ANNIE MARSDEN

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My PhD work has focused on the fundamental limitations of machine learning under resource constraints. Most recently I have been interested in optimization with memory constraints. Because my work lies in the foundation of machine learning and artificial intelligence, I am adaptable to many applications of AI. In general, I am interested in building or adapting machine learning algorithms to be resource efficient and to understand the performance/resource tradeoffs.

EDUCATION

PhD	Stanford University, Computer Science	Expected June 2023
	Topic: Learning and Memory Tradeoffs	
	Advisors: Gregory Valiant and John Duchi	
MPhil	University of Cambridge, Scientific Computing	September 2016
	Thesis: "Sequential Matrix Completion."	
	Advisor: Sergio Bacallado	
BS	University of Chicago, Mathematics **(GPA 4.00/4.00)**	June 2015
BA	University of Chicago, Chemistry **(GPA 4.00/4.00)**	

PUBLICATIONS AND PREPRINTS

Annie Marsden, Vatsal Sharan, Aaron Sidford, Gregory Valiant. "Efficient Convex Optimization Requires Superlinear Memory." *Proceedings of Thirty Fifth Conference on Learning Theory, PMLR, 2022.* **Best Paper Award.**	Optimization; memory lower bounds
Jonathon Kelner, Annie Marsden, Vatsal Sharan, Aaron Sidford, Gregory Valiant, Honglin Yuan. "Big-Step-Little-Step: Gradient Methods for Objectives with Multiple Scales." *Proceedings of Thirty Fifth Conference on Learning Theory, PMLR, 2022.*	Optimization; conditioning; memory constraints.
Annie Marsden, John Duchi, Gregory Valiant. "Misspecification in Prediction Problems and Robustness via Improper Learning." *International Conference on Artificial Intelligence and Statistics. PMLR, 2021.* **Awarded with an Oral Presentation.**	Online learning; stochastic optimization; model misspecification.
Annie Marsden and Sergio Bacallado. "Seqential Matrix Completion." arXiv preprint arXiv:1710.08045.	Compressed sensing; multiarmed bandits; variational inference.
Annie Marsden. "Eigenvalues of the Laplacian and their relationship to the connectedness of a graph." *University of Chicago REU 2013*.	A survey paper.
Annie Marsden and R.S. Berry. "Enrichment of Network Diagrams for Potential Surfaces." *The Journal of Physical Chemistry C, 119(26), pp.14702-14705.*	Network diagrams to represent potential energy landscapes.

RESEARCH EXPERIENCE

Deepmind, London   June 2022-Oct. 2022
Research Scientist Intern, Cognition Team
- Advised by Murray Shanahan and Kim Stachenfeld.
- Developed a novel algorithm for agent exploration.
- Implemented the algorithm (in JAX) and ran experiments.
- Paper in preparation.

Department of Oncology, Marshall Health   June 2017-Sept. 2017
Statistical Advisor
- Advised a team of urological oncologists on the statistical aspects of prostate cancer research.
- Wrote an algorithm and built a GUI to help doctors better decide the sequence of diagnostic tools to use for prostate cancer patients.

Department of Statistics, University of Chicago   Sept. 2016-June 2017
Research Assistant to John Lafferty
- Worked on an algorithm which optimizes the mixing rate of a Markov chain.

Department of Chemistry, University of Chicago   Sept. 2012-Sept. 2014
Research Assistant to Stephen Berry
- Studied the core melting behavior of nanoparticles using Molecular Dynamics (MD) simulations.

Department of Chemistry, University of Cambridge   July 2014-Aug. 2014
Research Assistant to David Wales
- Wrote a "screening function" to improve the Modified Embedded Atom Method (MEAM) so that it may be used in computational chemistry simulations.

TEACHING

Stanford EE364a: Convex Optimization I   Winter 2020
Course Assistant.

Navajo Nation Math Circles   June 2019
Served as a math instructor to high school students on
the Navajo Nation. See https://navajomathcircles.org.

Stanford CS265/CME309: Randomized Algorithms and Probabilistic Analysis   Fall 2018
Course Assistant.

Polk Bros. Foundation   Sept 2014-June 2015
Taught a classroom of talented mathematics students
in an underprivileged elementary school in Chicago.

University of Chicago, Mathematics Department   Fall 2012
Math instructor for the Youth Scholars Program.

HONORS AND AWARDS

ACM SIGHPC/Intel Fellow
Churchill Scholar
Barry M. Goldwater Scholar
Elected Phi Beta Kappa as a Junior
Norman H. Nachtrieb Memorial Award for Excellence in Undergraduate Studies of Chemistry (*Given to the top Chemistry student at the University of Chicago*)
Frances Knock Prize for Outstanding Academic Achievement in Chemistry
Recipient of the Peter Salamon Young Scientist Award
Recipient of the Lillian Gertrude Selz Prize (*Given to the woman with the highest academic achievement after their first year of college.*)

PRESENTATIONS AND INVITED LECTURES

Best Paper Presentation, "Efficient Convex Optimization Requires Superlinear Memory," The 35th Annual Conference on Learning Theory, July 2, 2022.

Paper Presentation, "Big-Step-Little-Step: Gradient Methods for Objectives with Multiple Scales," The 35th Annual Conference on Learning Theory, July 4, 2022.

Invited Talk, "Efficient Convex Optimization Requires Superlinear Memory," Toyota Technological Institute at Chicago Young Researcher Seminar Series, May 18, 2022.

LANGUAGES

English: Native Language
French: Advanced Listener, Advanced Speaker, Advanced Reading and Writing
Spanish: Intermediate Listener, Intermediate Speaker, Intermediate Reading and Writing
Chinese: Novice

RELEVANT COURSEWORK

Programming with GPUs (learned CUDA, openMP, and MPI), Grade: Pass with Distinction
Programming Languages (type systems, concurrency/parallelism, metaprogramming, learned OCaml and Rust), Grade: A+
Compilers (lexical analysis; parsing theory; scope; semantic analysis; runtime environments; code generation and basic optimization; wrote a basic compiler in C), Grade: A
Deep Learning (CNNs, RNNs, LSTM, Adam, Dropout, BatchNorm; all implemented in Python and TensorFlow), Grade: Pass.
Machine Learning Courses: Randomized Algorithms, Theory of Probability, Convex Optimization, Information Theory and Statistics, Machine Learning, Real Analysis, Algebra, Theory of Algorithms, ODEs, Deep Learning. Grade for all: A

OTHER INTERESTS

Skiing, Surfing, Running, Piano, Linguistics