

Ian Char

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RESEARCH INTERESTS

My main research interests are focused around deep reinforcement learning, decision making under uncertainty, and uncertainty quantification. I am particularly interested in developing algorithms for engineering and the sciences.

EDUCATION

Carnegie Mellon University, Pittsburgh, PA, United States

Ph.D. in Machine Learning

Advisor: Jeff Schneider

August 2018 - Present

University of Colorado Boulder, Boulder, CO, United States

M.S./B.S. in Applied Math and B.S. in Computer Science

Advisor: Manuel Lladser

UGRD GPA: 4.00, GRAD GPA: 3.88

August 2013 - May 2018

RESEARCH EXPERIENCE

Carnegie Mellon University, Pittsburgh, PA, United States

Control for Nuclear Fusion

August 2018 - Present

My research efforts during my Ph.D. have all revolved around learning controls for tokamaks. In particular, I have worked on reinforcement learning, Bayesian optimization, and uncertainty quantification. A significant amount of my time has focused on using historical data and implementing controllers on a real physical device (DIII-D).

University of Colorado Boulder, Boulder, CO, United States

Stochastic Analysis of Minimal Automata

August 2016 - May 2018

For my master's thesis, I worked with Professor Manuel Lladser to analyze the growth rate of a particular class of minimal deterministic finite automaton. We derived a high probability bound on the number of states that grows polynomially.

WORK EXPERIENCE

Google, *Software Engineering Intern*

May 2017 - August 2017

- Integrated several components into simulation to evaluate Google's supply chain.
- Leveraged simulation framework to conduct several studies on how varying several quantities such as weeks of supply and lead time affect overall performance.

Terra Bella (Google), *Software Engineering Intern*

May 2016 - August 2016

- Analyzed historical weather datasets in order to help predict the supply of satellite imagery that could be provided.
- Ingested a new dataset with over 54,000 images into Google Earth Engine for internal use.

Google, *Software Engineering Intern*

May 2015 - August 2015

- Created an interactive tutorial in order to teach users about AdWords' Conversion Tracking.
- Implemented an Android package name search service in Conversion Tracking.

SOFTWARE

Uncertainty Toolbox, <https://uncertainty-toolbox.github.io/>

2020

- Open source python library for predictive uncertainty quantification, calibration, metrics, and visualizations.
- Currently has more than 1.5k stars on GitHub.

PUBLICATIONS

CONFERENCES AND JOURNALS

Char, I. & Schneider, J. "PID-Inspired Inductive Biases for Deep Reinforcement Learning in Partially Observable Control Tasks." In *Advances in Neural Information Processing Systems*, 2023.

Char, I., Abbate, J., Bardóczi, L., Boyer, M., Chung, Y., Conlin, R., ... & Schneider, J. (2023, June). "Offline Model-Based Reinforcement Learning for Tokamak Control." In *Learning for Dynamics and Control Conference* (pp. 1357-1372). PMLR.

Li, X., Mehta, V., Kirschner, J., Char, I., Neiswanger, W., Schneider, J., ... & Bogunovic, I. (2022). "Near-optimal Policy Identification in Active Reinforcement Learning." *International Conference on Learning Representations*, 2023.

Mehta, V., Char, I., Abbate, J., Conlin, R., Boyer, M., Ermon, S., ... & Neiswanger, W. (2022). "Exploration via planning for information about the optimal trajectory." *Advances in Neural Information Processing Systems*, 35, 28761-28775.

Apostolopoulou, I., Char, I., Rosenfeld, E. & Dubrawski, A. "Deep Attentive Variational Inferences." *International Conference on Learning Representations*, 2021.

Chung, Y., Neiswanger, W., Char, I. & Schneider, J. "Beyond Pinball Loss: Quantile Methods for Calibrated Uncertainty Quantification." In *Advances in Neural Information Processing Systems*, 2021.

Mehta V., Char, I., Neiswanger, W., Chung, Y., Nelson, A. O., Boyer, M., Kolemen E. & Schneider, J. "Neural Dynamics Systems: Balancing Structure and Flexibility in Physical Prediction." *IEEE Conference on Decision and Control*, 2021.

Char, I., Chung, Y., Neiswanger, W., Kandasamy, K., Nelson, A. O., Boyer, M., Kolemen, E. & Schneider, J. "Offline contextual bayesian optimization." In *Advances in Neural Information Processing Systems*, 2019.

Char, I., & Lladser, M. E. "Stochastic Analysis of Minimal Automata Growth for Generalized Strings." *Methodology and Computing in Applied Probability*, 2019.

TECHNICAL REPORTS AND WORKSHOPS

Mehta, V., Abbate, J., Wang, A., Rothstein, A., Char, I., Schneider, J., Kolemen E., Rea C. & Garneir, D. "Towards LLMs as Operational Copilots for Fusion Reactors." *NeurIPS 2023 Workshop AI4Science*.

Char, I.*, Chung, Y.*, Shah, R. & Schneider, J. "Correlated Trajectory Uncertainty for Adaptive Sequential Decision Making." *NeurIPS 2023 Workshop on Adaptive Experimental Design and Active Learning in the Real World*.

Igoe, C., Chung, Y., Char, I. & Schneider, J. "How Useful are Gradients for OOD Detection Really?" <https://arxiv.org/abs/2205.10439>

Char, I.*, Mehta, V.*, Villaflor, A., Dolan, J. & Schneider, J. "BATS: Best Action Trajectory Stitching." *NeurIPS 2021 Offline Reinforcement Learning Workshop*.

Chung, Y., Char, I., Guo H., Schneider, J. & Neiswanger, W. "Uncertainty Toolbox: an Open-Source Library for Assessing Visualizing and Improving Uncertainty Quantification." *ICML 2021 Uncertainty and Robustness in Deep Learning Workshop*.

Chung, Y., Char, I., Neiswanger, W., Kandasamy, K., Nelson, A. O., Boyer, M., Kolemen, E. & Schneider, J. "Offline contextual bayesian optimization for nuclear fusion." *NeurIPS 2019 Machine Learning and the Physical Sciences Workshop*.

AWARDS	Machine Learning Department Teaching Assistant of the Year	2021-2022
	NSF Graduate Research Fellowship	2018
	Chancellor's Award	2018
	Awarded by the chancellor of the University of Colorado for highest GPA university-wide.	

TEACHING	10-606/607: Mathematical/Computational Foundations for Machine Learning	Fall 2021
	<i>Teaching Assistant, Carnegie Mellon University</i>	
	10-716: Advanced Machine Learning: Theory and Methods	Spring 2020
	<i>Teaching Assistant, Carnegie Mellon University</i>	

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