Clark University, MACD 335
Worcester, MA 01609
(860) 882 7015
mtdicicco@wpi.edu
masinister.github.io

Mason DiCicco

Summary

Ph.D. in Computer Science (WPI, 2025) with research in learning theory, communication complexity, and circuit lower bounds. 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. Currently Adjunct Professor of Computer Science at Clark University.

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

Selected Coursework

Graduate Level — Combinatorics, Analysis, Algebra, AI, Reinforcement Learning, Deep Learning, Networks.

Mathematics — Abstract and Linear Algebra, Real Analysis, Topology, Probability.

Computer Science — Algorithms and Complexity, Machine Learning, Cryptography, Computational Geometry.

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

May 2021 - September 2022 **The Learning and Communication Complexity of Subsequence Containment**, *International Symposium on Information Theory 2023*.
Proved tight lower and upper bounds for the learning and communication complexity of subsequence detection. Demonstrated that non-contiguity leads to increased complexity.

December 2022 - May 2023 **Inoculation Strategies for Bounded Degree Graphs**, *Theoretical Computer Science, Vol. 1035*.
Analyzed epidemic containment as a game on graphs and established tight bounds on the price of anarchy for many families of graphs in terms of their maximum degree. Explored conditions (e.g., contagion thresholds and cost variations) that reduce equilibrium inefficiency.

January 2024 - October 2024 **The Karp Dataset**, *NeurIPS MATH-AI Workshop 2024*.
Constructed the Karp Dataset, a structured collection of reductions between NP-hard decision problems, tailored towards training language models on advanced reasoning tasks.

November 2023 - January 2024 **Nearest Neighbor Complexity and Boolean Circuits**, *Innovations in Theoretical Computer Science 2025*.
Established 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. Results address open problems posed by Hajnal et al. (2022).

Industry Experience

May 2023 – July 2023 — **Naval Research Lab**, *Washington, D.C.*.
- Implemented PINNs and universal differential equation frameworks for anomaly detection in physical systems.
- Designed a localized spectral neural operator to improve learning accuracy on spatially heterogeneous datasets.

June 2019 – August 2019 — **Naval Information Warfare Center**, *San Diego, CA*.
- 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.

July 2015 – September 2015 — **United Technologies Aerospace Systems**, *Windsor Locks, CT*.
- Built a Dymola simulation of the Integrated Fuel Pump Control system, increasing model accuracy and supporting design validation for aerospace applications.

Talks

March 2024 — **Communication complexity and linear arrangements**,
Discrete Math Seminar, WPI.

July 2024 — **Nearest neighbor complexity and boolean circuits**,
CS Theory Seminar, Tufts University.

November 2023 — **Threshold circuit lower bounds from communication complexity**,
Discrete Math Seminar, WPI.

September 2023 — **Introduction to nearest neighbor complexity**,
Discrete Math Seminar, WPI.

September 2022 — **Expected length of the longest common subsequence**,
Discrete Math Seminar, WPI.

October 2021 — **The communication complexity of subsequence detection**,
Discrete Math Seminar, WPI.

Teaching Experience

2025–Present — **Adjunct Professor**, *Clark University*.
- 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*.
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 (advanced), Julia (advanced), 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