

ZHAORUN CHEN

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EDUCATION

Shanghai Jiao Tong University (SJTU) School of Electronic Information and Electrical Engineering (SEIEE) **Shanghai, China**

Bachelor of Engineering in Automation

Sept. 2018 – June 2022

GPA: Overall: 3.7/4 (87.3/100)

Core Courses: Data Structure (93), Thinking and Approaching of Programming (94), Digital Image Processing (93), Human Factors in System Design (95), Robotics (91), Digital Signal Processing (90), Database Principles and Applications (91)

Purdue University Elmore Family School of Electrical and Computer Engineering

West Lafayette, IN, US

Master in Electrical and Computer Engineering (2 year program, full-funded)

Aug. 2022 – Aug. 2023

GPA: Overall: 3.6/4

Core Courses: MA511 Linear Algebra with Applications (A+), ECE602 Lumped System Theory (A), ECE608: Computational models and Methods (A), ECE629 Neural Networks Theories (A), ECE695 Advanced IoT Design & Applications (A+)

PUBLICATIONS AND PRE-PRINTS

- Chen, Z.**, Chen, B., He, T., Gong, L., & Liu C. (2023). Progressive Adaptive Chance-Constrained Safeguards for Reinforcement Learning. submitted to *2024 IEEE International Conference on Robotics and Automation (ICRA)*, arXiv preprint [arXiv:2310.03379](https://arxiv.org/abs/2310.03379)
- Chen, Z.**, Zhu, Z., Zhang, R., Li, X., Raj, B., & Yao., H. (2023). AutoPRM: Self-supervised Fine-grained Feedback for Multi-Step Reasoning via Controllable Question Decomposition. submitted to *2024 NAACL, ACL Rolling Review December Cycle*
- Gong, L., **Chen, Z.**, Sun, T., Li, X., Lin, K., Liu, C., Díaz-Rodríguez, N., & Filliat, D. (2023). Embodied Cognition Based Robot Teaching via Learning from Demonstration in Dynamic Environments," *IEEE Transactions on Cognitive and Developmental Systems (TCDS)*, accepted with a major revision.
- Hai, X., Liu, X., **Chen, Z.**, Tan, Y., Zhang, H., Liu, G., Zhou, R., & Zhou, X. (2023). Ghost in Wave: An Attribute That Misleads All Deepfake Voice Detectors in ASVspoof. Submitted to ICASSP.
- Chen, Z.**, Chen, B., Xie, S., Gong, L., Liu, C., Zhang, Z., & Zhang, J. (2021, September). Efficiently training on-policy actor-critic networks in robotic deep reinforcement learning with demonstration-like sampled exploration. In *2021 3rd International Symposium on Robotics & Intelligent Manufacturing Technology (ISRIMT)* (pp. 292-298). IEEE. (**Best Paper Award**).
- Xie, S., Gong, L., **Chen, Z.**, & Chen, B. (2023, July). Simulation of Real-time Collision-Free Path Planning Method with Deep Policy Network in Human-Robot Interaction Scenario. In *2023 International Conference on Advanced Robotics and Mechatronics (ICARM)* (pp. 360-365). IEEE.

MANUSCRIPTS IN PREPARATION

- Chen, Z.**, Zhao, Z., Zhu, Z., Luo, H., Gao, L., & Zhou, J. (2023). HaLC: Mitigating Object Hallucination in LVLMs via Contextual density-layer Contrastive Decoding. Targeting ACL 2024.
- Chen, Z.**, Tan, Y., Zhu, Z., Liang, D., & Su, L. (2023). Learning a Global Cost Function for Dynamic Interactive Trajectory Prediction via Contrastive Inverse Optimal Control. Targeting IJCAI 2024.

RESEARCH EXPERIENCE

Self-supervised Multi-step Reasoning Enhancement for LLMs via Controllable Problem Decomposition May 2023–Present

Advisor: Huaxiu Yao (Assistant Professor), CS, UNC Chapel Hill; Bhiksha Raj (Professor), CS, Carnegie Mellon University

- Propose AutoPRM, a process-supervision pipeline that automatically decomposes long-form reasoning into sub-questions and assign fine-grained RL rewards to intermediate steps to enhance internal logic consistency and transfer of meta-knowledge.
- To allow a holistic view of the primary problem, we propose FiM guided decoding to guide each subproblem solver towards solution of the original problem. AutoPRM improves the accuracy on GSM8K (+4.2%) and StrategyQA (+6.2%) dataset over SOTA without any external data, and further reach 70.6% on GSM8K based on MetaMath augmented data.

