Matthew Faw

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Research Interests

Online learning, optimization, transfer learning, adaptive data analysis, prophet inequalities.

Education

2018–Present **Ph.D. in ECE**, *University of Texas at Austin*, Austin, TX.
Advisors: Sanjay Shakkottai, Constantine Caramanis.

2013–2017 **B.S.E. ECE, B.S. Computer Science, A.B. Math**, *Duke University*, Durham, NC.

Awards + Honors

2022 Highlighted reviewer for ICLR 2022
2022 Top 10% reviewer for AISTATS 2022
2020 NXP Foundation Fellowship for the 2020-2021 academic year
2017 Cum Laude Graduation Honors, Duke University
2016 Member, Tau Beta Pi and Eta Kappa Nu Honor Societies, Duke University
2015 $6000 Research Grant, SMiF Undergraduate User Program
2014 Gold medal, International Genetically Engineered Machine Competition

Publications + Preprints

Constantine Caramanis, Paul Dütting, Matthew Faw, Federico Fusco, Philip Lazos, Stefano Leonardi, Orestis Papadigenopoulos, Emmanouil Pountourakis, and Rebecca Reiffenhäuser. Single-Sample Prophet Inequalities via Greedy-Ordered Selection. In *Proceedings of the 2022 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pages 1298–1325. Society for Industrial and Applied Mathematics, 2022.

Matthew Faw, Orestis Papadigenopoulos, Constantine Caramanis, and Sanjay Shakkottai. Learning To Maximize Welfare with a Reusable Resource. Accepted to SIGMETRICS 2022.

Matthew Faw, Rajat Sen, Karthikeyan Shanmugam, Constantine Caramanis, and Sanjay Shakkottai. Mix and Match: An Optimistic Tree-Search Approach for Learning Models from Mixture Distributions. In *Advances in Neural Information Processing Systems*, 2020.

Matthew Faw, Karthikeyan Shanmugam, Constantine Caramanis, and Sanjay Shakkottai. Multi-source Domain Adaptation Under Sparsity Constraints. In preparation.

Matthew Faw, Isidoros Tziotis, Constantine Caramanis, Aryan Mokhtari, Sanjay Shakkottai, and Rachel Ward. The Power of Adaptivity in SGD: Self-Tuning Step Sizes with Unbounded Gradients and Affine Variance. Accepted to COLT 2022.

Seyed Majid Zahedi, Songchun Fan, Matthew Faw, Elijah Cole, and Benjamin C Lee. Computational sprinting: Architecture, dynamics, and strategies. *ACM Transactions on Computer Systems (TOCS)*, 34(4):12, 2017.

Talks

January 2022 SODA 2022: Single Sample Prophet Inequalities via Greedy-Ordered Selection

Conference Reviewing

2021 AISTATS, ICML, NeurIPS

2022 AISTATS (Top 10% reviewer), ICLR (Highlighted reviewer), NeurIPS

Research Experience

March 2021– **The Power of Adaptivity in SGD: Self-Tuning Step Sizes with Unbounded Gradients and Affine Variance**, UT Austin.
Proved that AdaGrad-Norm enjoys essentially the same rate of convergence as an optimally-tuned SGD under the same assumptions, and without knowledge of smoothness or gradient noise parameters.

March 2021– **Learning To Maximize Welfare with a Reusable Resource**, UT Austin.
Studying a variant of the i.i.d prophet inequality problem where, every time a gambler collects a reward, the resource becomes blocked for some period of time.

May 2020– **Improved Single-Sample Prophet Inequalities**, UT Austin.
Derived a novel single-sample prophet inequality for combinatorial auctions, and improved best-known inequalities for matchings, as well as a number of matroid constrains (e.g., transversal, graphic, and laminar matroids).

Feb 2019– **New Algorithms and Relaxed Assumptions for Domain Adaptation**, UT Austin.
Proved novel concentration and stability results for iterative hard thresholding and SGD. Used these results to design algorithms for several multi-source domain adaptation problems with provable guarantees.

Jan-Dec 2016 **Datacenter Architecture**, *Advisor: Dr. Benjamin Lee*, Duke University.
Evaluated performance and economic viability of several strategies for system-level computational sprinting for Spark applications. Worked on extensions for co-locating batch and latency-critical workloads.

Jan-Dec 2015 **Microfluidics**, *Advisor: Dr. Richard Fair*, Duke University.
Designed and fabricated digital microfludic devices capable of manipulating E.coli using magnetic beads within droplet to conduct small-scale biology experiments.

May-Nov 2014 **Synthetic Biology**, *Advisor: Dr. Nick Buchler*, Duke University.
Conducted molecular titration experiments to evaluate several CRISPR-based techniques for creating an ultrasensitive response in gene expression. Designed 3D-printed lab equipment to lower financial barriers to biology research.

Industry Experience

June 2017-July 2018 **Software Engineer**, *Verato*, McLean, VA.
Co-designed and built a custom continuous integration system using Kubernetes, capable of testing hundreds of simultaneous builds of the software stack. Designed software to maintain 300M entry Mongo database and Solr search engine.

May-August 2016 **Software Engineering Intern, Stateflow Semantics**, *MathWorks*, Natick, MA.
Co-designed and implemented a proof-of-concept architectural change to the team's code generation process that allowed product extensibility and optimizations that were previously infeasible.

Teaching Experience

Fall 2018, Spring 2019 **EE 460J, Data Science Lab TA**, *UT Austin*.
Led lab sessions, and graded homeworks and exams

Spring 2017 **CS 308, Software Design and Implementation TA**, *Duke University*.
Personally mentored 3 undergraduate CS students, conducted code reviews, advised and evaluated design and implementation of 3 software projects.

Fall 2015 **ECE 280, Signals & Systems TA**, *Duke University*.
Held office hours and graded assignments for 70 undergraduate students.

Spring 2015 **Synthetic Biology House Course Co-Designer/Instructor**, *Duke University*.
Co-designed and taught the first-offered Duke course on synthetic biology to 10 undergraduates.

Graduate Coursework

Fall 2018 Probability & Stochastic Processes, Large Scale Optimization I
Spring 2019 Analysis & Design of Communication Networks, Large Scale Optimization II
Fall 2019 Online Learning, Combinatorics & Graph Theory
Spring 2020 Markov Chains & Mixing Times, Theoretical Statistics
Fall 2020 Advanced Probability, Combinatorial Optimization, Sublinear Algorithms

Technical Skills

Programming Java, Python (PyTorch, Sklearn), C/C++, JavaScript
Infrastructure Kubernetes, AWS, Google Cloud, Mongo, Solr

References

Sanjay Shakkottai, Professor, UT Austin, sanjay.shakkottai@utexas.edu
Constantine Caramanis, Professor, UT Austin, constantine@utexas.edu
Benjamin Lee, Professor, University of Pennsylvania, leebcc@seas.upenn.edu