KAITIAN CHAO

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PROFESSIONAL SUMMARY

Kaitian Chao is a second-year Master student majoring in Robotics at the University of Pennsylvania affiliated to GRASP Laboratory, specializing in **robot learning, control, and 3D computer vision.** He has extensive experience in deep learning and robotics research, with projects spanning VLM and VLA for robot arm fine-manipulation, robotic fish modeling and control, F1tenth autonomous driving, UAV autonomous control and navigation, diffusion models, and large language models, all aimed at advancing AI-driven capabilities. His passion lies in leveraging cutting-edge AI and vision technologies to develop super-intelligent robotics and software that can significantly enhance productivity.

EDUCATION

University of Pennsylvania **August 2024 - May 2026**
Master's, Robotics
- Machine Perception
- Control and Optimization with Applications in Robotics
- F1/10 Autonomous Racing Cars
- Learning in Robotics
- Advanced Robotics
- Introduction to Robotics

ShanghaiTech University **September 2020 - July 2024**
Bachelor's, Electrical Engineering *GPA: 3.73*
- Stochastic Processes
- Introduction to Communication Systems

University of California - Berkeley **August 2022 - May 2023**
Certification, Electrical Engineering and Computer Science *GPA: 3.96*
- Designing, Visualizing and Understanding Deep Neural Networks
- Introduction to Machine Learning
- Feedback Control Systems
- Optimization Models in Engineering
- Data Structures

PUBLICATIONS

Learning Flow-Adaptive Dynamic Model for Robotic Fish Swimming in Unknown Background Flow
Kaitian Chao*, Xiaozhu Lin*, Xiaopei Liu, Yang Wang
IEEE International Conference on Intelligent Robots and Systems (IROS), 2025

Ambient Flow Perception of Freely Swimming Robotic Fish Using an Artificial Lateral Line System
Hongru Dai*, Xiaozhu Lin*, Kaitian Chao, Yang Wang
IEEE International Conference on Robotics and Automation (ICRA), 2025

RESEARCH & ENGINEERING PROJECTS

VLManipulation: Vision Language Models as Coding Agents for Robotic Manipulation **Philadelphia, PA, USA**
Graduate Researcher at GRASP PAL Lab, advised by Prof. Dinesh Jayaraman *May 2025 - Present*
- Developed VLManipulation, a self-evolving, general-purpose “code-as-policy” framework that leverages coding VLMs to orchestrate perception, planning, and control for diverse dexterous robotic manipulation tasks across tabletop and mobile platforms.

- Designed a unified pipeline that incorporates state-of-the-art VLAs for fast, low-level control while leveraging VLMs for reasoning, memory, and long-horizon planning—achieving state-of-the-art performance and enabling data collection and policy distillation to produce faster and more capable VLA models.

Eureka for Manipulation: LLM-Guided Digital Twin Refinement for Large-Scale Dexterous RL **Philadelphia, PA, USA**
Graduate Researcher at GRASP PAL Lab, advised by Prof. Dinesh Jayaraman *May 2025 - Present*

- Extended the Eureka framework to dexterous manipulation by enabling an LLM/VLM agent to not only design RL rewards but also auto-refine object dynamics (mass, density, stiffness, joint limits) for realistic simulation.
- Developed a real2sim2real pipeline where agents align digital twin behavior with real-world demonstrations, creating high-fidelity environments that close the reality gap.
- Enabled large-scale reinforcement learning in physically accurate simulators, improving policy transfer to previously unexplored dexterous tasks in robotics.

Learning Flow-Adaptive Dynamic Model for Robotic Fish Swimming in Unknown Background Flow **Shanghai, China**
Undergraduate Researcher at MAgIC Lab *October 2023 - October 2024*

- Developed a general and effective method for the dynamic modeling of robotic fish in the background flow environment, utilizing the Domain Adversarial Meta Learning algorithm to achieve flow-agnostic and adaptive modeling.
- Designed and trained deep reinforcement learning policy to enable robust control of robotic fish swimming with different flow conditions.
- First author of a paper on learning-based dynamic modeling of robotic fish in flow environment, accepted by the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2025)

Autonomous Racing with MPPI and Hybrid Control – F1TENTH Race Car **Philadelphia, PA, USA**
February 2025 - May 2025

- Led the development and deployment of a full-stack autonomous driving system on a 1/10-scale F1TENTH car, integrating LiDAR/vision-based perception, SLAM, particle filtering for localization, and RRT* for obstacle-avoidance planning.
- Implemented MPPI and a hybrid Pure Pursuit–MPC controller for real-time collision-free trajectory optimization, complemented by reinforcement and imitation learning to refine racing strategies.
- Optimized hardware dynamics (suspension, tires) and achieved robust, low-latency performance, securing a top-tier finish at the 24th Roboracer Grand Prix, ICRA 2025.

Vision-Based Motion Planning for Agile Drone Navigation in Cluttered Environments **Philadelphia, PA, USA**
March 2025 - May 2025

- Developed a complete vision-based navigation pipeline for quadrotors by integrating onboard mapping, A* path planning, and differential flatness–based geometric control to execute collision-free, time-optimal trajectories.

Dynamic Pick-and-Place Motion Planning with 7-DOF Franka Emika Panda robot arm **Philadelphia, PA, USA**
November 2024 - December 2024

- Developed an end-to-end pipeline for real-time 7-DOF robot to pick and place static and dynamic blocks using ROS and Gazebo framework. Implemented motion planning using Geometric Inverse Kinematic and bi-directional RRT for tight and fast control.

Ambient Flow Perception of Freely Swimming Robotic Fish Using an Artificial Lateral Line System **Shanghai, China**
Undergraduate Researcher at MAgIC Lab *October 2023 - September 2024*

- Developed the first ALLS-based ambient flow classifier for robotic fish, training an LSTM on only 3.5 minutes of swimming sensor data from 5 pressure sensors to achieve 81.25% accuracy across 8 flow categories (0.08–0.18 m/s), establishing a robust and generalizable perception framework. Research accepted for publication at IEEE ICRA 2025

PROFESSIONAL EXPERIENCE

Penn Aerial Robotics **Philadelphia, PA, USA**
Software Team Lead *October 2024 - Present*

- Work in software team to design autonomous control, perception and machine learning algorithm for the UAV plane.
- Participated in the SAE Aero Design West 2025 competition, achieving 2nd place nationally with the team; successfully completed 3 takeoffs and 1 full flight sequence, lifting over 110 lbs in total payload.

SKILLS

Skills: Python, Pytorch, ROS2, IsaacSim, IsaacLab, Gazebo, Pybullet, Java, C/C++, MATLAB, C#, Unity, Git, Machine learning, Deep reinforcement learning, 3D computer vision, SLAM, NERF, Excel/Numbers/Sheets
Languages: Chinese, English