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

Technical Skills

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

Work Experience

Polymath Robotics May - Aug 2023
Robotics Engineering Intern *San Francisco, CA*

- Led the development and optimization of a robot perception/navigation stack for low-latency 3D object detection and map generation with camera + LiDAR sensor fusion using PyTorch, ROS 2, and C++.
- Designed configurable multi-layer costmap scheme to fuse static maps, gradient-based traversability, semantic information, and obstacle inflation; enhanced behavior/path planners and simulations for compatibility.
- Built ROS integration and costmap generation algorithms for the Compound Eye VIDAS vision system.
- Coordinated with clients and engineering teams to define architecture requirements and evaluate solutions.
- Other projects: LLM integration for robot navigation, automated Kalman filter tuning for faster localization.

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 deep reinforcement learning for high-dimensional control to achieve precise pose-based grasping.

National Research Council Canada / University of Waterloo 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 NeRFs.

Publications

- K. Ma, S.He, G. Sinha, A. Ebadi, A. Florea, S. Kohli S. Tremblay, A. Wong, P. Xi,"**Towards Building a Trustworthy Deep Learning Framework for Medical Image Analysis**", *Sensors*, 2023.
- 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.

Projects

SlimeVolleyTeam | *gym, NumPy, EvoJAX*

- Slime bots working together to play volleyball through reinforcement learning and genetic algorithms.
- Expands self-play training environment and policy algorithms to accomodate multi-agent gameplay and collaborative learning, as well as functionality for observation & action space experiments.

IRAP-Trainer | *TensorBoard, Matplotlib/seaborn, cx-Freeze*

- Developed model training platform for NRC's Industrial Research Assistance Program with distributed training, integrated logging, visualization, hyperparameter setting/importing, and progress tracking.