Sophie Liu

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Education

University of Toronto — Toronto, Canada
BASc in Engineering Science + PEY Co-op — *September 2023 – April 2028 (Expected)*

- **Relevant Coursework**: Introduction to Computer Programming (Python), Computer Algorithms and Data Structures (C, Python), Applied Fundamentals of Deep Learning (**PyTorch, MLP, CNN, RNN, Transformer, Autoencoder**), Introduction to Machine Learning (**Regression, Classification**), Machine Intelligence, Software and Neural Networks (**Data Augmentation, Pre-trained Networks, GANs, Transformers**), Introduction to Robotics **(Control, Localization, Manipulation, EKF)**, Mathematics for Robotics (**Complex Analysis, Optimization Techniques, Signals and Filtering, Advanced Probability Theory, Numerical Methods**), Matrix Algebra and Optimization (**Non-linear, Non-convex Optimization**), Calculus Ordinary Differential Equations (**MATLAB**), Linear Algebra, Probability and Statistics (**R**)

Skills

Programming Languages	Python, C/C++, MATLAB, Swift, Java, SQL (ProgrestQL), SystemVerilog, Assembly
Robotics Fundamentals	ROS1/2, sensors (camera, LiDAR), localization & EKF, non-linear optimization, trajectory planning (non-linear optimization), simulation (Unity)
ML/AI Fundamentals	MLP, CNN, RNN, Autoencoder, Transformer, PyTorch, NumPy, pandas, scikit-learn, scipy, Matplotlib
Tools	Git, Linux, LaTeX, SSH, HTML/CSS, VSCode, Vim, Wandb, Google Cloud, Prompt Engineering, Google/Microsoft/Apple Office Suite, Slack, Notion
Creative Tools	Adobe Premiere Pro, Adobe Photoshop, Adobe Audition, Final Cut Pro X
Leadership & Collaboration	Project Management, Codebase Management, Independent Research, Academic Writing, Teamwork, Oral and Written Communication, Time Management

Publications

Y. Lin*, **S. Z. Liu***, R. Qi*, G. Z. Xue*, X. Song, C. Qin and H. H.-T. Liu, "Agentic aerial cinematography: from dialogue cues to cinematic trajectories" 2025, *arXiv:2509.16176*, submitted to *IEEE International Conference on Robotics and Automation (ICRA) 2026*. [*PDF*] [*Website*] [*Video*]

Research Experiences

Autonomous Drone Cinematography from Natural Language Input — July 2025 – September 2025
Flight Systems and Control Lab, University of Toronto Institute for Aerospace Studies — *Toronto, Canada*

- Proposed an **end-to-end trajectory generation agent** that turns natural language prompt + short exploratory video into a cinematic drone tour videos. Agent is able to generate trajectories that match user intent and cinematic framing, while maintaining collision-free paths in test scenes; pipeline supports plug-and-play prompts and **generalizes across layout**.
- Used VLMs to aid **semantic scene understanding** and reason about **aesthetic preferences** from image and text. Allowing quick identification of language-aligned keyframes from thousands of candidates.
- Used **preference-based Bayesian Optimization** to improve **VLM/LLM**'s capabilities in understanding and executing abstract 3D tasks.
- Designed a data collection and validation system using **C++**, **ROS2**, **Unity** simulation, and Vicon **motion capture**.
- Submitted a first author paper to ICRA 2026.

Bayesian Optimization under Uncertainty — October 2024 - Present
Department of Mechanical & Industrial Engineering, University of Toronto (Supervisor: Prof. Béland) — *Toronto, Canada*

- Proposed a risk-aware Bayesian optimization framework that separates aleatoric (data randomness) and epistemic (model uncertainty), enabling safer, more reliable decisions under noisy feedback.
- Built a **Python library** (GPyTorch, PyTorch, NumPy) with interchangeable acquisitions (EI, UCB, ES, Max Value ES).
- Designed synthetic **benchmarks** (e.g., Branin, Hartmann, Ackley with controlled noise), and robustness under misspecified noise.

Computational Topology Optimization for Partially Dense Materials May 2024 – August 2024
Multifunctional Structures Lab, University of Toronto Institute for Aerospace Studies *Toronto, Canada*

- Implemented the **Single Isotropic Material with Penalization (SIMP) algorithm** in **MATLAB** on **Linux Gentoo**.
- Validated the algorithm using **ABAQUS** and on different boundary conditions and structures.

Extra-Curriculars

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

- Explored and analyzed newest literatures on perception and image segmentation algorithms, leveraging **computer vision** and **deep learning** models.
- Developed a ramp-detection algorithm using odometry and LiDAR point clouds through **sensor fusion**.

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

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

Projects

FilmList May 2023 – Jun 2024
Personal Project *[]*

- Developed iOS app with **Swift**, integrating **TMDB API** for real-time movie data.
- Implemented Supabase (**PostgreSQL**) backend for efficient data retrieval and indexing.
- Designed **dynamic UI** components to enhance user experience.

Drone Acrobatics Jan 2024 – May 2024
Applied Fundamentals of Deep Learning Course (APS360H1) Project *[]*

- Developed a GRU-based deep learning flight controller in **Python**, **PyTorch**, and **ROS1** 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 systemagainst MPC using **Dynamic Time Warping** with metrics (MSE, RMSE, MAE, R^2) to evaluate robustness.

KitchenVision September 2024
Hack the North 2024 *[]*

- Developed an Android mobile app using **Java**, and **Python** to streamline grocery management and meal planning.
- Integrated **CEIR (computer vision model)**, **Cohere's LLM**, **Databricks** and **Apache server with PHP**, optimizing data processing and storage for over 30,000 recipes.

SymptoMatch for GenAI May 2024 – August 2024
GenAI 2023 *[]*

- Developed a chatbot with an HTML interface that diagnoses illnesses and diseases from images and text input.

Awards

Engineering Science Research Opportunities Program (ESROP, CA$8,000), University of Toronto 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, University of Toronto September 2023 - April 2024

- For obtaining a weighted term average of 79.5% or higher.
- Top 200 in the world (out of more than 1600 participants), 34th in Ontario.
- Top 25% percentile of more than 16800 contestants.

Licences & Certifications

U of T Myhal Maker's Lab Access Sep 2023
Ontario G Driver's License Sep 2023