Michael Celentano

Miller Fellow in Statistics

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Education

Stanford University (Stanford, CA), Ph.D. in Statistics, 2021.
Thesis: *Topics in exact asymptotics for high-dimensional regression.*
Advisor: Andrea Montanari.

Stanford University (Stanford, CA), M.S. in Electrical Engineering, 2016.
Depth Area: Signal Processing and Optimization.

Stanford University (Stanford, CA), B.S. in Mathematics and Physics (double major), 2014.
Degree honors: with Distinction.

Experience

Postdoctoral research

Miller fellow, University of California, Berkeley (2021–present).
I developed novel theory and methodology for debiasing in missing data models in "inconsistency regimes", variational inference in $\mathbb{Z}_2$-synchronization and linear models, and multivariate two-sample testing.
Hosts: Martin Wainwright and Ryan Tibshirani.

Student academic research

PhD student researcher, Stanford University (2016–2021).
I developed theory for high-dimensional regression using exact asymptotics. Theory includes optimality theory for estimation in high-dimensional regression models under computationally motivated constraints; characterization of the behavior of high-dimensional penalized least squares estimators with symmetric penalties (sole author); analysis of hypothesis testing and hyperparameter tuning methods using the Lasso; and novel methodology for debiasing conditional association estimates in "inconsistency regimes".

Masters student researcher, Dept. of Applied Physics, Stanford University (2015–2016).
I analyzed and designed optical networks for implementing information processing tasks.
Advisor: Hideo Mabuchi.

Summer internships

Research intern, Microsoft Research New England (Summer 2019).
I explored the construction of confidence intervals adaptive to the complexity of unknown parameters in non-parametric statistics and causal inference.
Advisors: Vasilis Syrgkanis and Greg Lewis.

Research intern, Dept. of Statistical and Biological Physics, LMU Munich (Summer 2013).
I designed and implemented stochastic simulations of genetic regulatory networks to study pattern formation in biological systems.
Advisor: Ulrich Gerland.

Research intern, Dept. of Radiation Oncology, Stanford University (Summer 2012).
I assessed whether treatment-planning protocols were appropriately robust but non- invasive by quantifying treatment sensitivity to various tumor-positioning errors.
Advisor: Peter Maxim.

Research intern, Dept. of Physics, Stanford University (Summer 2011).
I collaborated on an experiment aimed at using optical levitation for short-range force measurements of gravity.
Advisor: Giorgio Gratta.

Workshops

Visiting postdoc, Computational Complexity of Statistical Inference. Simons Institute (Fall 2021).

Long-term visiting graduate student, Probability, Geometry, and Computation in High Dimensions. Simons Institute (Fall 2020).

Participant, Summer School on Random Matrices @ MCAIM. University of Michigan (Summer 2018).

Participant, Statistical Physics and Machine Learning Back Together Again. Institut d'Études Scientifiques de Cargése (Summer 2018).

Fellowships and Funding

- Miller Fellowship, 2021–2024.
- NSF Graduate Research Fellowship Program, 2016–2020.
- National Institute of Health, Grant T-32, 2016–2017.
- DAAD RISE, 2013.
- Robert C. Byrd Scholarship, 2010.

Awards

- Theodore W. Anderson Theory of Statistics Dissertation Award (2021).
  Awarded by the Stanford Statistics Department recognizing exceptional achievements from Ph.D. candidates in the area of theoretical statistics.
- Honor Roll, William Lowell Putnam Mathematical Examination (2011, 2012).

Teaching

Courses Taught at Stanford

- Statistics 302: Statistical Theory Qualifying Exam Workshop. (Summer 2018, 2021).
  I designed and organized six weeks of review sessions to help first-year Ph.D. students at Stanford prepare for the qualifying examination in theoretical statistics. This involved reviewing material and working through past years' qualifying exams.

