

BLAKE MASON

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EDUCATION

University of Wisconsin, Madison

Ph.D. Electrical and Computer Engineering, December 2020, Advisor: Dr. Robert Nowak

University of Southern California

B.S. Electrical Engineering, May 2015

Research Focus: active learning, multi-armed bandits, metric learning, nearest neighbors, level set estimation

SELECTED RESEARCH & INDUSTRY EXPERIENCE

Rice University | Dept. of Electrical & Computer Engineering

9/21 - Present

- **Active Learning for Knowledge Graphs**

Collaborated with researchers to develop active learning techniques to estimate knowledge graphs for use in intelligent textbooks.

- Benchmarked existing techniques to understand their applicability for use with education data
- Collaborated with practitioners and researchers to develop new data collection methods

- **Theoretical Foundations of Membership Inference**

Applied statistical expertise to develop study the connection between overparametrization in machine learning models and their susceptibility to membership inference attacks.

- Leveraged classical theory to establish the theoretical limits of membership inference
- Demonstrated a fundamental trade-off between model accuracy and membership inference risk
- Experimentally showed this phenomenon in many model classes

University of Wisconsin — Madison | Dept. of Electrical & Computer Engineering

8/15 - 9/21

- **Bandit Algorithms for Learning all Epsilon-Good Arms**

Led a project studying a new, more natural bandit objective for crowd-sourcing and scientific applications and designed optimal and computationally efficient algorithms.

- Motivated new multi-armed bandit objective based on scientific discovery and crowd-sourcing applications
- Developed optimal algorithms and comprehensive theory controlling sample complexity
- Tested algorithm against state of the art baselines on large, crowd sourced dataset

- **Nearest Neighbors With Noisy Data**

Led a project developing an active, multi-armed bandit approach to learn nearest neighbor graphs for recommendation and network detection with noisy data.

- Applied bandit techniques and methods for nearest neighbor detection to develop an efficient algorithm
- Demonstrated novel theory guaranteeing sample complexity and success of algorithm
- Compared algorithm against state of the art techniques for recommendation in experiment using user data

- **Metric Learning with Human Data**

Worked under professors in Machine Learning and Educational Psychology through UW Madison's interdisciplinary research program, LUCID, Led a project adapting metric learning techniques to assess individual learning differences in STEM education.

- Applied and compared low dimensional metric learning algorithms to rank visual features present in the molecules by correlation with students' judgments, and access concept knowledge
- Developed novel theory demonstrating the sample complexity, optimality, and convergence rates of low dimensional metric learning algorithms
- Conducted large scale perceptual similarity experiment in chemistry classroom, asking students to judge the similarity between molecules

- **Fast Ordinal Triplet Embedding (FORTE)**

Co-wrote an open-source library of ordinal embedding algorithms in Cython and Python, providing fast implementations of many classical and modern algorithms.

- Analyzed algorithmic performance and quality of results
- Applied FORTE to improve existing data analysis tools used by collaborators

Amazon | Seattle, WA | Applied Scientist Intern

6/18 – 8/18

Designed and implemented novel recommendation systems for Amazon Music business in MXNet. Developed novel algorithm for extreme classification. Built prototype of product and demonstrated to senior managers.

- Applied MXNet and Gluon to reduce training time by 35% and decrease codebase by 60%
- Improved new artist discovery for customers
- Increased diversity of recommended music

The Aerospace Corporation | El Segundo, CA | Engineering Intern

5/14 – 5/15

Designed and built a testing environment to measure thermo-acoustic transduction in carbon-nanotube transistors. Successfully captured the world's first audio recording of a single molecule, the smallest known loudspeaker.

- Wrote LabView code to automate testing and data-analysis
- Published first author paper and presented at a conference

SKILLS & INTERESTS

Programming: Python (NumPy, Dask, Multiprocessing, Cython, SciPy, pandas), MATLAB, Pyspark, LaTeX

Machine Learning: Active Learning & Bandits, Ordinal Embedding, Metric Learning, Level Set Estimation

Interests: Active learning, human data, sparsity, similarity embeddings, running, choir, writing poetry, folk music

LEADERSHIP & INVOLVEMENT

GODDESSES Seminar | Founder, Organizer

9/17 – 9/18

Founded and led a graduate student only Optimization and Machine Learning speaker series where students can practice scientific communication skills and get feedback on research ideas.

