

Chong CAO

☎ (+86) 19803647860 ✉ cxls1534826624w@sjtu.edu.cn

Education

Shanghai Jiao Tong University

Bachelor's Degree of Automation

Sep 2021 – Jun 2025 (Expected)

Shanghai, China

GPA: 92/100, **Rank:** 1/87

Core Courses: *Robotics: 95; Modern Control Theory 97; Principles of Automatic Control(A): 94; Linear Algebra: 95; Introductory Pattern Recognition: 98.5; Fundamentals of Digital Image Processing: 95; Introduction to Control: 97.*

Honors:

- ZhiYuan scholarship (Dec 2023, Dec 2022, 15%)
- Samsung Scholarship (Oct 2023, as the 3rd place in the Department of Automation)
- “Pan Wenyuan” scholarship (Oct 2022, as the 2nd place in the Department of Automation)
- The First Prize, Shanghai Regional Competition, National Undergraduate Electronics Design Contest, 2024
- The Second Prize, Shanghai Regional Competition, National Undergraduate Electronics Design Contest, 2023

Research Experience

Improve human-robot interaction by Imitation Learning and Inverse Optimal Control

August 2024 - now

Supervisor: Prof. Jianping He. IWIN-FINS Lab, Shanghai Jiao Tong University

Shanghai, China

In This project, we want to utilize Imitation Learning(IL) and Inverse Optimal Control(IOC) to deduce human intention in human-robot interaction. In the considering context, the human intention is represented by the Q and R weight parameters in LQR control. We hope to combine game theory and IL/IOC methods to improve the robot's efficiency of coordinating with human proactively.

- Surveyed current research status of human-robot interaction and Imitation Learning
- Got an initial conclusion that there is few work utilizing IL to learn the human intention online in the task in which humans and robots physically interact.
- reproduced a similar work which utilizes game theory to model human-robot interaction and adapt the Q and R parameters in LQR by gradient descent method.

Proactive Robot assistance considering human uncertainty

Mar 2024 - now

Supervisor: Prof. Hesheng Wang. IRMV Lab, Shanghai Jiao Tong University

Shanghai, China

This Project used LSTM to predict the human user's intention and LQR as the control method. The LSTM model will output not only the desired state but also the prediction covariance matrices. We combine this uncertainty information into control to improve the performance of robot assistance.

- The human manipulated a sawyer robot to move it from the start point to the endpoint, avoiding obstacles in the process. The resulting trajectory and sensed human force constitute the training data.
- Complemented the controller program and collected training data.
- Conducted robot assistance experiments and analyze the reasons of bad results.
- Complete part of the adaptation control law theory work.

Human-robot shared visual control

Sep 2023 - Mar 2024

Supervisor: Prof. Hesheng Wang. IRMV Lab, Shanghai Jiao Tong University

Shanghai, China

This Project used game theory to model the behaviors of human and robot in the visual servoing task and proposed a human-robot shared visual servoing system framework. The human intention was estimated based on the measured human force and used to dynamically adjust the robot control target to achieve human-robot shared control.

- Learned the use of ROS and basic knowledge of robot, such as kinematics, dynamics and robot controller design.
- Complemented the controller program and wrote the robot state and control command publishing programs.
- Calibrated the intrinsic matrix of the camera and the homogeneous transform matrix from the robot base frame to the camera frame.
- Conducted experiments on Sawyer robot to verify the effectiveness of the proposed method.
- Used MATLAB to process experimental data.
- Completed this work and summarized to a paper as a co-author.

Competition Experience

National Undergraduate Electronics Design Contest

Aug 2024

The selected project required using the visual module and an arm robot to complete an automatic system of the tic-tac-toe game which needed to play with a human and ensure victory or draw. We used an OpenMV camera and a Mirobot to construct the system.

- Used an OpenMV camera to recognize the white and black tiles, as well as the checkerboard state, based on the encapsulated recognition function.
- Solved the coordination transform problem between the camera and robot using the least square method.
- Solved the communication between the Single-Chip Microcomputer and the OpenMV camera.
- Designed the game algorithm which used the recognition data as input and output the coordinate of tile and corresponding placing position on the checkerboard.
- Received the First Prize in Shanghai regional competition

National Undergraduate Electronics Design Contest

Aug 2023

The selected task contained two parts: the first required controlling a red laser point to move along a black rectangle stuck on a board. The second required controlling a green laser point to follow the red laser point moving along the rectangle.

- Constructed a visual servo motion system using brackets, servos, laser pens, a K210 camera, and a single-chip microcomputer.
- Used the K210 camera to recognize the coordinates of corners of the rectangle and laser points.
- Solved the communication problem between the single-chip microcomputers and the K210 camera.
- Controlled the motion of the servos based on the PID method.
- Received the Second Prize in Shanghai regional competition

Course Project

Project of Fundamentals of Digital Image Processing

Jan 2024

This project required using traditional image recognition methods or convolutional neural network(CNN) methods to recognize the gestures(rock, scissors, and paper) in the test set.

- Adopted the SIFT+K-means+SVM method to recognize the gestures.
- Adopted the CNN method and constructed the network based on the AlexNet.
- The best accuracy of the SIFT+K-means+SVM method and CNN method on the test set was 86.3% and 97%, respectively. Based on the result and the training process, the CNN method was easier to use and achieved higher recognition accuracy.
- Received a final score of 95 for this project.

Extra Experience

2023 SJTU-THU-PKU Computer Science Summer School

Jul 2023

- Listened some reports and learned two courses *Cryptography in Blockchain* and *Frontiers in Artificial Intelligence: Principles and Practice*.
- Participated 2023 world artificial intelligence conference(WAIC).
- Visited Microsoft Research Asia and Shanghai Artificial Intelligence Laboratory
- Received an outstanding certificate.

USTC 2022 FuSEP Global Online Summer Camp

Jul 2022

- Listened lectures on frontier technology and Chinese traditional culture.
- Received the completion certificate.

Skills

Programming Language: Python, C++, Matlab

Developer Tools: VSCode, Pycharm

Technologies/Frameworks: ROS, Linux