Kai Ma

587-718-0455 | ✉ k78ma@uwaterloo.ca | 🔗 linkedin.com/in/k78ma | ⊙ github.com/k78ma

Technical Skills

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

Work Experience

Deep Learning Intern — Sept - Dec 2022
Vision and Image Processing Lab - University of Waterloo — *Waterloo, ON*
- Working to improve robotic grasping as part of FLAIROP (collaboration with DarwinAI, Festo, and KIT).
- Built adaptive ensemble models with PyTorch and OpenMMLab to improve classification for similar objects.
- Delivered proof-of-concept reinforcement learning simulations (Omniverse/PyBullet) for pose-based grasping.
- Implemented supervision method for robot vision using NeRF scene representations and object descriptors.
- Reduced model size while maintaining performance to optimize inference on resource-constrained robots.
- Automated label generation and expanded segmentation annotations for our MetaGraspNet synthetic dataset.

Machine Learning & Computer Vision Intern — Jan - Apr 2022
National Research Council Canada — *Ottawa, ON*
- Developed 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 robust motion planning and NerF-based 3D modeling/view synthesis.

Projects

⊙ **RL-Adventure** | *PyTorch, NumPy*
- Reinforcement learning framework that learns command policies to play a text-based RPG game.
- Compares epsilon-greedy 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-)