Courses Served as Teaching Assistant at Stanford

- Statistics 361: Causal Inference. Spring 2021 — Graduate Level.
- Statistics 318: Modern Markov Chains, Spring 2020 — Graduate Level.
- Statistics 300A: Theory of Statistics, Fall 2019 — Graduate Level.
- Statistics 300C: Theory of Statistics III, Spring 2019 — Graduate Level.
- Statistics 300C: Theory of Statistics III, Spring 2018 — Graduate Level.
- Physics 60: Introduction to Statistical Methods, Spring 2017 — Undergraduate Level.
- Physics 21S: Mechanics, Fluids, and Heat with Laboratory, Summer 2014 — Undergraduate Level.
- Physics 61: Mechanics and Special Relativity, Fall 2013 — Undergraduate Level.

Professional Service Activities

- *Reviewer*, Annals of Statistics, Journal of the American Statistical Association, Information and Inference: A Journal of the IMA, IEEE Transactions on Information Theory, Biometrics, Bernoulli, SIAM Journal on Mathematics of Data Science, Journal of Machine Learning Research, Journal of Computational and Graphical Statistics, Sankhya A, Conference on Learning Theory (COLT), Artificial Intelligence and Statistics (AISTATS), IEEE International Symposium on Information Theory (ISIT), Uncertainty in Artificial Intelligence (UAI).
- *Member*, Miller Institute 2024 Symposium Organizing Committee, (Summer 2023 - present).
- *Co-organizer*, Stanford Statistics Department Orientation Program for Ph.D. students (September 2020).
- *Co-organizer*, Online Causal Inference Seminar (March 2020 — August 2021).
- *Co-organizer*, Stanford Statistics Department Orientation Program for Ph.D. students, (September 2019).

Presentations

Invited Presentations

- *Challenges of the inconsistency regime: Novel debiasing methods for missing data models.*
  IMS Young Mathematical Scientist Forum, Nov. 20 – 23, 2023 (upcoming).
- *Challenges of the inconsistency regime: Novel debiasing methods for missing data models.*
  Online Causal Inference Seminar, Oct. 24, 2023 (upcoming).

- *Sudakov-Fernique post-AMP, and a new proof of the local convexity of the TAP free energy.*
  Computational Complexity of Statistical Problems Workshop, MIT, Jun. 14, 2023.
- *Debiasing in missing data models with inaccurate nuisance parameters.*
  International Indian Statistical Association Conference, Jun. 3, 2023.
- *Discussant for "A modern central limit theorem for the classical doubly robust estimator: variance inflation and beyond."*
  Main speaker: Pragya Sur.
  International Seminar on Selective Inference, Apr. 28, 2022.
- *Sudakov-Fernique post-AMP, and a new proof of the local convexity of the TAP free energy.*
  Computational Complexity of Statistical Inference Reunion, Simons Institute, Dec. 13, 2021.
- *Correlation-adjusted debiasing: Debiasing the Lasso with inaccurate covariate model.*
  Neyman Seminar, Department of Statistics, University of California, Berkeley, Dec. 1, 2021.
- *Correlation-adjusted debiasing: Debiasing the Lasso with inaccurate covariate model.*
  Department Seminar, Department of Statistics, Wharton, University of Pennsylvania, Oct. 27, 2021.
- *The estimation error of general first order methods.*
  Rigorous Evidence for Information-Computation Trade-offs, Simons Institute, Oct. 27, 2021.
- *Debiasing the Lasso with Inaccurate Precision Matrix.*
  Youth in High Dimensions, ICTP, Jun. 18, 2021.
- *The Lasso with general Gaussian designs with application to hypothesis testing.*
  International Seminar on Selective Inference, Sep. 10, 2020.

