

Yang Jiao (she/her)

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SUMMARY

Self-motivated and perceptive master's student with more than 3 years of research experience in robotics. Innovative thinker with enthusiasm for mathematical modeling and real robot application. Proficient coding skills built on well-developed research and course projects. Spread thin into various fields including modular robots, SLAM, motion planning, etc.

SKILLS

Programming Skills | [GitHub](#) | [Personal Website](#)

- Programming languages: **Python, MATLAB, C/C++**
- Frameworks/tools: **ROS, NumPy, Matplotlib, PyTorch, Jupyter Notebook, CMake, Linux CLI, SolidWorks, Markdown, LaTeX**

Language Skills

English (fluent, TOEFL scores 108), Chinese (native)

EDUCATION

University of California, San Diego (UCSD)

09/2022 – Present

Master of Science, Electrical and Computer Engineering

La Jolla, USA

Major: Intelligence Systems, Robotics and Control | **UC-GPA: 3.957/4.0**

- Core courses: *Robot Motion Planning (A+), Mathematics for Robotics (A), Sensing & Estimation Robotics (A)*

The Chinese University of Hong Kong, Shenzhen (CUHKSZ)

09/2018 – 07/2022

Bachelor of Engineering with Honors, First Class

Shenzhen, CHN

Major: Electronic Information Engineering | **Major GPA: 3.806/4.0**, Cumulative GPA: 3.705/4.0

- Achievements: CUHKSZ Bo Wen Scholarship & 2020-21 Academic Performance Scholarship
2018-22 Dean's List Awards
- Core courses: *Programming for Robotics (A-), Automatic Control Theory and Linear Systems (A-), Calculus I-II (A-, A), Probability and Statistics I-II (A-, A), Discrete Mathematics (A), Optimization (A-)*

Oxford University

08/2020

Oxford Prospects and Global Development Institute (OPGDI) Online Summer Program

Module: Foundations of Human Science: Artificial Intelligence – Chemistry – Physics

PUBLICATIONS

1. L. Zhang, Y. Huang, Z. Cao, **Y. Jiao**, H. Qian, "Parallel Self-assembly for a Multi-USV System on Water Surface with Obstacles," *IEEE Transactions on Automation Science and Engineering* (Conditionally accepted).
2. L. Zhang, X. Ji, **Y. Jiao**, Y. Huang and H. Qian, "Design and Control of the 'TransBoat': A Transformable Unmanned Surface Vehicle for Overwater Construction," *IEEE/ASME Transactions on Mechatronics*, vol. 28, no. 2, pp. 1116-1126, April 2023, doi: 10.1109/TMECH.2022.3215506.
3. Y. Huang, **Y. Jiao (co-first author)**, X. Chen, L. Zhang, X. Ji, H. Qian, "Modeling and Implementation of Tacking for Wing Sail Land-Yacht," *2021 IEEE International Conference on Real-time Computing and Robotics (RCAR 2021)*, Xining, China, July 15-19, 2021, pp. 405-410.

PATENT

L. Zhang, Y. Huang, **Y. Jiao**, X. Chen, H. Qian, X. Ji, "A Control Method for Autonomous Driving of Lightweight Unmanned Wind Sail Land-yacht," China Patent, Pub. No. CN113479060A

RESEARCH EXPERIENCE

 **Prior-Assisted Indoor Semantic SLAM**, supervised by Prof. Henrik I. Christensen

10/2022 – Present

Student Researcher | *Cognitive Robotics Lab* | *UCSD*

La Jolla, USA

- Implemented prior-assisted semantic SLAM using **factor graph** representation (GTSAM) and optimized with incremental solver (**iSAM2**). Designed prior factors and improved variable initialization to assist online updates
- Solved the object-level data association by integrating short-term on-image tracking and long-term map-to-image association
- Incorporated visual odometry (**ORB-SLAM3**), object detection (**YOLOv8**), and object tracking (**SORT**) algorithms into a full semantic SLAM system
- Conducted experiments on the 3RScan dataset and the TUM RGBD dataset. Reduced the mapping error by 50% and the overall measurement error by 91% on average

Project Title: Planning for Floating Structure Construction on Water Surface by Multiple USVs

