Sophie Liu

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Education

University of Toronto — Toronto, Canada
BASc in Engineering Science — *September 2023 – Present*

- **Selected Coursework**: Applied Fundamentals of Deep Learning, Computer Algorithms and Data Structures, Ordinary Differential Equations, Linear Algebra, Probability and Statistics

Experiences & Projects

Béland Research Group, University of Toronto — Toronto, Canada
Research Assistant — *October 2024 - Present*

- Implemented a robust Gaussian Process (GP) framework for Bayesian optimization under uncertainty, incorporating expected covariance kernels to handle uncertain control variables and random noise.
- Extended the GP model to compute expected kernel integrals over noise distributions (uniform and Gaussian), implemented in Python with **GPyTorch**, **PyTorch**, and **NumPy**, and verified through synthetic data experiments and robust posterior mean/covariance computations.

Drone Acrobatics for APS360H1 | ***Github*** — *Jan 2024 – May 2024*

- Developed a GRU-based deep learning flight controller in **Python**, **PyTorch**, and **ROS** for quadrotors to enable robust trajectory tracking in high-speed, dynamic environments.
- Simulated diverse flight conditions using **Flightgoggles** and **TOGT**, injected noise and sensor occlusion for realism.
- Benchmarked against MPC using **Dynamic Time Warping** and metrics (MSE, RMSE, MAE, R^2) to evaluate robustness.

University of Toronto Robotics Association, Autonomous Rover Team — Toronto, Canada
Software Developer — *September 2024 - May 2025*

- Developing perception algorithms, including 3D object detection, ramp detection, depth estimation, and camera calibration, leveraging **computer vision** and **deep learning** models.
- Using odometry and SLAM through **sensor fusion** and **EKF** to improve localization and path reconstruction.
- Integrating **ROS** to process sensor data and generate motor commands, enhancing autonomous navigation.

Autonomous Drone Racing, AI team — Toronto, Canada
Software Developer — *September 2024 - May 2025*

- Developing a new drone controller utilizing **Proximal Policy Optimization (PPO)** to optimize flight control and improve autonomous navigation.
- Integrating the controller into simulation environments such a **flightmare** for testing and tuning before real-world deployment.

Multifunctional Structures Lab, University of Toronto Institute for Aerospace Studies — Toronto, Canada
Research Assistant — *May 2024 – August 2024*

- Conducted research on **topology optimization** for partially dense materials using **MATLAB**, **ABAQUS**, and the **Single Isotropic Material with Penalization (SIMP) algorithm**.
- Modified optimization algorithms and debugged code in a **Linux Gentoo** environment to enhance computational efficiency and accuracy.
- Developed models for predicting elastic properties of lattice structures and generating manufacturable designs.

Awards

Engineering Science Research Opportunities Program (ESROP, CA$8,000) — May 2024

- UofT's flagship summer research grant for first and second year Engineering Science students, given to those with a strong research proposal and academic achievement.

Dean's Honor List — September 2023 - April 2024

- For obtaining a weighted term average of 79.5% or higher.

SKILLS

Programming Languages: Python, Swift, Java, C/C++, MATLAB, SystemVerilog, Assembly, HTML/CSS, ROS, SQL (ProgrestQL)

Libraries: Matplotlib, NumPy, pandas, scikit-learn, scipy, PyTorch, GPyTorch

Tools: Git, Linux, LaTeX