Kai Ma

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TECHNICAL SKILLS

Languages: Python, C++, Java, JavaScript, MATLAB, Go, Rust, Scheme, Bash
Tools: PyTorch, ROS, TensorFlow, CUDA, JAX, Docker, ONNX, TensorRT, Git, Unix, GCP/AWS, 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/navigation stack for low-latency **3D object detection** and map generation with camera + LiDAR **sensor fusion** using PyTorch, ROS 2, and C++.
- Designed ROS-based mapping system with individual layers for semantic classes and configurable cost adjustment to allow for flexibility with navigation algorithms and new environments.
- Built ROS integration and costmap generation algorithms for the Compound Eye VIDAS vision system.
- Coordinated with clients and team to define/build **simulations** for robot systems and environments.
- 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/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 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.
- Built a robust training pipeline for large-scale **distributed training** with data and model parallelism.
- Implemented **trust quantification**, cross-validation, and visualizations to study **Vision Transformers**.
- Engineered modular framework with **self-supervised learning**, surrogate loss functions combat limited data and class imbalances using TensorFlow.

WATonomous — Mar 2022 - Present
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.

EDUCATION

University of Waterloo — Sept 2021 - Apr 2025
*Honors Bachelor of Applied Science in **Mechatronics Engineering** (Artificial Intelligence Option)*
- President's Research Award, Undergraduate Research Assistant, Co-op Student of the Year Nominee