

# Benjamin Recht

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## Academic Employment

**Professor**, 2021-present  
**University of California, Berkeley**  
Department of Electrical Engineering and Computer Sciences

**Associate Professor**, 2015-2021  
**University of California, Berkeley**  
Department of Electrical Engineering and Computer Sciences

**Associate Professor**, 2015-2017  
**University of California, Berkeley**  
Department of Statistics

**Assistant Professor**, 2013-2015  
**University of California, Berkeley**  
Department of Electrical Engineering and Computer Sciences  
Department of Statistics

**Assistant Professor**, 2009-2013  
**University of Wisconsin, Madison, WI**  
Computer Sciences Department  
Wisconsin Institute for Discovery

**Post-doctoral Fellow**, 2006-2009  
**California Institute of Technology, Pasadena, CA**  
Center for the Mathematics of Information

**Research Assistant**, 2000-2006  
**Massachusetts Institute of Technology, Cambridge, MA**  
Media Laboratory/Center for Bits and Atoms  
*Advisor: Neil Gershenfeld*

## Education

**PhD**, 2006  
**Massachusetts Institute of Technology, Cambridge, MA**  
Thesis: Convex Modeling with Priors  
*Advisor: Neil Gershenfeld*

**Master of Science**, 2002  
**Massachusetts Institute of Technology, Cambridge, MA**  
Thesis: Spingineering: Quantum Control in the Presence of Relaxation  
*Advisor: Neil Gershenfeld*

**Bachelor of Science**, 2000  
**University of Chicago, Chicago, IL**

## Preprints

1. N/A

## Books

1. “Optimization for Modern Data-Analysis.” Stephen Wright and Benjamin Recht. Cambridge University Press. 2022.
2. “Patterns Predictions and Actions: Foundations of Machine Learning.” Moritz Hardt and Benjamin Recht. Princeton University Press. 2022.

## Journal Publications

1. “Interpolating Classifiers Make Few Mistakes.” Tengyuan Liang and Benjamin Recht. *Journal of Machine Learning Research*. 2022.
2. “Re-analysis on the statistical sampling biases of a mask promotion trial in Bangladesh: a statistical replication.” Maria Chikina, Wesley Pegden, and Benjamin Recht. *Trials*. Volume 23, No. 1, 1-5. 2022
3. “Active Learning for Nonlinear System Identification with Guarantees.” Horia Mania, Michael I. Jordan, and Benjamin Recht. *Journal of Machine Learning Research*. Volume 23. 1-30. 2022.
4. “A generalizable and accessible approach to machine learning with global satellite imagery.” Esther Rolf, Jonathan Proctor, Tamma Carleton, Ian Bolliger, Vaishal Shankar, Miyabi Ishihara, Benjamin Recht, and Solomon Hsiang. *Nature communications*. Volume 12, No. 1, 4392. 2021.
5. “A Lyapunov Analysis of Momentum Methods in Optimization.” Ashia C. Wilson, Benjamin Recht, and Michael I. Jordan. *Journal of Machine Learning Research*. Volume 22. 1-34. 2021.
6. “A Successive-Elimination Approach to Adaptive Robotic Source Seeking.” Esther Rolf, David Fridovich-Keil, Max Simchowitz, Benjamin Recht, and Claire Tomlin. *IEEE Transactions on Robotics*. DOI:10.1109/TRO.2020.300553. 2020.
7. “On the Sample Complexity of the Linear Quadratic Regulator.” Sarah Dean, Horia Mania, Nikolai Matni, Stephen Tu, and Benjamin Recht. *Foundations of Computational Mathematics*. Volume 20, No 4, 633-679. 2020.
8. “High-throughput fluorescence microscopy using multi-frame motion deblurring.” Zack F. Phillips, Sarah Dean, Benjamin Recht, and Laura Waller. *Biomedical Optics Express*. Volume 11, No. 1, 281-300. 2019.
9. “A Tour of Reinforcement Learning: The View from Continuous Control.” Benjamin Recht. *Annual Reviews of Control, Robotics, and Autonomous Systems*. Volume 2, No 1. 2018.
10. “Universality of Mallows’ and degeneracy of Kendall’s kernels for rankings.” Horia Mania, Aaditya Ramdas, Martin J. Wainwright, Michael I. Jordan, and Benjamin Recht. *Electronic Journal of Statistics*. Volume 12, No 2, 2537-2577. 2018.
11. “Saturating Splines and Feature Selection.” Nicholas Boyd, Trevor Hastie, Stephen Boyd, Benjamin Recht, and Michael Jordan. *Journal of Machine Learning Research*. Volume 18, No 197,

