Xinchen Yao

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Education

Dual degree program in:

University of Illinois Urbana-Champaign, Urbana, Illinois — Sep 2022 – May 2026
BS in Computer Engineering, GPA: 3.77/4.0

Zhejiang University, Zhejiang, China — Sep 2022 – May 2026
BS in Electronic and Computer Engineering, GPA: 3.83/4.3

Technical Skills

Programming Languages: Python, C/C++, CUDA, Matlab, Rust, RISC-V Assembly

Learning Frameworks: PyTorch, RSL-RL, Jax, Brax

Simulators: Isaac Lab, Isaac Gym, Genesis, Mujoco MJX, MJ Lab

Control Algorithms: PID, LQR, MPC

Low-level Software: ROS/ROS2, Concurrency, STM32, Communication Protocols, SLAM, OpenCV

Experience

Physical Intelligence Lab, Zhejiang, China — Undergraduate Researcher
Zhejiang University - University of Illinois Urbana-Champaign Institute — Jul 2025 - Present
Advisor: **Prof. Hua Chen**

- Eliciting emergent behaviors in locomotion controllers for bipedal robots and humanoids, using Isaac Lab and Genesis simulation platforms with custom RSL-RL implementations.
- Developing sim-to-sim evaluation pipelines in Mujoco. Deploying trained policies onto various real robots.
- Research on minimizing sim-to-real gap with learned dynamics models and simulation alignment.
- Developing algorithms based on PPO and APG, which can achieve higher sample efficiency and stability.

Human Dynamics and Controls Lab, Illinois, US — Undergraduate Researcher
The Grainger College of Engineering, University of Illinois Urbana-Champaign — Sep 2024 - Jun 2025
Advisor: **Prof. Elizabeth Hsiao-Wecksler**

- Developed a dynamics model in Genesis simulator for ballbot PURE Gen3 platform, which aims to accurately simulate the omniwheels while preserving computational efficiency.
- Implemented a learning-based control policies in Genesis to optimize balancing and movement performance and robustness for the PURE Gen3.
- Integrated new force sensors into PURE Gen3 hardware, improving state estimation and control reliability of existing model-based controller.

RoboMaster Meta Team, Zhejiang, China — Control Group Leader
Zhejiang University - University of Illinois Urbana-Champaign Institute — Jun 2023 - Present
Advisor: **Prof. Jiahuang Cui**

- Won second prize in RoboMaster regional competitions, as the leader of the control group.
- Architected and implemented an ROS2-based distributed control system supporting multiple robots (sentry, hero, infantry, engineer robots) with modular asynchronous communication infrastructure.
- Developed software and hardware interfaces for real-time motor control and sensor data acquisition through their protocols, as well as high-level autonomous navigation and decision-making algorithms.
- Trained and mentored new team members on control theory fundamentals, ROS2 framework, robot hardware architecture, embedded systems programming, and algorithm design.
- Collaborated in mechanics-control co-design iterations to optimize robot kinematics, actuator selection, and sensor placement for improved controllability and performance.

Projects

Where to Learn: Analytical Policy Gradient Directed Exploration for On-Policy Robotic Reinforcement Learning — Second Author

- A novel reinforcement learning algorithm combining Proximal Policy Optimization (PPO) with Adaptive Policy Gradient (APG) mechanisms to realize guided exploration in PPO, enhancing sample efficiency and stability.
- Implemented the algorithm in Brax, conducted training experiments in Mujoco MJX environments, performed hyperparameter tuning in benchmarks, and conducted ablation studies.
- Developed a new Mujoco MJX environment for our Tron1A biped robot, trained a policy with our new method, and deploy in reality for experiments.
- Website: wheretolearn.github.io

Omni WBR: Learning Adaptive Hybrid Wheeled-Biped Robot Omnidirectional Locomotion via Position-Based Incentive — First Author

- An engineering method in reinforcement learning to generate emergent omnidirectional gaits for wheeled bipedal robots, enabling smooth adaption to uneven terrains without explicit gait planning.
- Designed the task setting to enable adaptive gaits, and implemented training environment in Isaac Lab for our Tron1A wheeled biped robot.
- Implement sim-to-real pipelines for the robot. Customized RSL-RL with concurrent teacher-student and applied Lipschitz constrain for better sim-to-real deployment.
- Demonstration available on my website: yao-xinchen.github.io/projects/omni-wbr

Meta-Team/Meta-ROS: Modular ROS2 Control Framework for multiple RoboMaster Competition Robots — Creator, Maintainer

- A comprehensive ROS2-based control system architecture encompassing sensor integration, actuator control, forward/inverse kinematics, and autonomous decision-making modules for multi-robot coordination.
- Supports heterogeneous robot platforms with dynamically configurable parameters, modular package structure for easy extension, and real-time performance optimization for competition scenarios.
- Includes high-level modules like visual recognition, trajectory prediction, lidar-based SLAM, and RL-based locomotion controllers.
- Code: github.com/Meta-Team/Meta-ROS

Custom Wheeled Biped Robot with RL-base Locomotion Controller — Leader

- Co-designed a custom wheeled biped robot with 4 degrees of freedom with a closed chain structure.
- Implemented a training environment in Isaac Gym and trained a policy with custom RSL-RL.
- Developed a low-level control system for the robot with ROS2 to deploy the trained policy.
- Demonstration available on my website: yao-xinchen.github.io/projects/wheeled-biped

Course Projects

Unix-Like RSIC-V Operating System, Including Kernel and Shell — ECE391 Computer Systems

- Implemented device drivers (UART, VirtIO block), filesystem I/O, virtual memory, process management, and preemptive multitasking with system calls for concurrent user program execution.
- Designed and Implemented a zsh-style shell that can spawn processes and restore interface upon completion.
- Composed a tutorial on my workflow setup for this coursework: github.com/Yao-Xinchen/ECE391-Workflow

Convolution Neural Network Implementation in CUDA — ECE408 Applied Parallel Programming

- Implemented and optimized CUDA-based CNN inference, achieving over 40% performance improvement.
- Applied advanced techniques including tensor cores, CUDA stream, Joint Register and Shared Memory Tiling, and cuBLAS for higher memory efficiency.

Autonomous Diagonal and Parallel Parking — ECE484 Safe Autonomy

- Implemented Simultaneous Localization and Mapping (SLAM) with Fast-LIO, and path recognition with ENet.
- Designed and implemented a autonomous parking system with predefined diagonal and parallel maneuvers.
- Demonstration available on my website: yao-xinchen.github.io/projects/auto-parking