Xuechao ZHANG

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Summary

Robotics engineer and AI researcher with a background bridging hardware and software, specializing in dexterous manipulation and active perception. Proven record from research to production — with industry deployments (at **Apple, Bosch, Tencent**, etc.) and publications at top conferences (**CoRL, IROS**).

Education

- **Arizona State University** — Arizona, USA
  Master, Robotics and Autonomous Systems ***GPA:*** *4.0/4.0* — *Jan. 2025 - May. 2026 (Expected)*
- **Shanghai Jiao Tong University** — Shanghai, China
  Master, Electronic Information ***GPA:*** *3.6/4.0* — *Sept. 2021 - Mar. 2024*
- **Georgia Institute of Technology** — Atlanta, USA
  Exchange Student in Atlanta Summer Program ***GPA:*** *3.9/4.0* — *Jul. 2018 - Aug. 2018*
- **Southeast University** — Nanjing, China
  Bachelor, Robotics Engineering (Chien-Shiung Wu College) ***GPA:****3.7/4.0* — *Sept. 2017 - Jun. 2021*
  - Chien-Shiung Wu College is a pilot college in Southeast University to cultivate top-notch undergraduate students selected from multiple science and engineering departments.

Work Experience

- **Silicon Validation Automation System** — Apr. 2024 - Jan. 2025
  Robotics Engineering Intern @ Apple Inc.
  - Architected and delivered a **UR10e**-based automation system for USB interoperability validation. Task included device ports localization, cable plugging (e.g., Type-C, HDMI) and simulating user operations on HID devices.
  - Implemented and fine-tuned state-of-the-art **6-DoF visual localization**, achieving precision of **0.3 mm/2°** with marker and **2.0 mm/5°** without markers at 1 m working distance.
  - Fused camera and force/torque feedback for contact-aware control, reaching **99.2%** grasp success (universal boxes) and **96.5%** cable-insertion success over **200+** device SKUs in a full regression pass.
  - Developed a **Python**-based robotics toolkit covering system calibration, front-end task management, robot path planning and visualization, plus robust fault-recovery and logging, enabling **24/7** reliable operation.
  - Deployed across labs in **Shanghai/Tokyo/Cupertino**; results presented to **VP**-level leadership.
- **Autonomous Driving Car Demonstration Model** — Aug. 2023 - Jan. 2024
  Strategic Intern (Part-time) @ Bosch (China) Investment Ltd.
  - Designed and implemented an autonomous indoor navigation platform using a Raspberry Pi-powered demonstration vehicle, equipped with onboard camera for real-time perception and control.
  - Developed educational materials and documentation as part of the global Bosch AI Learning Curriculum, and conducted online and offline training sessions for internal staff, reaching over **100** employees.
- **Swarm Robots System for Cooperative Construction** — Jun. 2022 - Sept. 2022
  Research Intern @ Tencent Robotics X Lab
  - Contributed to the development of a digital-twin system for heterogeneous robots, including **quadruped robots and Mecanum wheeled robots**, which can transport blocks/slopes to construct multi-layer buildings.
  - Designed the mechanical and electrical systems and developed the embedded software based on the Robot Operating System (ROS) to enable Mecanum wheeled robots to operate blocks/slopes under centralized control.
  - Integrated the visual sensors and IMU of the robots using Kalman filtering to enable autonomous localization, reducing positioning error by **43%** and improving positioning information reporting rate by **57%**.

Research Experience

- **Prompted Policy Search for Robotics via VLM Reasoning** — Aug. 2025 - Present
  Research Associate @ Interactive Robotics Laboratory — *Advised by Prof. Heni Ben Amor*
  - Designing a framework that leverages **Vision-Language Models (VLMs)** for policy optimization, incorporating **image/video-based feedback** alongside numerical rewards.
  - Formulated a multimodal policy search loop where VLMs iteratively propose parameter updates based on visual trajectories, reward curves, and textual goals—enabling **in-context reasoning** over task progress, failure modes, and strategy refinement.
  - Preliminary results in simulation show improved sample efficiency and robustness over reinforcement learning baselines, especially in **sparse-reward** environments.

- **Contact-Rich Dexterous Manipulation** Jan. 2025 - Jul. 2025
  Research Associate @ Intelligent Robotics & Interactive Systems Lab *Advised by Prof. Wanxin Jin*
  - Conducted research on model-based planning for contact-rich dexterous manipulation, including fingertip in-air manipulation, and **LEAP Hand** on-palm reorientation.
  - Designed a real-time contact-implicit **Model Predictive Control (MPC)** framework based on a recently proposed complementarity-free multi-contact dynamic model. Implemented in **Python** with **CasADi**, sustaining **50–100 Hz** control, matching or exceeding reinforcement-learning baselines on challenging dexterous tasks.
  - Introduced a global sampling-based contact-position replanning layer on top of MPC, yielding a **bi-level** controller that escapes local minima; achieved **90.1%** average success on continuous-rotation tasks over a **20 object** test set.
  - Co-developed a **20 Hz 6-DoF pose tracker** for unknown dynamic objects in contact-rich scenes by integrating the contact dynamics into a visual-tracking pipeline; geometry is supervised via **Gaussian Splatting**, while physical parameters (mass, inertia, friction) are **updated online** via sampling-based optimization. Summarized in paper[1].

