Wallace Lee

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Education

University of Waterloo *Waterloo ON*

Biomedical Engineering with Co-op: Bachelor of Applied Sciences (Honours) Candidate *Sept 2022 - June 2027*

- **Grade:** 90
- **Design Team:** WatAI, WATOLINK, Waterloo iGEM, WARG, BioMechantronics
- **Clubs:** Data Science Club, Animusic, and Art Club (Executive role)
- **Extracurricular:** Zero Experience Program, team projects working on space technology problems including project analysis, user outreach, risk mitigation, and solution design.

Experience

Machine Learning Engineering Intern *Remote*

Safari AI *May 2025 - Aug 2025*

- Building computer vision products using detectors and various computer vision algorithms such as optical flow and geometry relation to generate business statistics
- Using 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
- Training and deploying detection models such as RTMDet and Fast RCNN on custom data with OpenMME
- Creating dashboards that draw data from InfluxDB and turn it into an aesthetic display of business statistics such as throughput, ingress/egress, real-time occupation etc.

Machine Learning Research Assistant *Remote*

National Research Council Canada (NRC) *Sep 2024 - Present*

- Research adversarial attack/defense strategies for medical imaging; 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 to separate adversarial vs. clean inputs
- Fine-tuned CNN and ViT backbones (ResNet50, DenseNet121, Vit, Deit) from Chexpert models to classify chest X-rays (healthy, tuberculosis, COVID-19) and integrated Grad-CAM for clinician-oriented explanations

Computer Vision Research Assistant *Waterloo ON*

Vision and Image Processing Lab *Sep 2023 - Present*

- Utilizing pose and mesh estimation techniques to perform 3D reconstruction of food and hand interactions from monoscopic 2D video (Poster), published in CVPR 2025 MetaFood Workshop
- Employing Generative AI techniques (LoRA, Dreambooth, Diffusion Models) to create synthetic data and expand COVID x-ray datasets
- Investigating foreign object detection in x-ray images using Fast R-CNN and Visual Language Models to create x-ray description labels for precise generation
- Generative AI research for controllable animation to apply realistic and dynamic movements on characters with video input
- Explore using 3D Gaussian Splatting to map out open large space such as an office or campus

Robotics and Machine Learning Research Assistant *Toronto ON*

The Hospital for Sick Children (SickKids) - CIGITI Lab *Jan 2024 - Apr 2024*

- Developed Fetal and Maternal segmentation pipeline 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
- Designed and simulated controllers for 6 DOF MR-safe robot-controlled transducers using Robot Operating System (ROS), RViz, and Gazebo

Medical Machine Learning Research Assistant *Toronto ON*

Sunnybrook Research Institute - Focused Ultrasound Lab *May 2023 - Aug 2023*

- Achieved a 99.97% time reduction in MRI regional segmentation by implementing 3D and 2D Machine Learning pipeline 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 Wiley Medical Physics

ML CFD Member *Waterloo ON*

WatAI - Radiel Health *Sep 2024 - Current*

- Literature review about CFD in human body and perform Ansys analysis
- Using UltraSAM to segment ultrasound images for artery structure

Software and Machine Learning Member

Waterloo ON

WATOLINK - BCI WheelChair, BCI Drone

Sep 2023 - Current

- 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

Mechanical Member

Waterloo ON

Waterloo Aerial Robotics Group

Sep 2023 - Sep 2024

- Designed and developed CAD models for an in-house electronic speed controller mounting case
- Engineered and detailed CAD designs for landing gear and storage systems for the AEAC 2024 competition drone
- Created and optimized a CAD model for a gimbal on the AEAC 2023 competition drone

Math and Modeling Co-Lead

Waterloo ON

Waterloo iGEM

Jan 2023 - Current

- 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
- 2024 Project: ”BovEco” - Reducing methane output from cows
  - 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
- 2025 Project: ”HydroGuard” - Prevent biofilm formation on Catheter for UTI
  - Organizing and planning deadline for Code Reviews and Conversation with advisor
  - Connecting with other leads for exchanging progress and data

