Kai Ma

587-718-0455 | k78ma.github.io | k78ma@uwaterloo.ca | in/k78ma | k78ma

Technical Skills

Languages: C++, Python, Java, C, ROS, JavaScript, MATLAB, R, Scheme, Bash
Tools: Git, Docker, CUDA, OpenGL, ONNX, IsaacGym/Omniverse, Linux, SSH, LaTeX
Frameworks/Libraries: PyTorch, TensorFlow/Keras, PyBullet, JAX, scikit-learn, OpenCV, NumPy, pandas

Work Experience

Robotics Engineering Intern Sept - Dec 2022
Vision and Image Processing Lab - University of Waterloo *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 detection for similar objects.
- Delivered proof-of-concept reinforcement learning simulations (PyBullet/Omniverse) for pose-based grasping.
- Reduced model size while maintaining performance to optimize inference on resource-constrained robots.
- Enhanced training pipeline by automating label generation for our MetaGraspNet synthetic dataset, and expanding annotations to include RLE segmentation, poses, and keypoints.

Machine Learning & Computer Vision Intern Jan - Apr 2022
National Research Council Canada *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 deep AUC maximization to combat limited data, class imbalances, and low trustworthiness, using TensorFlow, Keras, and PyTorch.
- Led project to study the visual explainability and performance of Vision Transformer model architectures.
- Improved model evaluation by building a robust pipeline for trust quantification, cross-validation, performance logging, and data visualization.
- Prepared and presented publications as lead author for major conferences and journals.

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

- Implemented motion planning solver module with C++, ROS 2, and Docker to generate the kinematic model of our autonomous vehicle, then solve for the next state based on the current trajectory.
- Built controller to use current vehicle state, reference spline, and obstacles to output a sequence of actuation to the vehicle (or CARLA simulator), such that trajectory is maintained and constraints are met.
- Leading research projects on 3D scene representation and view synthesis with NeRF.

Projects

RL-Adventure | *PyTorch, NumPy*
- Reinforcement learning framework that learns control policies to play a text-based RPG 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 robust GUI for users with non-technical backgrounds, allowing them to train ML models easily.
- Implemented real-time result visualization, hyperparameter setting/importing, and progress tracking.
- Adopted by National Research Council Canada's Industrial Research Assistance Program (NRC-IRAP).

COVID-Cam | *TensorFlow, Darknet (YOLO), OpenCV*
- Integrated OpenCV, YOLOv3 and a CNN to observe security camera footage, identifying and logging social distancing and mask-wearing violations in real-time.
- Innovated simple depth approximation method from 2D images using spherical geometry of target heads.

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.

Education

University of Waterloo Sept 2021 - Apr 2026

*Honors Bachelor of **Mechatronics Engineering**, Artificial Intelligence Option*
- Co-op Student of the Year Nominee, Academic Representative GPA: 3.7/4.0 (A-)