Yifeng Cao

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EDUCATION

Columbia University, *New York, USA* Dec 2024
Master of Electrical and Electronics, GPA: 3.82/4.00

North China University of Technology (NCUT), *Beijing, CHN* Jun 2022
Bachelor of Engineering in Automation, GPA: 3.88/4.00

ACADEMIC EXPERIENCE

Columbia University, ROAM LAB, *New York, USA* Sep 2023 - Present

Supervisor: Ph.D. Zhanpeng He and Prof. Matei Ciocarlie

- Independently developed and integrated a Human-in-the-Loop approach with advanced Offline Reinforcement Learning algorithms, including Soft Actor-Critic (SAC), Batch-Constrained deep Q-learning (BCQ), and Conservative Q-Learning (CQL). Assessed and optimized their performance within RLbench and D4RL environments.
- Engineered and executed a sophisticated learning-based control policy for the UR5 robotic arm using ROS2, ensuring high precision and efficiency in automated tasks.
- Innovatively adapted and implemented a Diffusion policy to address high-uncertainty states, enabling the AI agent to determine optimal times for seeking human expert assistance. This significantly enhanced the adaptability and effectiveness of the algorithms in multimodal action scenarios.

Columbia University, Creative Machines Lab, *New York, USA* May 2024 - Present

Human-Robot Interaction System Development, Supervisor: Ph.D. Yuhang Hu and Prof. Hod Lipson

- Leveraged Large Language Model (LLM) and text-to-speech technology to process human language inputs, generating realistic robotic audio responses.
- Innovatively created videos depicting the robot speaking with natural human-like expressions and lip movements, utilizing synthesized audio and robot face images.
- Combined facial landmark tracking and synthesized robot talking video to generate control video based on Variational AutoEncoder (VAEs) modal, thus these videos precisely direct facial motor movements. This approach significantly improved the quality and realism of human-robot interactions.

New York University, CILVR LAB, *New York, USA* Jun 2024 - Present

Supervisor: Postdoc. Raunaq Bhirangi and Prof. Lerrel Pinto

- Incorporated a Feature-wise Linear Modulation (FiLM) structure into the existing image encoder to process tactile sensor data, enhancing the new structure's performance significantly. This adaptation improved success rates by approximately 15% across most tasks.
- Independently developed various task scenarios specifically designed for the use of tactile sensors, including tasks like inserting chargers into sockets and wiping whiteboards. Utilized our 'Open Teach' method with virtual reality to collect data, demonstrating that these tasks were infeasible without tactile sensors and thereby underscoring the essential utility of our tactile sensors.

University of Chinese Academy of Sciences (UCAS), *Beijing, CHN* Jun 2021 - Jun 2022

Supervisor: Assoc. Prof. Haoran Li and Prof. Dongbin Zhao

- Developed a high-fidelity Unity-based simulation environment for the Mecanum-wheel chassis and gimbal through Real2Sim dynamic modeling, facilitating efficient and cost-effective testing and training of control algorithms.
- Implemented Sim2Real transfer by refining the simulation model using real-world vehicle data and deploying Python-based reinforcement learning algorithms on the physical robot, resulting in a 20% improvement in control accuracy.
- Created ROS1-based interaction between low-level control system and high-level identification.
- Applied Reinforcement Learning to achieve the autonomous decision-making of the robot, such as path planning, striking and tactics selection.
- Employed YOLOv5 model to train the labeled data for visual recognition development in Python.
- Added A-star algorithm to complete the global planning and navigation, combined visual odometry and wheel odometry to obtain the accurate coordinate of the robot, and applied Bezier Smooth algorithm to assure more stable robot motion. This integrated approach decreased the navigation error from 15cm to 5cm.

North China University of Technology (NCUT), *Beijing, CHN* Sep 2019 - Jul 2021

- Programmed with C in Keil v5 to realize the control of the robot, achieved motor control of omnidirectional motion of Mecanum wheel based on CAN communication and PID controller.
- Partook in the PCB design and packaging of the core chip of the robot based on Altium designer.
- Assisted in a Two-Wheeled Self-balancing Car mechanical design and test by modeling in SolidWorks.
- Applied Kalman filter and median filter to obtain robust gyroscope data to better ensure the balance of the car.

COURSE PROJECT

Team leader, *CS Retake Mode with Behavioral Cloning* Sep 2023 - Dec 2023

- Assigned tasks based on each person's expertise and developed corresponding timetables
- Created an AI agent for Counter-Strike: Global Offensive (CSGO) retake mode using Video Vision Transformers (ViViT)

Large Language Model (LLM) Game NPC May 2023 – Sep 2023

- Developed a game testing environment with C# and Unity, integrating Python scripts to interact with the LLM component, enabling the creation of intelligent, context-aware NPCs.
- Implemented Attention Mechanism to enhance NPC's context-awareness, and fine-tuned prompts to endow NPCs with game-specific self-perception and adaptive backstories, ensuring coherent and immersive player-NPC interactions.

PUBLICATION

- **Yifeng Cao**, Y. F. Wu, Z. Y. Tian, X. Yu, An auxiliary tool for preliminary tests of skin cancer: A self-modifying meta-learning method for clean and noisy data. 2021 2nd International Conference on Big Data & Artificial Intelligence & Software Engineering (ICBASE), ISBN: 978-1-6654-2709-8, pp.172-176

LANGUAGE AND IT SKILLS

- C/C++/C#, Python, Matlab/Simulink, ROS1, ROS2, Altium Designer, Unity, SolidWorks, LabVIEW, G-code, Adobe Premiere, Linux, LaTex