Mitigating Object Hallucination in LVLMM via Contextual density-layer Contrastive Decoding Aug. 2023 – Present

Advisor: Jiawei Zhou (Assistant Professor), CS, TTIC; Kevin Gimpel (Assistant Professor), CS, TTIC

- Propose the key pattern to detecting hallucination is identifying an appropriate bandwidth in the image with moderate contextual information to safely predict the object; employ pair-wise Jensen-Shannon Divergence to detect the target context window and then perform contrastive decoding to reveal its essential information.
- Our algorithm outperforms SOTA (e.g. post-editing) on benchmark datasets (e.g. COCO) in terms of CHAIR and POPE metrics.

Progressive Adaptive Chance-Constrained Safeguards for Reinforcement Learning Aug. 2022 – Present

Advisor: Liang Gong (Associate Professor), ME, SJTU; Changliu Liu (Assistant Professor), CS, Carnegie Mellon University

- Propose an advantage-based algorithm that incorporates a surrogate safety chance constraint to mitigate exploration-safety trade-offs for RL and a gradient-based hierarchical correction framework to theoretically ensure recovery to safe control set.
- Assess on 4 simulated and real-world safety-critical robotic tasks; our algorithm enforce safety (nearly zero violation) and preserve optimality (+23.8%), time efficiency (+13.7%) and generate well to high-dimensional stochastic real-world settings.

Learning a Global Cost for Interactive Trajectory Prediction via Contrastive Inverse Optimal Control Oct. 2022 – Present

Advisor: Lu Su (Professor), ECE, Purdue University

- Design a set of interactive features to effectively capture driving modes in complex traffic intersections; Present a novel self-supervised contrastive IRL algorithm to learn a global cost function for multi-modal driving policies.
- With the proposed attentional encoded map, the contrastive IOC controller addresses the curse of locality with a unified cost function; our algorithm outperforms SOTA on several trajectory prediction benchmarks (e.g. argoverse, inD, CitySim).

Unrolling Embodied Cognition via Learning from Demonstration in Dynamic Environments Mar. 2019 – Aug.2022

Advisor: Liang Gong (Associate Professor), ME, SJTU; David Filliat (Professor), INRIA Paris

- Propose a hierarchical-sampling method to distill informative guidance from few-shot noisy demonstration data; Boost RL performance (+40%) with fewer demonstration; Presented this work at *IEEE ISIRIMT 2021* and earned the “Best Paper” award.
- Release *Robotics-RL-SRL*, a simulation platform that integrated SOTA deep RL and state-representation-learning (SRL) algorithms, which has now earned over 500 stars on Github; this work is submitted to *Journal of Intelligent & Robotic Systems*.
- Establish a comprehensive embodied cognition framework for robot teaching that incorporates an enlightenment pre-training stage and a hierarchical-sampling in-training expert guidance stage; this work is accepted by *IEEE Transactions on TCDS*.

INTERNSHIP EXPERIENCE

Self-supervised Fine-grained Feedback for LLMs RLHF | Research Intern June 2023 – Aug. 2023

Advisor: Huaxiu Yao, UNC-Chapel Hill

Motion Planning for Decentralized Multi-manipulator Assembly System | AI Intern Feb. 2022 - Aug. 2022

Advisor: Cewu Lu, Flexiv Robotics Inc.

SKILLS

- **English Standard Test:** TOEFL: 111 (R: 28, L: 27, S: 28, W: 28)
- **Programming Languages:** solid expertise in Python, Matlab, C++, and various algorithms and data structures
- **Tools:** PyTorch, Matlab, LaTeX, TensorFlow, OpenCV, ROS, Linux, QT5, MySQL

AWARDS & HONOR

Full-funded two-year Guaranteed Fellowship at Purdue ECE (Very Rare) 2022
Best paper award in IEEE ISIRIMT 2021 2021
Third Prize in the Contemporary Undergraduate Mathematical Contest in Modeling 2020
First Prize in RoboCup China Open 2020
Academic Excellence Scholarship (Top 5%) 2019-2022

SERVICE

Graduate Teaching Assistant for Data Structure (ECE368) 2023.02

Graduate Teaching Assistant for Data Structure (ECE368) 2022.08