Mason DiCicco

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Summary

Ph.D. in Computer Science (WPI, 2025) with research in complexity theory, game theory, and learning theory. Recent projects explore the reasoning capabilities of large language models, including fine-tuning on formal mathematical tasks. Broader experience includes physics-informed and general machine learning, heuristic search algorithms, and neuromorphic computing. Publications in ISIT, ITCS, TCS, and NeurIPS. Seeking research positions at the intersection of mathematics and AI.

Education

2020–2025   **Ph.D. Computer Science**, *Worcester Polytechnic Institute*
Advised by Daniel Reichman.

2016–2020   **B.S. Computer Science**, *University of Connecticut*
Concentration: Theory and Algorithms

2016–2020   **B.A. Mathematics**, *University of Connecticut*
Concentration: Pure Mathematics

Research Experience

2020 - 2025   **Graduate Student**, *Worcester Polytechnic Institute*, Advisor: Daniel Reichman
Conduct research in theoretical computer science, proving hardness results in communication complexity, learning theory, and circuit complexity.

September 2022   **Research Visit**, *Santa Fe Institute*, Host: Cris Moore
Derived combinatorial upper bounds on the expected length of the longest common subsequence in random strings, towards computing the exact value of the Chvatal-Sankoff constant.

Publications

2025   **Nearest Neighbor Complexity and Boolean Circuits**,
Innovations in Theoretical Computer Science (ITCS)
Established, with Vladimir Podolskii and Daniel Reichman, new connections between nearest neighbor classification and Boolean circuit complexity. Proved exponential lower bounds on the k-nearest neighbor complexity of explicit functions and demonstrated separations between 1-NN and k-NN models, addressing open problems posed by Hajnal et al. (2022).

2024   **The Karp Dataset**,
NeurIPS MATH-AI Workshop
Constructed, with Eamon Worden, Conner Olsen, Nikhil Gangaram, Daniel Reichman, and Neil Heffernan, a structured collection of reductions between NP-hard decision problems tailored towards training language models on advanced reasoning tasks.

2023   **Inoculation Strategies for Bounded Degree Graphs**,
Theoretical Computer Science, Vol. 1035
Analyzed epidemic containment as a game on graphs with Henry Poskanzer and Daniel Reichman. Established tight bounds on the price of anarchy for many families of graphs in terms of their maximum degree and explored conditions (e.g., contagion thresholds and cost variations) that reduce equilibrium inefficiency.

2023   **The Learning and Communication Complexity of Subsequence Containment**,
International Symposium on Information Theory (ISIT)
Proved tight lower and upper bounds for the learning and communication complexity of subsequence detection with Daniel Reichman. Demonstrated that non-contiguity leads to increased complexity.

Industry Experience

May 2023 – July 2023	**Naval Research Lab**, *Washington, D.C.*, (40 hrs/week) ○ Implemented scientific machine learning frameworks (physics-informed neural networks and universal differential equations) for anomaly detection in physical systems. ○ Designed a localized neural operator leveraging the Gabor transform to extend spectral methods to spatially heterogeneous domains.
June 2019 – August 2019	**Naval Information Warfare Center**, *San Diego, CA*, (40 hrs/week) ○ Developed a Python-based spiking neural network simulator to test learning rules and benchmark neuromorphic models against traditional deep networks. ○ Applied persistent homology to analyze and visualize activation landscapes, providing insight into neural network behavior.

Talks

January 2025	**The Karp Dataset of NP-Hardness Reductions**, *AMS Special Session on Machine Learning Tools for Mathematical Discovery*, Joint Mathematics Meetings, Washington D.C.
July 2024	**Nearest neighbor complexity and boolean circuits**, *CS Theory Seminar (invited)*, Tufts University
2021–2024	**Various topics in complexity theory and learning**, *Discrete Math Seminar*, Worcester Polytechnic Institute Communication complexity, circuit lower bounds, nearest neighbor complexity, longest common subsequence.

Teaching Experience

Fall 2025	**Adjunct Professor**, *Clark University*, (20 hrs/week) ○ Designed and delivered the undergraduate Algorithms course (25 students), covering many standard algorithmic frameworks and amortized/worst-case analysis techniques. ○ Developed Java programming assignments using Gradescope for automated grading and feedback.
2020–2025	**Teaching Assistant**, *Worcester Polytechnic Institute*, (20 hrs/week) Supported 400+ students across 20+ terms at WPI as a Teaching Assistant. Held office hours, graded assignments, and occasionally led lectures. Courses taught: ○ Foundations of Computer Science (Finite automata, context-free grammars, Turing machines) ○ Introduction to Machine Learning (Regression, MLE, clustering, neural networks) ○ Algorithms: Design and Analysis (Divide and conquer, dynamic programming, amortized analysis, NP-completeness)

Skills

Programming	Python, Julia, Java, C/C++
ML/AI	PyTorch, TensorFlow, Transformers, Reinforcement Learning, Fine-tuning of LLMs
Techniques	Deep Learning, Meta-Learning, Few-shot Learning, Physics-informed ML
Other	Git, LaTeX, Linux, HPC systems (SLURM)