

# Wallace Lee

2673 Burnford Trail Mississauga ON, L5M 5E1

📞 647-867-9881 | ✉️ wwlee@uwaterloo.ca | 🏠 w12l3-c.github.io/wal/ | 🐙 github.com/w12l3-c | 🔗 linkedin.com/in/wallace-lee-yh/

## Skills

<b>Languages</b>	Python, C++, SQL, MATLAB, HTML/CSS, JavaScript
<b>Libraries</b>	PyTorch, TensorFlow, Scikit-learn, Transformers, Diffusers, Hloc, OpenCV, Scipy, PyQT, VTK, DjangoREST, React
<b>Skills</b>	ML, Computer Vision, Generative AI, LLM, Medical Imaging, Robotics, Biosignal processing, Biophysics
<b>Tools</b>	AWS Sagemaker, S3, Lambda, Docker, Postgres, CUDA, Bash, Linux, HPC, Langchain, Git, W&B, CometML, ClearML
<b>Hardware</b>	RaspberryPi, Solidworks, Arduino, ESP32, ROS-Noetic, ROS2, Blender, Machining, LTSpice, 3D printing

## Experience

### Biomedical Engineering Intern

Toronto ON

#### Cognixion Inc

Jan 2026 - Present

- Developing Adaptive Noise Canceling Filter to improve EEG Signal Quality

### Machine Learning Engineering Intern

Remote - New York

#### Safari AI

May 2025 - Aug 2025

- Built and deployed **10 computer vision products** using detectors and various computer vision algorithms such as optical flow and geometry relation to generate business statistics based on customers' needs
- Used **AWS Sagemaker, S3, Lambda, ECS, Postgresql, and FastAPI** to create a Queue API for fast video inference customization and resource management for all Sagemaker-related tasks within the company, increase the **team's efficiency by 50%**
- Trained and deployed detection models such as **RTMDet and Fast RCNN** on custom data with OpenMME, **achieving 0.95 mAP**

### Machine Learning Research Intern

Remote - Ottawa

#### National Research Council Canada (NRC)

Sep 2024 - Dec 2025

- Researched adversarial attack/defense strategies for medical imaging AI models; improved robust accuracy on chest X-ray classification from **28% to 98%** under defined attack settings (**Poster**).
- Implemented a Multivariate Gaussian (Mahalanobis) detector over penultimate-layer embeddings for CNN, Attention-based, and Self-Supervised models to separate adversarial vs. clean inputs, **achieving 98% of clean images filtered**
- Fine-tuned CNN and ViT backbones (ResNet50, DenseNet121, ViT, DeiT) from Chexpert models to classify chest X-rays and integrated Grad-CAM for clinician-oriented explanations, **consistently reaching >96% f1 score and AUC-ROC**

### Computer Vision Research Assistant

Waterloo ON

#### Vision and Image Processing Lab

Sep 2023 - Present

- Utilized pose and mesh estimation techniques to perform 3D reconstruction of food and hand interactions from monoscopic 2D video, **published in CVPR 2025 MetaFood Workshop**
- Employed Generative AI techniques (LoRA, Dreambooth, Diffusion Models) to create synthetic data and expand COVID x-ray datasets
- Developed models to detect foreign objects in X-rays using **Fast R-CNN** and **Visual Language Models (VLM)** to create description labels for prompt engineering
- Researched Generative AI for controllable animation to apply realistic and dynamic movements on characters with video input
- Explored 3D Gaussian Splatting and Image Generation to create **dynamic artistically inspired worlds**

### Robotics and Machine Learning Research Assistant

Toronto ON

#### The Hospital for Sick Children (SickKids) - CIGITI Lab

Jan 2024 - Apr 2024

- Developed machine learning models for Fetal and Maternal segmentation to aid Magnetic Resonance guided Focused Ultrasound (FUS) treatment simulation
- Built FUS simulator for treatment cell planning and safety validation of FUS treatment using **acoustic and thermal simulations with kWave**
- Researched in **diffusion-based models** such as instruct pix2pix and **biophysics embedded ML** for time-series Laser interstitial thermal therapy heatmap prediction to improve surgery planning workflow, **achieved accuracy of 85%**
- Designed and simulated controllers for **6 DOF MR-safe robot-controlled transducers** using Robot Operating System (ROS), RViz, and Gazebo

### Software and Machine Learning Member

Waterloo ON

#### WATOLINK - BCI WheelChair, BCI Drone

Sep 2023 - Present

- Developed GUI to collect motor imagery signal from G.Tec 8-channel Unicorn
- CAD and developed a custom headset utilizing the G.Tec Unicorn to focus on motor imagery cortex
- Developed Software for Android SDK communication from computer to a DJI 3 Drone
- Developed software and custom data collection scripts to gather EEG data using Jetson Nano, OpenBCI, and the Crown
- Created motor control scripts to operate the wheelchair based on predictions from machine learning models
- Conducted research on motion prediction from EEG data, exploring various model architectures like CNNs and **ConvLSTM**
- Conducting research for controlling drones using BCI with **motor imagery** and **SSVEP**