Shenzhen, CHN

- Designed and implemented a **parallel self-assembly** algorithm in MATLAB, which can be adapted for modular floating structure construction
- Represented the parallel self-assembly procedure by a **binary tree structure** (assembly tree), and proposed a method to generate a parallel construction order based on the assembly tree
- Succeeded in simulating robot group behavior at a scale of around 10 robots and obtained an overall grade of A


 **Design and Control of a Modular Transformable Unmanned Surface Vehicle (USV)**

06/2021 – 12/2021

Research Intern / Robotics and Artificial Intelligence Laboratory (RAIL) / CUHKSZ

Shenzhen, CHN

- Accomplished the parameter identification of the USV dynamic model. Employed the **Trust Region Reflective** method by adopting the Optimization toolbox in MATLAB
- Participated in the trajectory tracking experiments of the USV via **Model Predictive Control (MPC)**. Restrained the average tracking error within 3.7% in circle shape trajectory tracking

 **Tacking Strategy of Wing Sail Land-yacht**

09/2020 – 04/2021

Research Intern / RAIL / CUHKSZ

Shenzhen, CHN

- Realized the design, modeling, and implementation of upwind steering maneuver (**tacking**) for wing sail land-yacht
- Developed a model describing the steering process based on the law of energy conservation to predict the minimum initial velocity for tacking
- Identified an acceleration error function induced by the environment disturbance by a series of experiments
- Conducted hardware experiments and achieved the tacking with a high success rate of 94.7%, based on the predicted minimum initial steering velocity

SELECTED COURSE PROJECTS

 **Multi-Agent Assignment and Planning** | MAE247 Cooperative Control of Multi-Agent Systems

05/2023 – 06/2023

- Reviewed extensive literature in multi-agent systems and demonstrated an in-depth analysis on the paper “CAPT: Concurrent assignment and planning of trajectories for multiple robots”
- Re-implemented the algorithms described in the paper. Simulated and visualized both centralized and decentralized CAPT at a scale of 10 – 20 robots. Tested with different robot sensing range
- Observed collision-free behavior of the agents with a clear trade-off between **decentralization** and **optimality**

 **Particle Filter SLAM and Texture Mapping** | ECE276A Sensing & Estimation in Robotics

02/2023 – 03/2023

- Utilized the **differential-drive** motion and observation models. Processed **encoder**, **IMU**, and **LiDAR** data to obtain measurements of the velocity input and obstacle information of the surrounding environment
- Solved the localization problem using **particle filter** and created a 2D occupancy grid map based on the estimated robot trajectory. Applied the SLAM results together with RGBD image data to construct a 2D texture map
- Achieved qualitatively non-distorted mapping outcome with 200 particles and **resampling** threshold of 20 particles

 **Warehouse Manipulation** | ECE4310 Programming in Robotics

05/2022

- Completed a vision-based grasping and sorting task by driving a 6-dof robot arm using **ROS** and **MoveIt**
- Detected object color using **HSV** color model and realized the eye-hand calibration. Implemented robust task planning and collision-free trajectory planning to fetch and sort items into different bins based on the detected color
- Improved the system efficiency by optimizing the end-effector trajectory and inserting failure detection checkpoints

 **Composition and Instrumental Music Generation** | EIE3510 Digital Signal Processing

11/2021 – 12/2021

- Composed and created a piece of piano melody from a slice of bird song and designed a GUI for demonstration in MATLAB. Obtained scores of 100pts/100 for proposal and 98pts/100 for report and code
- Denoised the bird song using an **FIR bandpass filter** and achieved a signal-to-noise ratio of 10.83dB. Extracted the fundamental frequency components by **spectrogram** analysis to generate digital notes (keys and beats)
- Mimicked the timbre of piano based on the ADSR envelope model and by superposition of high order harmonics

TEACHING EXPERIENCE

UG Tutorial Teaching

09/2021 – 12/2021

Teaching Assistant / CUHKSZ

Shenzhen, CHN

- Taught tutorials of the course *Principles of Communication Systems* in English. Facilitated students to review lecture content, demonstrated solutions to assignment questions, and explained the physical interpretation
- Discussed grading standards on quizzes and exams with the course teaching team. Offered individual support to students during weekly office hours