Dmitriy (Tim) Kunisky

Last Updated: July 29, 2019

Contact Information

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Research Interests

My focus is on probability theory with applications to statistics, data science, computational complexity, and optimization. In particular:

- Computational hard regimes in random optimization and inference problems.
- Average-case convex relaxations (especially the sum-of-squares hierarchy).
- Geometric complexity of high-dimensional optimization landscapes (especially the Kac-Rice method).

Education

Courant Institute of Mathematical Sciences — New York, NY
Ph.D. Candidate in Mathematics — 09/2016—Present

- Advised by Afonso Bandeira and Gérard Ben Arous
- Oral Preliminary Examination passed in April 2018
- Written Preliminary Examination passed in January 2017

Princeton University — Princeton, NJ
A.B. *summa cum laude* in Mathematics — 09/2010—06/2014

- Certificate in Applications of Computing
- Senior Thesis: *The Theft and the Honest Toil: Applications of Large Cardinal Axioms to the Theory of Measurable Selection*, advised by John Burgess
- Junior Paper: *Discrete Applications of Brownian Motion*, advised by Michael Damron

Publications

A tight degree 4 sum-of-squares lower bound for the Sherrington-Kirkpatrick Hamiltonian. Dmitriy Kunisky, Afonso Bandeira. Preprint available online.

Subexponential-time algorithms for sparse PCA. Yunzi Ding, Dmitriy Kunisky, Alexander S. Wein, Afonso S. Bandeira. Preprint available online.

Computational hardness of certifying bounds on constrained PCA problems. Afonso S. Bandeira, Dmitriy Kunisky, Alexander S. Wein. Submitted (2019).

Connections between sum-of-squares optimization and structured tight frames. Afonso Bandeira, Dmitriy Kunisky. SPIE Wavelets & Sparsity 2019.

Sum-of-squares optimization and the sparsity structure of equiangular tight frames. Afonso Bandeira, Dmitriy Kunisky. SampTA 2019.

A Gramian description of the degree 4 generalized elliptope. Afonso Bandeira, Dmitriy Kunisky. Preprint available online.

Mapping political communities: a statistical analysis of lobbying networks in legislative politics. In Song Kim, Dmitriy Kunisky. Submitted (2019).

Hysteresis control of the epithelial-mesenchymal transition dynamics generates a distinct program with metastatic abilities. Toni Celià-Terrassa, Caleb Bastian, Daniel Liu, Brian Ell, Yong Wei, Jose Zamalloa, Andres M Blanco, Xiang Hang, Thomas Pisano, Dmitriy Kunisky, Herschel Rabitz, Yibin Kang. Nature Communications 9, No. 1, 2018.

Honors

Student Government Conference Fund Award, New York University
Harold Grad Memorial Prize, New York University
Best Poster Award, Princeton Day of Optimization 2018
Charles Newman Fellowship, New York University
Honorable Mention, NSF Graduate Research Fellowship
Henry MacCracken Fellowship, New York University
Phi Beta Kappa Society (Early Admission), Princeton University
Shapiro Award for Academic Excellence, Princeton University

Teaching

Recitation Leader / Grader for "Probabilistic Time Series Analysis" — Fall 2018
New York University (Center for Data Science)

Teaching Assistant for "Algebra II" — Spring 2013
Princeton University

Service

Organize Courant Institute student probability seminar, Fall 2018—present.

Reviewed for conferences: COLT 2018

Invited Talks

SampTA 2019, Frame Theory Session — July 2019
Columbia Computer Science Theory Seminar — April 2019
MIT Seminar on Algebra, Statistics, and Optimization — March 2019

Events

Princeton Day of Optimization — September 2018
Princeton University

Machine Learning and Statistical Physics Back Together — Summer 2018
Institut d'Études Scientifiques de Cargèse

Deep Learning and Statistical Physics — Summer 2018
Beg Rohu Summer School

Limits to Inference in Networks and Noisy Data — April 2018
Santa Fe Institute

Visiting Researcher (hosted by Cristopher Moore) — August 2017
Santa Fe Institute

Complex Systems Summer School — Summer 2017
Santa Fe Institute

Summer School in Mathematical Logic — Summer 2013
University of California, Los Angeles

Industry Experience

Google, Inc. — Mountain View, CA; New York, NY
Software Engineer — 10/2014—07/2016

- Developed interactive semantic code differencing tools for working with complex search ranking algorithms.
- Improved machine learning infrastructure for semantic parsing tasks in natural language processing.

Relevant Skills

Languages: Russian (fluent), French (intermediate)

Programming: Python (scientific: NumPy/SciPy ecosystem; web: Django), C, C++, Java, Mathematica, MATLAB, Stan