Hongyi Chen

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Research Interests

High-level robot planning and reasoning: Language-model based high-level task reasoning and decomposition; Neuro-symbolic planner; Planner-guided progressive skill learning.
Contact-rich manipulation: Bridge learning and control theory to create robust and efficient solutions for greater scopes of contact-rich manipulation tasks.
Trustworthy learning algorithms: Design reliable learning and execution models using rigorous control theory to achieve safety assurances and robustness guarantees.
Application: Smart robotics for manufacturing applications and daily household assistants.

Education

Carnegie Mellon University, Pittsburgh, PA
Incoming Ph.D in Robotics 2023 Fall

Georgia Institute of Technology, Atlanta, GA — May 2023
M.S in Robotics; GPA: 4.0 / 4.0

Carnegie Mellon University, Pittsburgh, PA — May 2021
M.S in Electrical and Computer Engineering; GPA: 3.72 / 4.0

Peking University, Beijing — June 2019
B.A in Economics; GPA: 3.19 / 4.0

Beijing University of Chemical Technology (BUCT), Beijing — June 2018
B.S in Mathematics and Applied Mathematics; GPA: 3.88 / 4.0

Refereed Journal Publications

[1] Ruinian Xu, **Hongyi Chen**, Yunzhi Lin and Patricio A. Vela. SGL: Symbolic Goal Learning for Human Instruction Following in Robot Manipulation. *Robotics and Automation Letters (RA-L) with the IROS option*, 7(4):10375–10382. 2022 [PDF]

[2] **Hongyi Chen**, Changliu Liu. Safe and Sample efficient Reinforcement Learning for Clustered Dynamic Uncertain Environments. *IEEE Control System Letters (L-CSS) with ACC option*, 6:1928–1933. 2021 [PDF]

[3] **Hongyi Chen**, Fan Zhang, Bo Tang, Qiang Yin and Xian Sun. Slim and Efficient Neural Network Design for Resource-Constrained SAR Target Recognition. *Remote Sensing*, 10(10):1618. 2018 [PDF]

Refereed Conference & Workshop Publications

[4] **Hongyi Chen**, Yilun Du, Yiye Chen, Patricio A. Vela, Joshua B. Tenenbaum. Planning with Language Models through Iterative Energy Minimization. In: *The International Conference on Learning Representations (ICLR)*, 2023. Under Review [PDF]

[5] **Hongyi Chen**, Letian Wang, Yuhang Yao, Ye Zhao, and Patricio A. Vela. Human Instruction Following: Graph Neural Network Guided Object Navigation. In: *CVPR workshop in Embodied AI*, 2022. Accepted [PDF]

[6] **Hongyi Chen**, Shiyu Feng, Ye Zhao, Changliu Liu, and Patricio A. Vela. Safe Hierarchical Navigation in Cluttered Dynamic Uncertain Environments. In: *IEEE Conference on Decision and Control (CDC)*, 2022. Accepted [PDF]

Research Experience

Georgia Institute of Technology, Atlanta, GA — Dec 2021 – present
Advisor: Patricio A. Vela, School of Electrical and Computer Engineering

- Designed a hierarchical solution consisting of a multi-phase planner and a low-level safe controller to jointly solve the safe navigation problem in crowded, dynamic, and uncertain environments.
- Developed a hybrid planner combining symbolic and neural-based approaches for human instruction parsing and task planning, and further designed a semantic graph neural network guided object searching for home-assistant robots.

Advisor: Danfei Xu, School of Interactive Computing

- Deployed human instruction following pipeline, including 3D map construction, object search and manipulation, on physical stretch robots.

- Decompose high-level tasks into mid-level plans with language models and train the task skills in self-supervised way through language guidance.

Massachusetts Institute of Technology, Cambridge, MA Jun 2022 – present
Advisor: Joshua B. Tenenbaum, Department of Brain and Cognitive Sciences
- Proposed an iterative planning approach with language models through energy minimization, and further demonstrate its unique benefits, including new task generalization, test-time constraints adaptation, and the ability to compose plans together.

Carnegie Mellon University, Pittsburgh, PA Jan 2021 – Sep 2021
Advisor: Changliu Liu, Robotics Institute
- Exploited safe control theory to address two major challenges in reinforcement learning (RL): satisfying safety constraints and efficiently learning with limited samples.

Tsinghua University, Beijing Jun 2018 – Sep 2018
Advisor: Zhihui Du, Department of Computer Science and Technology
- Accelerated online-searching for gravitational waves by parallelizing the linear recurrence computation and optimizing the inefficient memory access in GPU.

Beijing University of Chemical Technology, Beijing Feb 2018 – May 2018
Advisor: Fan Zhang, College of Information Science and Technology
- Designed slimmed CNN in resource-constrained platforms, achieving 40x model compression while maintaining its accuracy for synthetic aperture radar target recognition.

Professional Experience

Carnegie Mellon University, Pittsburgh, PA May 2020 – Aug 2020
Autonomous Driving Software Engineer
- Implemented path planning algorithms, from high level behavior planning to low level RRT path generation; Improved localization accuracy by fusing the IMU and GPS sensor.

Interdisciplinary-Technology Company, Beijing Feb 2020 – May 2020
Quantitative Trading Researcher
- Constructed and optimized effective stock factors using genetic algorithms and further developed the dynamic contextual multi-factor model to build stock portfolio.

Course Projects

Carnegie Mellon University, Pittsburgh, PA
18-349 Introduction to Real-Time Embedded Systems (A)
- Developed a real-time kernel capable of admission control, task scheduling, isolation, and synchronization.

Georgia Institute of Technology, Pittsburgh, PA
CS8803 Specical Topics in Compiler (A)
- Built a TigerCompiler that includes scanner, parser and syntax error detector in front-end, and is capable of semantics analysis and IR code generation in back-end.

Awards and Honors

Outstanding Undergraduate Thesis (Top 1%) of BUCT, 2018
Outstanding Student Scholarship (Top 5%) of BUCT, 2014, 2015

Technical Skills

Programming: C/C++, Python, Jave, CUDA
Tools: Tensorflow, Pytorch, ROS
Languages: Proficient in English and Chinese