## Medical Machine Learning Research Assistant

### Sunnybrook Research Institute - Focused Ultrasound Lab

Toronto ON

May 2023 - Aug 2023

- Achieved a **99.9% time reduction** in MRI regional segmentation by implementing 3D and 2D Machine Learning system with **89.5 dice score**
- Manually created a **multilabel segmentation dataset with 8K masks** on MRI DICOM files for MRI Guided FUS Surgery of Uterine Fibroids
- Developed a GUI with streamlit to allow custom model inference and a Huggingface Demo with gradio
- Awarded **first place** in Sunnybrook's academic poster competition
- Paper published on American Association of Physicists in Medicine**

## Math and Modeling Co-Lead

Waterloo ON

### Waterloo iGEM

Jan 2023 - Current

- 2025 Project: "HydroGuard"** - Bacteriophage Infused Hydrogel Coating around Catheter to Prevent UTI - **Silver Prize**
  - Organizing and planning deadline for Code Reviews and Conversation with advisor
  - Representing team to present in **2025 Paris Grand Jamboree** along with 2 other teammates
  - Researched and **Modeled Bacterial Viral Dynamics (Modified Predator-Prey) Model** to capture the effectiveness of lab-designed phage cocktail against bacteria
  - Use **ProteinMPNN and AlphaFold2** to generate and validate sequences with optimal hydrogel crosslinking strength
  - Help ideation and research of modeling the slow release of bacteriophage through hydrogel degradation and biofilm formation along the catheter
- 2024 Project: "BovEco"** - Reducing Methane Output from Cows with Modified Feed
  - Research and implement **regression ML models** for predicting methane output from feed information
  - Research and implement ODE system to model the cow's rumen microbiome and manipulate it to reduce methane production
  - Create interfaces for the ML models and ODE system for the ease of use for non-technical users
- 2023 Project: "Guarden"** - Developing a vaccine against Tomato Spotted Wilt Virus (TSWV) - **Bronze Prize**
  - Researched and implemented the **SIR model** to simulate the TSWV epidemic in plant populations
  - Investigated and modeled the **RNA interference mechanism** to target TSWV mRNA, aiming to inhibit the virus's replication

## Projects

### Enabling BCI for Spinal Cord Injury Patient

Waterloo ON

#### Capstone

September 2025 - Current

- BCI connecting with external devices to enable hand motor functions for Spinal Cord Injury Patients
- Prototyping exoskeleton and BCI headset**, along with custom housing and specific design of BCI sensors
- Conduct Research on Algorithms and ML models to Predict Action from Motor Imagery Data
- Develop user requirements, primary functions, and constraints to guide the team with **Quality Function Deployment**
- Conduct **Market Research, Needs Assessment**, and **Stakeholder Interviews** to affirm the problem space

### MediMentor: Personal Biomedical Engineering Study Assistant

Mississauga ON

#### Personal

Dec 2024 - Feb 2025

- Built a study assistant using **open-source LLMs** (Qwen, Mixtral, LLaMA) for biomedical coursework and literature review.
- Implemented **retrieval-augmented generation (RAG)** using **LangChain** with **vector databases (ChromaDB)** to ground responses in course materials.
- Developed **agentic question-answering** with **reranking** and **prompt engineering** to improve factual accuracy and reliability.
- Designed an **MCP-inspired tool interface** enabling LLM access to **external services** (Google Drive, Google Calendar).

## Education

### University of Waterloo

Waterloo ON

#### Biomedical Engineering with Co-op: Bachelor of Applied Sciences (Honours) Candidate

Sept 2022 - June 2027

- Cumulative Average: **90 (3.9 GPA)**
- Velocity 5K 2023F Semifinalist - Limbitless Bionics
- Dean's honour list 2022-2025 | President's Research Scholarship 2023-2025 | President's Scholarship of Distinction**

## Achievements

2025	<b>Recognition</b> , Dean's Honour List	University of Waterloo
2025	<b>Award</b> , President's Research Award	University of Waterloo
2024	<b>Recognition</b> , Dean's Honour List	University of Waterloo
2023	<b>Award</b> , President's Research Award	University of Waterloo
2023	<b>Recognition</b> , Dean's Honour List	University of Waterloo
2023	<b>Award</b> , Best Poster in Physical Sciences	Sunnybrook Research Institute
2022	<b>Recognition</b> , Dean's Honour List	University of Waterloo
2022	<b>Award</b> , President's Scholarship of Distinction	University of Waterloo