Nicolas H. Christianson

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RESEARCH INTERESTS

Online optimization and algorithms; reliable machine learning; energy and sustainability applications

EDUCATION

California Institute of Technology, *Ph.D. in Computing and Mathematical Sciences* 2020–25 (expected)
NSF Graduate Research Fellow, 2021–present.
Advisors: Adam Wierman and Steven Low

Harvard College, *A.B. summa cum laude in Applied Mathematics* 2016–20
Honors: Phi Beta Kappa Junior 24, Detur Book Prize, John Harvard Scholar. *GPA*: 3.976/4.0.

PAPERS

*equal contribution

C. Yeh*, **N. Christianson***, A. Wu, A. Wierman, Y. Yue. "End-to-End Conformal Calibration for Optimization Under Uncertainty." Under review, preliminary proposal at *ICLR Workshop on Tackling Climate Change with Machine Learning*, 2023.

N. Christianson, W. Cui, S. Low, W. Yang, B. Zhang. "Fast and Reliable N - k Contingency Screening with Input-Convex Neural Networks." In preparation.

N. Christianson, B. Sun, S. Low, A. Wierman. "Risk-Sensitive Online Algorithms." Accepted to the Conference on Learning Theory (COLT) 2024.

A. Lechowicz, **N. Christianson**, B. Sun, N. Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy. "Chasing Convex Functions with Long-term Constraints." Accepted to the International Conference on Machine Learning (ICML) 2024.

B. Sun, J. Huang, **N. Christianson**, M. Hajiesmaili, A. Wierman, R. Boutaba. "Online Algorithms with Uncertainty-Quantified Predictions." Accepted to the International Conference on Machine Learning (ICML) 2024.

A. Lechowicz, **N. Christianson**, B. Sun, N. Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy. "Online Conversion with Switching Costs: Robust and Learning-Augmented Algorithms." Accepted to ACM SIGMETRICS/IFIP Performance 2024.

T. Chen, Y. Lin, **N. Christianson**, Z. Akhtar, M. Hajiesmaili, A. Wierman, R. Sitaraman. "SODA: Smoothness-Optimized Dynamic Adaptive Streaming." Accepted to SIGCOMM 2024.

C. Yeh, V. Li, R. Datta, J. Arroyo, **N. Christianson**, C. Zhang, Y. Chen, M. Hosseini, A. Golmohammadi, Y. Shi, Y. Yue, A. Wierman. "SustainGym: Reinforcement Learning Environments for Sustainable Energy Systems." *Conference on Neural Information Processing Systems (NeurIPS), Datasets and Benchmarks Track*, 2023.

A. Lechowicz, **N. Christianson**, J. Zuo, N. Bashir, M. Hajiesmaili, A. Wierman, P. Shenoy. "The Online Pause and Resume Problem: Optimal Algorithms and an Application to Carbon-Aware Load Shifting." *Proceedings of the ACM on Measurement and Analysis of Computing Systems*, 7.3 (2023).

L. Werner*, **N. Christianson***, A. Zocca, A. Wierman, S. Low. "Pricing Uncertainty in Stochastic Multi-Stage Electricity Markets." *IEEE Conference on Decision and Control (CDC),* 2023.

N. Christianson, J. Shen, A. Wierman. "Optimal robustness-consistency tradeoffs for learning-augmented metrical task systems." *International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2023.

D. Rutten, **N. Christianson**, D. Mukherjee, A. Wierman. "Smoothed Online Optimization with Unreliable Predictions." *Proceedings of the ACM on Measurement and Analysis of Computing Systems*, 7.1 (2023).

N. Christianson, C. Yeh, T. Li, M. Torabi Rad, A. Golmohammadi, A. Wierman. "Robustifying machine-learned algorithms for efficient grid operation." Under review at *Environmental Data* Science; preliminary version at *NeurIPS Workshop on Tackling Climate Change with Machine Learning*, 2022.

N. Christianson, T. Handina, A. Wierman. "Chasing convex bodies and functions with black-box advice." *Conference on Learning Theory (COLT)*, 2022.

N. Christianson*, L. Werner*, A. Wierman, S. Low. "Dispatch-aware planning for feasible power system operation." *Electric Power Systems Research* 212 (2022): 108597.

