

Boya Zhang

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EDUCATION

Engineering Science, Robotics Major (GPA: 3.67)

September 2024 - June 2029

University of Toronto

Toronto, Canada

EXPERIENCE

Robotics Software Lead

September 2025 – Present

University of Toronto Underwater Exploration Team

Toronto, Canada

- Lead a team of **eight software engineers** developing **adaptive control**, **localization**, and **path planning** algorithms for autonomous underwater drone navigation.
- Collaborate with electrical and mechanical subteams to integrate **sensors**, **actuators**, and **power management systems** with a **Raspberry Pi** and flight controller.
- Own software architecture decisions and sprint planning across the team, coordinating module interfaces to keep integration on schedule for internal deadlines.

Machine Learning Researcher

May 2025 – August 2025

King Mongkut's University of Technology Thonburi

Bangkok, Thailand

- Co-authored **publication** at IEEE International Conference on Web Intelligence and Intelligent Agent Technology
- Designed parameter-efficient latent **diffusion architecture** achieving **220× parameter reduction** and **52× faster inference** than SOTA while maintaining generation quality.
- Built **large-scale audio data pipeline (431 hours)** including scraping, preprocessing, encoding, and distributed training using PyTorch and Google Colab.
- Conducted architectural ablations and performance benchmarking to analyze efficiency-quality trade-offs.

PROJECTS

HuArm: Collaborative Robotic Erhu Bowing

August 2026

- Trained a custom **5-DoF robotic arm** to bow the erhu via **hierarchical reinforcement learning** in simulation, enabling safe, adaptive collaborative music-making with human players.
- Optimized a **JAX-based MuJoCo** simulation pipeline for RL training, tuning solver and contact complexity against physics realism to speed up policy learning.
- Applied **domain randomization** over sensor noise and physics parameters to train a sim-to-real robust policy.
- Built an **iPhone teleoperation pipeline** to collect dexterous bowing contact data for imitation and policy warm-starting.

Urban Autonomous Rover

June 2026

- Engineered **iSLAM**, a framework bridging iPhone pose estimation and GPS to an onboard Jetson computer, enabling low-cost localization without specialized sensors.
- Built a **local VLM agent (Qwen3.5:2b via Ollama)** with a custom tool-calling harness for scene understanding and navigation decisions, running on-device at target inference frequency on **Jetson Orin Nano**.
- Integrated an existing low-level end-to-end navigation policy (**MBRA**) for real-time waypoint following and object avoidance from cross-embodiment training data.
- Developed a wireless dashboard for live autonomy monitoring and validated full manual teleoperation via iPhone joystick; end-to-end autonomous navigation testing in progress.

3D End-Effector Tracking with Reinforcement Learning

March 2026

- Built a **MuJoCo** environment for continuous 3D Cartesian end-effector tracking on a Franka Emika Panda arm, empirically comparing **model-based RL (CEM)** against **PPO** on the same task.
- Designed the state/action/reward formulation, including a trajectory tangent term to reduce lag on moving targets.
- Under Gaussian sensor noise, the model-based policy held **~1% z-axis deviation** while PPO underperformed by **~2 orders of magnitude**; diagnosed the gap via targeted ablations.

SKILLS

Languages: Python (Advanced), C/C++ (Proficient), Java, Swift, MATLAB, Assembly, System Verilog

AI/ML Tools: PyTorch, JAX, Tensorflow, OpenCV, Gymnasium, GStreamer

Robotics & System: ROS2, MuJoCo, MJX, Ubuntu/Linux, Git, Docker