Naixiang Gao

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Education

Stanford University Sept 2024 – Present
M.S. in Mechanical Engineering – Robotics and Kinematics Track, Overall GPA: ***4.0****/4.0* *Stanford, CA*

University of Illinois at Urbana-Champaign Aug 2020 – May 2024
B.S. in Computer Engineering, ***Summa cum laude****, Overall GPA:* ***3.97****/4.00* *Champaign, IL*

- Bruce C. Mather Memorial ECE Scholarship (2022-2023, 1 of 2 recipients annually)
- Ernest A. Tolli Memorial Scholarship (2023-2024, 1 of 3 recipients annually)
- Grainger Best Overall Project Award, Senior Design Hall of Fame (12/2023)

Working Experience

Manifold Technology Holdings (Shenzhen) Co., Ltd Jun 2025 – Sept 2025
Computer Vision Research Intern | Project details are confidential *Remote*

- Independently built a stereo-vision data collection and evaluation pipeline, capturing image data for **3D point-cloud reconstruction**.
- Generated point clouds using an open-source algorithm based on a **Transformer** architecture, performed runtime and accuracy-error analysis, and validated results with a laser rangefinder
- Analyzed the **computational complexity** of different 3D reconstruction algorithms and evaluated their deployment feasibility on **resource-constrained platforms** (e.g., mobile or edge-computing devices).

Research Experience

GRaD-Nav/GRaD-Nav++ : (Efficiently Learning/VLM Enabled) Visual Drone Navigation with Gaussian Radiance Fields and Differentiable Dynamics Jan 2025 – Nov 2025
Multi-Robot System Lab, Advisor: Prof. Mac Schwager *Stanford, CA*

- Developed GRaD-Nav, an **end-to-end** actor–critic–based **Differentiable Deep Reinforcement Learning** (DDRL) framework that integrates **3D Gaussian Splatting (3DGS)** with differentiable **UAV dynamics** to enable vision-based drone navigation. Subsequently proposed a lightweight **VLA + MoE** architecture to support natural-language-driven flight control.
- Replaced the original pretrained **SqueezeNet** vision module with an **asynchronously** executed pretrained **CLIP** vision-language matching component, and introduced a β**-VAE–based Context Encoding Network (CENet)**. This significantly improved UAV adaptability in unseen environments, increasing experimental success rates by roughly 50%.
- Employed a **Mixture-of-Experts (MoE)** policy network where expert selection enables task generalization and environmental adaptation. In **task-generalization evaluation**, achieved 83%/75% success rates on seen/unseen tasks in simulation and 67%/50% in real-world tests. In **environment-adaptation evaluation**, achieved 81%/67% success rates in simulation/real-world testing.

Hierarchical Imitation Learning for Bimanual Human-Robot Collaboration Mar 2025 – Jun 2025
ARMLab, Advisor: Monroe Kennedy *Stanford, CA*

- Built an **end-to-end** imitation learning system enabling human–robot collaboration for asymmetric two-handed manipulation tasks (e.g., grasping, handing over).
- Collected synchronized human demonstrations using a **Zed Camera + Rokoko Glove**, extracting 21 hand-joint keypoints for model training.
- Enabled prediction of **7-DOF virtual proprioception + gripper** state from human hand poses, enhancing the robot's self-state awareness.
- Designed a two-stage imitation learning architecture: **Stage 1** predicts smoothed human hand-motion trajectories from glove inputs; **Stage 2** outputs robot control actions using scene semantic segmentation, virtual proprioception, and the predicted trajectories.

Project Experience

Vision-Based Picking-and-Place System | *Python, PyBullet, Pytorch* Sept 2024 – Dec 2024

- Utilized **U-Net** for object segmentation, applied the **Iterative Closest Point (ICP)** algorithm for pose estimation, and implemented **inverse kinematics (IK)** for grasp planning, enhancing the robot's perception and grasping accuracy for more stable and efficient autonomous operations.
- Pioneered implementation of Spatial Action Map to train an end-to-end grasping algorithm, improving accuracy in recognizing unseen objects by **32.8%** while reducing algorithm memory by **10%**.

Wheel-Legged Balancing Robot | Control Engineer (Development Log) | *C++, MatLab* Aug 2023 – Jan 2024

- Conducted **classical mechanics analysis** to establish the physics and dynamical model for the robot movement.
- Applied **linear quadratic regulator (LQR)** algorithm for wheel control, enabling self-balancing.
- Leveraged **virtual model control (VMC)** algorithms to control the leg motion, making the robot have adaptive suspension and keeping the robot level even with the difference in leg heights.
- Simulated robot motion in **Matlab (Simulink)** and implemented the control system in C++ for hybrid testing.

Robotics Club Experience

IRM (Illini RoboMaster) Dec 2021 – Aug 2024

Vice-Captain, Embedded Team, Student Organization (Group size: 15) *Champaign, Illinois*

- Trained new employees and held weekly R&D meetings to synchronize development progress across departments.
- Designed and implemented a **PID + feedforward controller** in C++ to ensure that the motor can generate sufficient torque when facing different kinds of resistance.
- Implemented drivers for various types of motors (Motor 3508, Motor 4310, Motor 2006, Motor 6020, etc.) and encapsulated the relay, remote controller, keyboard, and laser functions using C++.
- Designed a **dart-system** gimbal for the "Hero" robot using springs and wire rails for precise 11m and 20m shots.

Publications

- Q. Chen*, **N. Gao***, S, Huang, et al. "*GRaD-Nav++: Vision-Language Model Enabled Visual Drone Navigation with Gaussian Radiance Fields and Differentiable Dynamics*", to appear *IEEE RA-L*, 2025.
- Q. Chen, J. Sun, **N. Gao**, et al. "*GRaD-Nav: Efficiently Learning Visual Drone Navigation with Gaussian Radiance Fields and Differentiable Dynamics,*", to appear *IROS 2025*.
- J. Xiang, H. Dinkel, H. Zhao, **N. Gao**, et al. "*TrackDLO: Tracking Deformable Linear Objects Under Occlusion with Motion Coherence,*" *IEEE RA-L*, 2023. DOI: 10.1109/LRA.2023.3303710

Awards & Certificates

- Standard Confrontation 2nd Runner Up, Robomaster 2023 University League North America. (Top 3%)
- Standard Confrontation 3rd Runner Up, Robomaster 2022 University League North America. (Top 5%)

Technical Skills

Python, C++, ROS2, Matlab, C, x86 Assembly, System Verilog, Java