

# 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 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 Duetting, Matthew Faw, Federico Fusco, Philip Lazos, Stefano Leonardi, Orestis Papadigenopoulos, Emmanouil Pountourakis, and Rebecca Reiffenhausser. Single Sample Prophet Inequalities via Greedy-Ordered Selection. Accepted to SODA 2022.

Matthew Faw, Orestis Papadigenopoulos, Constantine Caramanis, and Sanjay Shakkottai. Learning To Maximize Welfare with a Reusable Resource. In submission.

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. In submission.

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

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## Conference Reviewing

- 2021 AISTATS, ICML, NeurIPS
- 2022 AISTATS (Top 10% reviewer), ICLR

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## 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 constraints (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 microfluidic 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.

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## Industry Experience

- June **Software Engineer**, *Verato*, McLean, VA.
- 2017-July  
2018 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.

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## Teaching Experience

- Fall 2018, **EE 460J, Data Science Lab TA**, *UT Austin*.
- Spring 2019 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](mailto:sanjay.shakkottai@utexas.edu)  
Constantine Caramanis, Professor, UT Austin, [constantine@utexas.edu](mailto:constantine@utexas.edu)  
Benjamin Lee, Professor, University of Pennsylvania, [leebcc@seas.upenn.edu](mailto:leebcc@seas.upenn.edu)