# Letian (Zac) Chen

letian.chen@gatech.edu www.letianchen.me/ +1 (404) 247-9580 Zac Chen

## Education

**Georgia Institute of Technology, Atlanta GA** Expected Dec 2024

*Doctor of Philosophy in Computer Science*, School of Interactive Computing. GPA: 4.00/4.00.

- Advisor: Dr. Matthew Gombolay.

**Georgia Institute of Technology, Atlanta GA** May 2020

*Master of Science in Computer Science*, College of Computing.

- Thesis: "Robot Learning from Heterogeneous Demonstration".
- Concentration: Machine Learning. GPA: 4.00/4.00.

**Peking University, Beijing China** July 2018

*Bachelor of Science in Computer Science*, School of Electronics Engineering and Computer Science.

*Bachelor of Science in Psychology*, School of Psychological and Cognitive Sciences.

## Awards & Honors

- Amazon Science Scholarship for AAAI 2022 Feb 2022
- Best Paper Finalist for Conference on Robot Learning (CoRL 2020) Nov 2020
- First Place in Brainhack ATL 2019 Track 2 Nov 2019
- Beijing Merit Graduate Jul 2018
- Excellent Graduate, Peking University Jul 2018
- Zhang Wenjin Scholarship Dec 2017
- Scholarship for Undergraduate research Sep 2017
- First-Prize Winner of National Olympiad in Informatics (Zhejiang Province) 2008, 2009, 2010, 2011

## Selected Research Projects

**Safe Learning form Demonstration** 2022-2023

- Created a new modality for users to specify safe vs. unsafe states for robots via demonstrations.
- Proposed a novel shielding algorithm, SECURE, that can be applied on policies to enforce customized safety bounds (defined by users), via a combination of data-driven control-barrier function and task-aware safe action search.
- Tested SECURE on two simulated robotic control tasks and a real robot kitchen cutting task where the robot is equipped with a knife; showed SECURE successfully prevent all unsafe executions, such as human-hand entering robot cutting space.

**Learning Interpretable Tree-based Control Policies for Autonomous Driving** 2022-2023

- Developed interpretable, tree-based continuous-control models that allow gradient updates.
- Demonstrated the strong qualitative and quantitative performance of the proposed model in comparison with black-box neural networks in 10+ driving scenarios.
- Verified interpretability with user-studies to show the proposed model is easier and faster to interpret than neural networks and other interpretable models.

**Learning from Offline Heterogeneous Demonstrations** 2022-2023

- Analyzed real Mars rover driving data and identified heterogeneity among rover drivers.
- Proposed a novel IRL framework, DROID, to accomodate the offline learning required by the application while allowing learning from heterogeneous demosntrations via dual reward and policy distillation.
- Applied DROID on two simulated robotic control tasks and the real Mars rover path-planning problem; achieved better learning and generalization to unseen conditions in all three domains.

**Fast Lifelong Adaptive Learning from Demonstrations** 2021

- Analyzed the personalization problem in lifelong learning from demonstration process where large number of heterogeneous demonstrations arrive sequentially by federation among users.
- Proposed a novel IRL framework, FLAIR, to provide efficient personalization and scalability by constructing *policy mixtures* with a concise set of prototypical strategy policies.
- Applied FLAIR on three virtual robotic control tasks and a real robot table-tennis task; achieved better personalization with significantly higher sample efficiency.

**Learning from Suboptimal Demonstrations** 2020

- Characterized policy performance degradation from noise injection by a sigmoid function.
- Proposed a novel IRL framework, SSRR, to learn policies that are better than suboptimal demonstrations by inferring the idealized reward function (i.e., the latent intent of the demonstrator).
- Applied algorithm on three virtual robotic tasks and a real robot table-tennis task; achieved accurate recovery of the demonstrator intention and a better-than-best-demonstration policy.

**Learning from Heterogeneous Demonstrations** 2019

- Modeled humans' latent objective via shared task reward and individual strategy reward.
- Proposed a novel IRL framework, MSRD, to jointly infer task reward and strategy reward to gain a better estimation of both.
- Applied algorithm on two virtual robot control tasks and one real robot table-tennis task; achieved better learning of task reward than SOTA AIRL, extracted precise strategic rewards, and optimized versatile policies that resemble the heterogeneous demonstrations.

