Splatting**, improving perception algorithms by enabling realistic scene relighting under diverse lighting and weather conditions, thereby boosting the robustness of reconstruction in autonomous driving systems
- Developed an algorithm called UniGaussian that **integrated fisheye and pinhole camera** models for 3D Gaussian Splatting reconstruction in autonomous driving scenarios via Unified Gaussian Representations, cumulating in a paper that were accepted by **3DV 2026**.
- Independently developed a novel **single-image-to-3D reconstruction pipeline** to address fine-detail loss in diffusion-based 3D asset generation. The system rendered diffusion-generated multi-view images and fused them with input ground-truth views to recover high-frequency geometric and texture details. Designed a feature-transfer mechanism inspired by video frame interpolation, incorporating feature matching, attention layers, and a modified optical-flow module to guide cross-view detail restoration, achieving significantly sharper reconstructions than methods such as Trellis and Zero123. This lead to future academic paper publication
- Conducted extensive algorithmic testing and optimization across multiple projects, providing practical benchmarks and contributing to the lab's broader research in advancing scene reconstruction and perception for autonomous driving

Algorithm Developer Intern & System Architect Assistant

May 2023 - Sept 2023

SenseTime Inc.

Shanghai, China

- Built the full pipeline for the "Intelligent Crop Breeding" project — from autonomous photo collection and 3D model construction to the integration and developing enhanced machine learning models based on **NeRF** in simulated and real-world scenarios, producing actionable results
- Contributed in developing novel model based on DNNGP to process multimodal crop phenotypic trait information as input and generate predictive assessments of crop quality as output
- Authored core technical documentation, including a Requirements Analysis Document and a Conceptual Design Book, which served as blueprints for subsequent development phases

Assistant in Autonomous Driving Algorithm Research

May 2022 - Aug 2022

SenseTime Inc.

Shanghai, China

- Conducted benchmarking and evaluation of state-of-the-art autonomous driving algorithms across perception, planning, and control
- Produced a comprehensive analytical report recognized internally as a reference document, guiding R&D direction and innovation strategy

PROJECT HIGHLIGHTS

University of Toronto Aerospace Team (UTAT)

Sept 2023 - May 2024

- Collaborated on autonomous UAV software for site targeting and flight navigation using PX4 Autopilot and Gazebo simulation tools
- Leveraged Git for revision control and contributed to refining navigation logic to improve UAV stability in competition settings

Automatically Delivery Robot Project, University of Toronto

Sept 2023 - Dec 2023

- Programmed a perceptive TurtleBot with ROS, implementing PID control, Kalman Filtering, and Bayesian Localization to achieve autonomous navigation under varied conditions

SKILLS

- **Technical Proficiencies:** Python, ROS/ROS2, C, C++, MATLAB, Linux, Arduino, System Verilog, RISC-V, git, L^AT_EX, AutoCAD
- **Proficient Modules/Libraries:** PyTorch, TensorFlow, torchvision, OpenCV, Open3D, NumPy, Nav2, SciPy, Matplotlib...
- **Simulated Tools:** Isaac Sim, Habitat, Genesis, CARLA, Gazebo, Simulink
- **Professional Skills:** Research debugging and idea generation, Algorithm Design, Robotics System Integration, Machine Learning and Model Training, Technical Document Control, Research Reporting, Project Coordination, Software Testing
- **Interpersonal Skills:** Cross-cultural Communication, Teamwork, Leadership, Innovative, Problem-Solving, Mentoring, Adaptability, Organization, Time Management, Multitasking, Active Listening, Attention to Detail
- **Languages:** English (Proficient) and Mandarin (Native)