Software & ML Lead

Waterloo ON

Waterloo Biomechatronics - Electromyography Sensing Fabric Team

Sep 2022 - Current

- Designed sensor sleeves for collecting surface EMG data through Myoware, enable wireless transmission through Bluetooth connectivity on ESP32s
- Developed GUI for data collection and auto labeling purposes
- Applied and experimented with signal processing techniques such as RMS, moving average, PCA, FFT, and Wavelet Transform to preprocess the collected surface EMG signals
- Developed a real-time hand gesture prediction model using LightGBM on EMG signals, achieving 95% accuracy and 96% F1 score
- Designed the exoskeleton attachment to a finger and drive it with servos

Projects

Daily Art Discord Bot

Personal

May 2025 - August 2025

- Designed a discord bot for the UW Visual Art Club for engaging with the members for submitting daily art to promote art improvement
- Gamification of the system where it is manually counter by a dedicated moderator previously
- Support a lot more interactive game mode between team members such as art duel, and art chaining to form a gif to encourage interaction with each other
- Used by 50+ members and deployed on raspberry pi with Makefile

InjectPro: Injection Prosthetics for Amputated Medical Professionals

School Project

May 2024 - August 2024

- Designed and simulated an EMG signal processing and motor control circuit using ltspice to precisely control servo motors with Arduino
- Breadboard the EMG processing circuit with modules such as instrument amplifier, 2nd order analog filters, precision full wave rectifier, envelope detector and Schmitt trigger
- Designed and printed a 3-bar linkage mechanism for needle injection, with motion analysis and FEA performed in SolidWorks
- Developed a 2 DOF CAD model and 3D printed it to mimic wrist motions and stabilize the arm for various injection modalities based on injection angles

5 DOF Robotic ARM

Personal

Feburary 2024 - May 2024

- Designed and developed a CAD model for a 5 DOF robotic arm, focusing on precision and functionality
- Created the URDF and Xacro files using Blender and Phobos to define the robotic arm’s structure and joints
- Utilized ROS and MoveIt to develop a package for forward and inverse kinematics controllers, simulating the arm’s operations in RViz

MediMentor: Personal Biomedical Engineering Study Assistant

Personal

Mar 2024 - August 2024

- Developing a large language model (LLM) tailored to assist with biomedical coursework by processing and understanding course materials
- Experimenting with Seq2Seq models like GPT, Llama, and Mixtral for foundational model structure and behavior
- Implementing Retrieval-Augmented Generation (RAG) through Langchain and Huggingface to enhance model accuracy and adaptability

ScribbleSync

UofTHacks 11 - Winner of Educational AI *Jan 2024*

- Developed a smart sticky note web application by using Flask and Google Cloud APIs to digitize handwriting notes using OCR and automatically create Google Calendar events
- Integrated Cohere APIs to fine-tune a text classification model and embedded a communication chatbot, enhancing the user experience

Symphonic

DeltaHacks 10 - Winner of Cloudfare AI Application *Jan 2024*

- Designed to assist teachers and small-budget businesses by enabling cost-free and minimal-effort editing of lecture and advertisement videos
- Implemented MusicLM to generate custom, royalty-free music tailored to the video's surroundings and transcript, and deployed the solution using Flask
- Use Cloudfare API to inference llama-2 and create a chatbot that provide users a customized experience around the website
- Semantic detection for adding transition special effects for the video and providing transcription

Face Recognition and Object Detection Door-lock

Personal *Dec 2022 - April 2023*

- Using Siamese Model, OpenCV for Face Recognition and Yolov7 to detect handheld objects
- Modelling on Solidworks for the case and gimbal to hold the Raspberry Pi, Servo and Camera Module

Paraplegic Rowing Scull Stabilizer *Waterloo ON*

School Design Project *Sept 2022 - Dec 2022*

- Created a device that aids the transferring process in and out of the scull in paraplegic rowing
- Performed engineering analysis on the design including setting requirements and constraints, QFD, functions diagram, report writing
- Used Solidworks to model and wood works to build a medium-fidelity prototype

Narwhale 3D puzzle *Waterloo ON*

School Design Project *Sept 2022 - Dec 2022*

- Designed a team-based 3D puzzle based on a Canadian motif: Walrus with 3D printing restrictions
- Used Procreate to gather and illustrate ideas, Solidworks to model and Prusa printer to 3D print the pieces
- Utilized Solidworks Composer to make an installation manual

Stable Diffusion Implementation

Personal *July 2022 - March 2023*

- Implementing and training Stable Diffusion models with different models from HuggingFace for Generative Art
- Incorporate research paper and implement state-of-the-art techniques like LoRA, Dreambooth, and ControlNet

Skills

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

Awards

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