## Teaching & Leadership Experience

### Advising & Mentorship

- Yue Yang, M.Sc. Student at Georgia Tech, now Ph.D. Student at UNC
- Sravan Jayanthi, B.Sc. and M.Sc. Student at Georgia Tech, now at C3 AI
- Daniel Martin, M.Sc. Student at Georgia Tech, now at Amazon Robotics
- Steve Zakharov, M.Sc. Student at Georgia Tech, now at Blue River Technology
- Sumedh Naik, M.Sc. Student at Georgia Tech, now at Intel
- Van Duong, M.Sc. Student at Georgia Tech, now at Jet Propulsion Laboratory

### Teaching Assistantship

- *Interactive Robot Learning* (CS 7648, Graduate-level), Georgia Tech (Spring 2021)
- *Machine Learning* (OMSCS 7641, Graduate-level), Georgia Tech (Fall 2020, Spring 2019)
- *Introduction to Computation* (Undergraduate-level), Peking University (Fall 2016)

### Guest Lecture

- *Interactive Robot Learning* (CS 7648, Graduate-level), Georgia Tech (Fall 2022, Spring 2021)

### Leadership

Academic President of Student Association, School of Psychological and Cognitive Sciences, Peking University (2015 - 2016)

## Industry Experience

**Toyota Research Institute**, *Research Intern* May 2023 – Aug 2023

- Implemented DIAYN to generate diverse driving policies for autonomous racing.
- Proposed a novel algorithm, Learn Thy Enemy (LTE), to model and leverage opponent information in multi-car racing.
- Deployed DIAYN and LTE policies on motion simulator hardware and demonstrated qualitatively and quantitatively high performance.

**iRobot Corporation**, *Reinforcement Learning Research Intern* May 2021 – Aug 2021

- Identified real-world challenges of Offline Policy Evaluation (OPE) algorithms.
- Created a benchmark dataset for OPE with real-world challenges.
- Proposed an ad-hoc OPE algorithm selection method to decide which OPE algorithm is reliable with the task and available offline data.

## Academic Service

**Reviewer for**

- International Conference on Human Robot Interaction (HRI)
- Conference on Robot Learning (CoRL)
- International Symposium of Robotic Research (ISRR)
- IEEE Robotics and Automation Letters (RA-L)
- International Conference on Intelligent Robots and Systems (IROS)
- International Conference on Robotics and Automation (ICRA)
- International Conference on Autonomous Agents and Multiagent Systems (AAMAS)
- Robotics: Science and Systems (RSS)
- International Conference on Machine Learning (ICML)

## Publications

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| Neuromodulation ′24 | E. Cole, M. Schrum, E. Opri, **L. Chen**, A. Nascimento, P. Testini, A. Wang, F. Isbaine, R. Gross, M. Gombolay, and S. Miocinovic, "Automated deep brain stimulation programming via meta-active learning of evoked potentials," in *North American Neuromodulation Society Conference*, 2024 |
| HRI ′24 | **L. Chen***, Y. Yang*, Z. Zaidi*, S. van Waveren, A. Krishna, and M. Gombolay, "Enhancing safety in learning from demonstration algorithms via control barrier function shielding," in *Proceedings of International Conference on Human-Robot Interaction (HRI)*, 2024 |
| CoRL ′23 OOD Workshop | V. Sreeramdass, R. R. Paleja, **L. Chen**, S. van Waveren, and M. Gombolay, "Generalized behavior learning from diverse demonstrations," in *First Workshop on Out-of-Distribution Generalization in Robotics at CoRL 2023*, 2023 |
| CoRL ′23 | **L. Chen***, S. Jayanthi*, N. Balabanska, V. Duong, E. Scarlatescu, E. Ameperosa, Z. H. Zaidi, D. Martin, T. D. Matto, M. Ono, and M. Gombolay, "Droid: Learning from offline heterogeneous demonstrations via reward-policy distillation," in *Proceedings of Conference on Robot Learning (CoRL)*, 2023 |
| Current Robotics Reports | **L. Chen***, M. Natarajan*, E. Seraj*, B. Altundas*, R. Paleja*, S. Ye*, R. Jensen, K. C. Chang, and M. Gombolay, "Human-robot teaming: Grand challenges," *Current Robotics Reports*, pp. 1–20, 2023 |
| IROS ′23 | S. Ye, M. Natarajan, Z. Wu, R. Paleja, **L. Chen**, and M. C. Gombolay, "Learning models of adversarial agent behavior under partial observability," in *Proceedings of International Conference on Intelligent Robots and Systems (IROS)*, 2023 |
| MRS ′23 | Z. Wu, S. Ye, M. Natarajan, **L. Chen**, R. Paleja, and M. C. Gombolay, "Adversarial search and track with multiagent reinforcement learning in sparsely observable environment," in *Proceedings of International Symposium on Multi-Robot & Multi-Agent Systems (MRS)*, 2023 |

