# Ben Gu

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## EDUCATION

**Carnegie Mellon University**, Pittsburgh, PA
**M.S. in Robotics** *GPA: 4.0/4.0* Aug 2025 – May 2027
**B.S. in Mechanical Engineering** *GPA: 4.0/4.0* Aug 2022 – May 2025
*Awards:* CIT Leadership and Service Award; CIT Honor Research; SURF Spotlight Researcher
*Relevant Coursework:* Optimal Control and Reinforcement Learning; Robot Learning; Feedback Control Systems; Soft Robotics Modeling; Robotics & AI for Agriculture; Mobile Robots; Legged Systems.

## EXPERIENCE

**Physical AI Engineer Intern** Summer 2026
*Stealth Robotics Startup, Boston, MA*

- Full-stack ownership of a mobile robot platform, with primary focus on developing **RSL-RL** policies to replace a model-based QP/IK posture controller, closing the sim-to-real gap and validating outdoors on untrained terrain.
- Benchmarked **reactive, recurrent and teacher-distilled** architectures under one reward and observation contract; direct RL trained the recurrent policy to deployment without the two-stage distillation pipeline, cutting a stage from the standard approach.

## RESEARCH

**Self-Stabilizing Penguin-inspired Bipedal Robot for Low-Friction Slopes** May 2025 – Present
*Research Assistant, Robomechanics Lab (PI: Prof. Aaron Johnson)*

- Modeled and fabricated a 3D model of a 5-DOF bipedal robot in **SolidWorks**, implementing a **crank-link leg extension system** that captures macaroni penguin biological inertial properties for energy-efficient waddling.
- Developed a **CPG-RL** framework to create stable, biomimetic walking gaits; integrated **closed-chain constraints** to optimize locomotion on low-friction, inclined surfaces.
- Developed **digital twins** in **MuJoCo** and **NVIDIA Isaac Lab** to validate contact-rich dynamics and closed-loop control policies in challenging environments.
- Developed an experimental testbed for evaluating locomotion and conducted experiments in a **motion capture laboratory** on viscous and slippery substrates.
- **Publications: Co-First Author** workshop paper, **ICRA 2026** (Vienna); **Co-First Author** full paper submitted to **ICRA 2027** (Seoul); live hardware demo at NFL Draft Tech Day, Pittsburgh 2026.

**Design and Control for Mugatu: A Minimally-Actuated Steerable Bipedal Robot** Dec 2023 – Present
*Research Assistant, Robomechanics Lab (PI: Prof. Aaron Johnson)*

- Engineered a **PID attitude controller** for the first steerable single-motor biped, enabling directional control.
- Analyzed 2D contact dynamics in **MATLAB** to investigate limit cycle stability and gait efficiency, validating non-linear dynamics and steering manifolds in **Drake** and **MuJoCo**.
- **Publication: Allometric Scaling Laws for Bipedal Robots**, submitted to **IROS 2026** (arXiv: 2603.22560). Presented at **Gordon Research Conference on Robotics 2026**, **NCUR 2025** and **CMU MOTM 2025**.

## PROJECTS

**Hybrid Locomotion for Unitree Go2-W in Agriculture Environments** Jan 2026 – Present
*Course Project, Robotics & AI for Agriculture (PI: Prof. George Kantor & Francisco Yandun)*

- Implementing a **PPO-based RL policy** in **NVIDIA Isaac Lab** for adaptive wheel-leg switching on the Go2-W.
- Training robust navigation in procedurally generated off-road terrains with multi-crop row constraints.

**MPPI-Based Autonomous High-Speed Drone Racing** Jan 2026 – May 2026
*Course Project, Mobile Robots (PI: Prof. Wennie Tabib)*

- Developed an **MPPI controller** for a 17-state quadrotor model to achieve real-time, aggressive gate navigation.
- Optimized trajectories in PyBullet by sampling control inputs to balance high velocity and collision avoidance.

**Sim-to-Real RL: Autonomous Quadrotor Landing** Aug 2025 – Jan 2026
*Course Project, Robot Learning (PI: Prof. Guanya Shi)*

- Synthesized a **PPO controller** with 4096 parallel agents and designed a curriculum learning scheme with exp reward scaling for precision landing on moving targets (<4 cm error).
- Mitigated the sim-to-real gap via **domain randomization**, **96% success rate** on Crazyflie 2.1+ hardware.

## SKILLS

- **Programming:** Python, C++, C, MATLAB, Julia
- **Robotics & Simulation:** Isaac Lab, MuJoCo, Drake, MJPC, Dojo, ROS2, Reinforcement Learning (PPO, DQN, CPG), Optimal Control (LQR, MPC, MPPI)
- **Design & Manufacturing:** SolidWorks, OnShape, Blender, ANSYS/FEA, CNC & fabrication (mill, lathe, waterjet, laser, 3D printing)