Contributed Oral Presentations

- *Debiasing in missing data models with inaccurate nuisance parameters.*
  Joint Statistical Meetings, Aug. 9, 2023.
- *Debiasing in missing data models with inaccurate nuisance parameters.*
  American Causal Inference Conference, May 24, 2023.
- *Debiasing in missing data models with inaccurate nuisance parameters.*
  Workshop on Computational-Statistical Interplay in Machine Learning, MIT, May 23, 2023.
- *Correlation-adjusted debiasing: Debiasing the Lasso with inaccurate covariate model.*
  Information Theory and Applications Workshop, Feb. 14, 2023.
- *Correlation-adjusted debiasing: Debiasing the Lasso with inaccurate covariate model.*
  Meet the Fellows, Simons Institute, Sep. 8, 2023.
- *The Lasso with general Gaussian designs with application to hypothesis testing.*
  Bernoulli-IMS One World Symposium, Aug. 26, 2020.
- *Fundamental barriers to tractable estimation in high-dimensions.*
  Joint Statistical Meetings, Aug. 4, 2020.
- *The estimation error of general first order methods.*
  Conference on Learning Theory, Jul. 9, 2020.
- *Mean field methods in high-dimensional statistics and nonconvex optimization.*
  Online Open Probability School, Problem Session Leader, Jul. 7 & 8, 2020.
- *Fundamental barriers to estimation in high-dimensions.*
  CS Theory Seminar, Stanford University, Apr. 22, 2020.
- *Fundamental barriers to estimation in high-dimensions.*
  IT Forum, Stanford University, Apr. 3, 2020.

Conference Poster Presentations

- *Correlation Adjusted Debiasing (CAD).*
  CLIMB Fall Retreat, University of California, Berkeley, November 2, 2022.
- *Fundamental barriers to tractable estimation in high-dimensions.*
  Information Theory and Applications Workshop, San Diego, February 7, 2020.

Publications and Preprints

[1] **M. Celentano,** A. Montanari, and Y. Wu. The estimation error of general first order methods. In J. Abernethy and S. Agarwal, editors, *Proceedings of Thirty Third Conference on Learning Theory*, volume 125 of *Proceedings of Machine Learning Research*, pages 1078–1141. PMLR, Jul 2020. Available at PMLR.

[2] **M. Celentano.** Approximate separability of symmetrically penalized least squares in high dimensions: characterization and consequences. *Information and Inference: A Journal of the IMA*, 10(3):1105–1165, Jan 2021. Available at IMAIAI.

[3] **M. Celentano,** T. Misiakiewicz, and A. Montanari. Minimum complexity interpolation in random features models. 2021, arXiv:2103.15996 [cs.LG]. Available at arXiv.

[4] **M. Celentano** and A. Montanari. CAD: Debiasing the Lasso with inaccurate covariate model. *Under revision at Journal of the Royal Statistical Society, Series B*, 2021, arXiv:2107.14172 [math.ST]. Available at arXiv.

[5] **M. Celentano,** C. Cheng, and A. Montanari. The high-dimensional asymptotics of first order methods with random data. *Under Revision at the Annals of Applied Probability*, 2021, arXiv:2112.07572 [math.PR]. Available at arXiv.

[6] **M. Celentano** and A. Montanari. Fundamental barriers to high-dimensional regression with convex penalties. *The Annals of Statistics*, 50(1):170 – 196, Feb 2022. Available at AOS.

[7] **M. Celentano.** Sudakov-Fernique post-AMP, and a new proof of the local convexity of the TAP free energy. *Under revision at the Annals of Probability*, 2022, arXiv:2208.09550 [math.PR]. Available at arXiv.

[8] **M. Celentano,** Z. Fan, and S. Mei. Local convexity of the TAP free energy and AMP convergence for Z2-synchronization. *The Annals of Statistics*, 51(2):519 – 546, Apr 2023. Available at AOS.

[9] **M. Celentano,** A. Montanari, and Y. Wei. The Lasso with general Gaussian designs with applications to hypothesis testing. *Accepted at the Annals of Statistics*, 2023, arXiv:2007.13716 [math.ST]. Available at arXiv.

[10] **M. Celentano** and M. J. Wainwright. Challenges of the inconsistency regime: Novel debiasing methods for missing data models. 2023, arXiv:2309.01362 [math.ST]. Available at arXiv.

[11] S. Paik, **M. Celentano,** A. Green, and R. J. Tibshirani. Maximum mean discrepancy meets neural networks: The Radon-Kolmogorov-Smirnov test. 2023, arXiv:2309.02422 [stat.ML]. Available at arXiv.

[12] **M. Celentano,** L. Lin, Z. Fan, and S. Mei. Mean-field variational inference with the TAP free energy: Geometric and statistical properties in linear models. *In preparation*, 2023.