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| IEEE RA-L | Z. Zaidi, D. Martin, N. Belles, V. Zakharov, A. Krishna, K. M. Lee, P. Wagstaff, S. Naik, M. Sklar, S. Choi, Y. Kakehi, R. Patil, D. Mallemadugula, F. Pesce, P. Wilson, W. Hom, M. Diamond, B. Zhao, N. Moorman, R. Paleja, **L. Chen**, E. Seraj, and M. Gombolay, "Athletic mobile manipulator system for robotic wheelchair tennis," *IEEE Robotics and Automation Letters*, vol. 8, no. 4, pp. 2245–2252, 2023 |
| HRI '23 | K. M. Lee*, A. Krishna*, Z. Zaidi, R. Paleja, **L. Chen**, E. Hedlund, M. Schrum, and M. Gombolay, "The effect of robot skill level and communication in rapid, proximate human-robot collaboration," in *Proceedings of International Conference on Human-Robot Interaction (HRI)*, 2023 |
| CoRL '22<br>Agility Workshop | Y. Yang*, **L. Chen***, and M. Gombolay, "Safe inverse reinforcement learning via control barrier function," in *Proceedings of CoRL Agility Workshop*, 2022 |
| CoRL '22 | **L. Chen***, S. Jayanthi*, R. R. Paleja, D. Martin, V. Zakharov, and M. Gombolay, "Fast lifelong adaptive inverse reinforcement learning from demonstrations," in *Proceedings of Conference on Robot Learning (CoRL)*, 2022 |
| AAAI '22<br>IML Workshop | **L. Chen***, S. Jayanthi*, and M. Gombolay, "Strategy discovery and mixture in lifelong learning from heterogeneous demonstration," in *Proceedings of AAAI Interactive Machine Learning workshop*, 2022 |
| IEEE T-RO | E. Seraj, **L. Chen**, and M. Gombolay, "A hierarchical coordination framework for joint perception-action tasks in composite robot teams," *IEEE Transactions on Robotics*, 2021 |
| AAAI '21<br>AI-HRI Symposium | **L. Chen**, R. Paleja, and M. Gombolay, "Towards sample-efficient apprenticeship learning from suboptimal demonstration," in *Artificial Intelligence for Human-Robot Interaction (AI-HRI), AAAI Fall Symposium Series*, 2021 |
| MICCAI '21 | R. D. Dias, M. A. Zenati, G. Rance, R. Srey, D. Arney, **L. Chen**, R. Paleja, L. R. Kennedy-Metz, and M. Gombolay, "Using machine learning to predict perfusionists' critical decision-making during cardiac surgery," *Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization*, vol. 10, no. 3, pp. 308–312, 2022 |
| CoRL '20 | **[Best Paper Finalist][Plenary Talk] L. Chen**, R. Paleja, and M. Gombolay, "Learning from suboptimal demonstration via self-supervised reward regression," in *Proceedings of Conference on Robot Learning (CoRL)*, 2020 |
| Master's Thesis | **L. Chen**, "Robot learning from heterogeneous demonstration," *Master Thesis*, 2020 |
| Neurips '20 | R. Paleja, A. Silva, **L. Chen**, and G. Matthew, "Interpretable and personalized apprenticeship scheduling: Learning interpretable scheduling policies from heterogeneous user demonstrations," in *Proceedings of Advances in Neural Information Processing Systems (NeurIPS)*, 2020 |
| HRI '20 | **L. Chen**, R. Paleja, M. Ghuy, and M. Gombolay, "Joint goal and strategy inference across heterogeneous demonstrators via reward network distillation," in *Proceedings of International Conference on Human-Robot Interaction (HRI)*, 2020 |

Undergrad Thesis

**L. Chen**, "Model-free vs model-based algorithms in human sequential decision making," *Undergraduate Thesis*, 2018