Kai Ma

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Education

University of Waterloo Sept 2021 - Apr 2026

Honors Bachelor of Applied Science in ***Mechatronics Engineering*** *(Artificial Intelligence Option)*

- President's Research Award, Co-op Student of the Year Nominee, Engineering Society GPA: 3.8/4.0

Technical Skills

Languages: Python, C++, Java, JavaScript, Go, Rust, Scheme, Bash
Tools: PyTorch, TensorFlow, CUDA, JAX, Docker, Git, Unix, GCP/AWS, OpenCL, LaTeX

Work Experience

Polymath Robotics (YC S22) May - Aug 2023
Software Engineering Intern *San Francisco, CA*

- Led the development and optimization of a robot perception stack for low-latency 3D object detection and costmap generation with LiDAR and camera sensor fusion using PyTorch, ROS 2, and C++.
- Improved navigation and controls algorithms for safety-critical industrial vehicles by implementing map traversability analysis and expectation-maximization for automated localization tuning.
- Built proof-of-concept LLM integration with Polymath's Synapse API to control robots with natural language.
- Implemented simulations and visualizations for various robots and environments using Gazebo and Foxglove.
- Worked with clients and engineering teams to define high level architecture requirements for robot subsystems.

Vision and Image Processing Lab, University of Waterloo Sept - Dec 2022
Deep Learning Research Intern *Waterloo, ON*

- Developed perception and robot learning systems for vision-based robotic grasping as part of FLAIROP.
- Built adaptive ensemble models with PyTorch and OpenMMLab to improve object detection in complex scenes.
- Automated label generation and expanded keypoint/pose annotations for the MetaGraspNet synthetic dataset.
- Implemented reinforcement learning methods and simulations for grasping objects based on pose estimation.

National Research Council Canada Jan - Apr 2022
Machine Learning & Computer Vision Intern *Ottawa, ON*

- Designed high-performing models for AI-assisted chest radiography as part of the COVID-Net project.
- Engineered modular framework with self-supervised learning and surrogate loss functions to combat limited data and class imbalances using TensorFlow.
- Led project to study the explainability and trustworthiness of Vision Transformer model architectures.
- Built a robust evaluation pipeline for trust quantification, cross-validation, and explainability visualization.

WATonomous Mar 2022 - Present
Software Engineer + Research Lead *Waterloo, ON*

- Implemented and containerized motion planning solver module with C++ and ROS 2 to generate the kinematic model of our autonomous vehicle, then solve for the next state based on the current trajectory.
- Leading research projects on multimodal trajectory prediction and 3D scene representation with NeRF.

Projects

RL-Adventure | *PyTorch, NumPy*

- Reinforcement learning framework that learns command policies to play a text-based role-playing game.
- Compares tabular Q-learning, linear Q-learning and deep Q-network methods to achieve the best results.

TrainGUI | *TensorBoard, Tkinter, Matplotlib/seaborn, cx-Freeze*

- Developed a web and desktop interfaces for training ML models.
- Implemented real-time result visualization, hyperparameter setting/importing, and progress tracking.
- Adopted by National Research Council Canada's Industrial Research Assistance Program (NRC-IRAP).

Publications

- K. Ma, P. Xi, K. Habashy, A. Ebadi, S. Tremblay, A. Wong, "**Attention-Based Feature Learning for COVID-19 Screening With Chest Radiography**", *ICML, Healthcare AI & COVID-19 Workshop*, 2022.
- K. Ma, S.He, P. Xi, A. Ebadi, S. Tremblay, A. Wong, "**A Trustworthy Framework for Medical Image Analysis with Deep Learning**", *Conference on Vision and Intelligent Systems*, 2022.