- Coordinate presenters to ensure a variety of topics and viewpoints are shared
- Assist younger students in forming topics and presenting them effectively

LUCID | Communications Board

8/16 – 9/18

- Graduate training program at UW Madison which focuses on interdisciplinary research
- Connect LUCID students to resources for developing cross-disciplinary communications skills
- Assist LUCID faculty in understanding the needs of the students in the program

Moneythink | Co-President, Mentor Captain

8/12 – 5/15

Led the USC chapter of the Chicago-based non-profit *Moneythink*; we trained students to teach financial literacy in local high schools, focussing on personal finance and college.

- Taught weekly course to underserved high school students in financial literacy
- Coordinated the teaching of over 400 students in urban Los Angeles

PUBLICATIONS

Tan, J., **Mason, B.**, Javidi, H., & Baraniuk, R. (2022). Parameters or Privacy: A Proveable Tradeoff Between Overparametrization and Membership Inference. *arXiv preprint arXiv:2202.01243*.

Mason, B., Jun, K., & Jain, L. (2022). A Experimental Design Approach for Regret Minimization in Logistic Bandits. *arXiv preprint*. (To appear at AAAI 2022)

Katz-Samuels, J., **Mason, B.**, Jamieson, K. G., & Nowak, R. (2021). Practical, Provably-Correct Interactive Learning in the Realizable Setting: The Power of True Believers. *Advances in Neural Information Processing Systems*, 34.

Mason, B., Tripathy, A., & Nowak, R. (2021, December). Nearest neighbor search under uncertainty. In *Uncertainty in Artificial Intelligence* (pp. 1777-1786). PMLR.

Mason, B., Camilleri, R., Mukherjee, S., Jamieson, K., Nowak, R., & Jain, L. (2021). Nearly Optimal Algorithms for Level Set Estimation. *arXiv preprint arXiv:2111.01768*. (To appear at AISTATS, 2022)

Jun, K. S., Jain, L., **Mason, B.**, & Nassif, H.. (2021, July). Improved confidence bounds for the linear logistic model and applications to bandits. In *International Conference on Machine Learning* (pp. 5148-5157). PMLR.

Mason, B., Jain, L., Tripathy, A., & Nowak, R. (2020). Finding All ϵ -Good Arms in Stochastic Bandits. In *Advances in neural information processing systems (NeurIPS)*.

- Mason, B.**, Tripathy, A., & Nowak, R. (2019). Learning Nearest Neighbor Graphs from Noisy Distance Samples. In *Advances in neural information processing systems (NeurIPS)*.
- Mason, B.**, Rau, M. A., & Nowak, R. (2019). Cognitive Task Analysis for Implicit Knowledge About Visual Representations With Similarity Learning Methods. *Cognitive Science*, 43(9), e12744.
- Sen, A., Patel, P., Rau, M, **Mason, B.**, Nowak, R., Rogers, T., and Zhu, X. "Machine Beats Human at Sequencing Visuals for Perceptual-Fluency Practice." *International Educational Data Mining Society* (2018).
- Sen, A., Patel, P., Rau, M.A., **Mason, B.**, Nowak, R., Rogers, T.T. and Zhu, J.. "For Teaching Perceptual Fluency, Machines Beat Human Experts." CogSci. 2018
- Nobles, J., Hamoudi, A., Nowak, R., Landau, E., Baron, A., Brittingham, J., & **Mason, B.** (2018, April). Socioeconomic Variability in Human Fecundity. In *PAA 2018 Annual Meeting*. PAA.
- Nobles, J., Hamoudi, A, Nowak, R., Landau, E., Baron, A., Brittingham, J., **Mason, B.** "Place-Based Variation in Early Pregnancy Loss: Evidence from Population Data." Reproductive Sciences. Vol. 25.
- Mason, B.**, Jain, L., & Nowak, R. (2017). Learning low-dimensional metrics. In *Advances in neural information processing systems (NeurIPS)* (pp. 4139-4147).
- Rau, M., **Mason, B.**, and Nowak, R. D. How to model implicit knowledge? Similarity learning. methods to assess perceptions of visual representations. In *Proceedings of the 9th International Conference on Educational Data Mining*, 2016. (**best paper nominee**)
- Mason, B.**, Rau, M., Jain, L., and Nowak, R., "Modeling Perceptual Fluency with Visual Representations". (2016). *33rd International Conference on Machine Learning - Workshop Publication*.
- Mason, B.**; Chang, S. W.; Chen, J.; Cronin, S. B.; & Bushmaker, A. W. (2015). Thermoacoustic Transduction in Individual Suspended Carbon Nanotubes. ACS nano.