- **Active Perception and Robotic Grasp Prediction** Sept. 2022 - Aug. 2023
  Research Intern @ Shanghai Artificial Intelligence Laboratory
  - Conducted research on **robotics grasping prediction** in cluttered desktop scenes, focusing on active perception under partial observability.
  - Proposed **ACE-NBV**, an affordance-driven next-best-view policy that actively selects next camera poses which guide the arm toward feasible grasps for target objects.
  - Formulated a **multi-task learning** scheme over a shared implicit neural representation to couple grasp affordance and 3D reconstruction; leveraged the paradigm of novel view imagery from **NeRF** to predict grasp affordances for previously unobserved views.
  - Demonstrated significant improvements over current state-of-the-art methods by consistently identifying more informative views, resulting in a comparable grasp success rate with **32.4%** fewer observations.
  - Published a paper[2] as the first author in **CoRL 2023**.

- **Real-Time Digital Twin Platform of Multi-Robots** Feb. 2021 - Mar. 2022
  Graduate Researcher @ Shanghai Jiao Tong University IWIN-FINS Lab *Advised by Prof. Jianping He*
  - Contributed to the development of a multi-robot testbed that exploits the ideas of digital-twin system.
  - Designed and implemented a distributed PTZ camera network and AprilTag visual positioning system which can achieve **120 Hz** tracking frequency, **10 ms** delay, and **0.5 mm** tracking error.
  - Proposed a multi-camera sensing quality model and an optimization strategy for camera network configuration based on this model, which improves the overall positioning performance of the platform.
  - Published a paper[3] as the first author in **IROS 2022**, and submitted an invention patent.

- **Competition Robots Software and Hardware Development** Apr. 2019 - Nov.2020
  Team Leader @ Southeast University Smart Car Team
  - Designed a Mecanum wheeled chess-playing robot, which utilizes IMU and cameras for self-positioning, an electromagnetic system for moving chess pieces, and algorithms for solving the Eight Queens problem and playing the Quoridor. Video
  - Designed an intelligent car which is powered by supercapacitors, capable of wireless charging at 30 W through self-made circuits, and utilized inductors to detect alternating currents for navigation. Video
  - Designed a self-balancing bicycle robot, which was manufactured using 3D printing and utilizes an IMU and a flywheel system for balancing. Figure
  - Won the **Second Prize** of the 14th National College Student "NXP Cup" Smart Car Competition and **First Prize** of the 10th Jiangsu Provincial College Student Robotics Competition. Submitted **two** invention patents.

Publications

1. Yang W, Xie Z, **Zhang X**, et al. TwinTrack: Bridging Vision and Contact Physics for Real-Time Tracking of Unknown Dynamic Objects[J]. arXiv:2505.22882, 2025. Paper Page Video

2. **Zhang X**, Wang D, Han S, et al. Affordance-Driven Next-Best-View Planning for Robotic Grasping[C]//Conference on Robot Learning (CoRL). PMLR, 2023: 2849-2862. Paper Page Video

3. **Zhang X**, Ding X, Ren Y, et al. Toward Global Sensing Quality Maximization: A Configuration Optimization Scheme for Camera Networks[C]//2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS). IEEE, 2022: 13386-13391. Paper Video

Honors and Awards

- Ira A. Fulton Schools of Engineering Graduate Scholarship, ASU — Aug. 2025
- Outstanding Graduate of Shanghai Jiao Tong University — Mar. 2024
- First Class Academic Scholarship from Shanghai Jiao Tong University — Sept. 2021&2022
- SMC Corporation Scholarship — Sept. 2022
- "Chien-Shiung Student" of Southeast University (Top 1%) — Jan. 2021
- Second Prize of the 14th National College Student "NXP Cup" Smart Car Competition — Aug. 2019
- Second Prize of Zhengbao Education Scholarship — Jun. 2019

Skills

- **Programming Languages**: Python, MATLAB, C++; Additional: CUDA, Swift, Verilog
- **Theoretical Knowledge**: control theory, optimization, deep learning, computer vision
- **Robotics Experience**:
  - **Algorithms**: MPC, RRT, SLAM, NeRF, Gaussian Splatting, Diffusion
  - **Systems & Tooling**: PyTorch, Docker, ROS, simulation (Isaac Lab, MuJoCo, MATLAB Simulink, Webots)
  - **Hardware & Platforms**: PCB design, CAD, 3D printing; Franka Emika, Universal Robots, NVIDIA Jetson