W. Qian, C.W. Lynn, A.A. Klishin, J. Stiso, N.H. Christianson, D.S. Bassett. "Optimizing the human learnability of abstract network representations." *Proceedings of the National Academy of Sciences* 119.35 (2022): e2121338119.

A.A. Klishin, N.H. Christianson, C.S.Q. Siew, D.S. Bassett. "Learning Dynamic Graphs, Too Slow." Preprint: *arXiv:2207.02177*.

N. Christianson, A.S. Blevins, D.S. Bassett. "Architecture and evolution of semantic networks in mathematics texts." *Proceedings of the Royal Society A* 476.2239 (2020): 20190741.

N.J. Porter, N.H. Christianson, C. Decroos, D.W. Christianson. "Structural and Functional Influence of the Glycine-Rich Loop G302GGGY on the Catalytic Tyrosine of Histone Deacetylase 8." *Biochemistry* 55.48 (2016): 6718-6729.

C. Decroos, N.H. Christianson, et al. "Biochemical and Structural Characterization of HDAC8 Mutants Associated with Cornelia de Lange Syndrome Spectrum Disorders." *Biochemistry* 54.42 (2015): 6501-6513. *Selected as "ACS Editors' Choice."*

INVITED TALKS

Provable Guarantees on AI/ML for Metrical Task Systems and Classification

- Theory Seminar, University of Massachusetts, Amherst, October 2023

Optimal Robustness-Consistency Tradeoffs for Learning-Augmented Metrical Task Systems

- INFORMS Annual meeting, October 2023

Chasing Convex Bodies and Functions with Black-Box Advice

- Asilomar Conference on Systems and Signals, November 2022
- Data Science Deep Dive Seminar, University of Massachusetts, Amherst, October 2022
- INFORMS Annual meeting, October 2022

MENTORSHIP, TEACHING, AND ACADEMIC SERVICE

Undergraduate research mentorship

James Chen 2023-24
Topic: Senior thesis on learning-augmented online optimization with ramp constraints
Next step: PhD student in EECS at MIT

Junxuan (Helen) Shen 2022-24
Topic: Learning-augmented algorithms for multiserver convex function chasing
Next step: PhD student in EECS at MIT

Jerry Huang 2022-23
Topic: Online algorithms with uncertainty-quantified predictions
Next step: PhD student in CS at CMU

Outreach and Mentorship

PhD application mentor – *Project SHORT* 2020–present
PhD application mentor – *Caltech Accountability Partners Program* 2022–present
Prelim exam preparation coordinator – *Caltech CMS* 2022

Teaching

Caltech:

TA, CS 146 "Control and Optimization of Networks"	Spring 2024
TA, CS 42 "Computer Science Education in K-14 Settings"	Winter 2024
TA, CS 146 "Control and Optimization of Networks"	Winter 2023
TA, CS 42 "Computer Science Education in K-14 Settings"	Winter 2023

Harvard:

Peer Tutor, Harvard Academic Resource Center	2018–20
CA, Math Ma "Introduction to Functions and Calculus I"	Fall 2017

Academic Service

- Workshop Chair, *Learning-augmented Algorithms: Theory and Applications* at ACM SIGMETRICS/IFIP Performance 2024
- Journal reviewer, *IEEE/ACM Transactions on Networking*, 2023, 2024
- Workshop reviewer, *NeurIPS Workshop on Computational Sustainability*, 2023
- Conference reviewer, *Asilomar Conference on Systems and Signals*, 2022, 2024

HONORS AND AWARDS

NSF Graduate Research Fellowship	2021
Phi Beta Kappa Junior 24 (Harvard)	2019
John Harvard Scholarship (Harvard)	2017, 19
Blair Research Fellowship (University of Pennsylvania)	Summer 2018
Detur Book Prize (Harvard)	2018

INDUSTRY EXPERIENCE

Microsoft Research – Research Intern | Redmond, WA — Summer 2023
Developed reliable machine learning methods to accelerate contingency analysis in power grids while ensuring provable guarantees on performance; conference manuscript in preparation

The Boston Consulting Group – Summer Associate | Boston, MA — Summer 2019
Partnered with a top-10 global biopharmaceutical company to optimize its supply and manufacturing networks, using data and digital-driven techniques to forecast production needs and increase efficiency

Covance – Data Science Intern | Princeton, NJ — Summer 2017
Developed statistical and machine learning models to forecast clinical trial patient recruitment