- 1-32. 2018.
12. “Gradient Descent Learns Linear Dynamical Systems.” Moritz Hardt, Tengyu Ma, and Benjamin Recht. To appear in *Journal of Machine Learning Research*. 2018.
13. “Sharp Time–Data Tradeoffs for Linear Inverse Problems.” Samet Oymak, Mahdi Soltanolkotabi, and Benjamin Recht. *IEEE Transactions on Information Theory*. Volume 64, No 6, 4129-4158. 2018.
14. “Isometric sketching of arbitrary sets via the Restricted Isometry Property.” Samet Oymak, Mahdi Soltanolkotabi, and Benjamin Recht. *Information and Inference: A Journal of the IMA*. iax019, <https://doi.org/10.1093/imaiai/iax019>. 2018.
15. “A Perturbed Iterate Framework for Asynchronous Stochastic Optimization Algorithms.” Horia Mania, Xinghao Pan, Dimitris Papailiopoulos, Kannan Ramchandran, Michael I. Jordan, and Benjamin Recht. *SIAM Journal on Optimization*. Volume 27, No 4, 2202–2229. 2017.
16. “Meaningless comparisons lead to false optimism in medical machine learning.” Orianna DeMasi, Konrad Kording, and Benjamin Recht. *PLOS One*. Volume 12, No 9, e0184604. 2017.
17. “Well-Being Tracking via Smartphone-Measured Activity and Sleep.” Orianna DeMasi, Sidney Feygin, Aluma Dembo, Adrian Aguilera, Benjamin Recht. *JMIR Mhealth*. Volume 5, No 10, e137. 2017.
18. “Super-Resolution Without Separation.” Geoffrey Schiebinger, Elina Robeva and Benjamin Recht. *Information and Inference: A Journal of the IMA*. Volume 00, 1–30. 2017.
19. “The Alternating Descent Conditional Gradient Method for Sparse Inverse Problems.” Nicholas Boyd, Geoffrey Schiebinger, and Benjamin Recht. *SIAM Journal on Optimization*. Volume 27, No. 2. 616–639. 2017.
20. “Analysis and Design of Optimization Algorithms via Integral Quadratic Constraints.” Laurent Lessard, Andrew Packard, and Benjamin Recht. *SIAM Journal on Optimization*. Volume 26, No. 1, 57—95. 2015.
21. “3D imaging in volumetric scattering media using phase-space measurements.” Hsiou-Yuan Liu, Eric Jonas, Lei Tian, Jingshan Zhong, Benjamin Recht, and Laura Waller. *Optics Express*. Volume 23, No. 11. 14461-14471. 2015.
22. “Efficient matrix completion for seismic data reconstruction.” R. Kumar, C. Da Silva, O. Akalin, A.Y. Aravkin, H. Mansour, B. Recht, F.J. Herrmann. *Geophysics*. Volume 80. No. 5. V97-V114. 2015.
23. “The Randomized Causation Coefficient.” David Lopez-Paz, Krikamol Muandet, and Benjamin Recht. To appear in *Journal of Machine Learning Research*. 2015.
24. “Fast methods for denoising matrix completion formulations, with applications to robust seismic data interpolation.” Aleksandr Y. Aravkin, Rajiv Kumar, Hassan Mansour, Benjamin Recht, Felix J. Herrmann. *SIAM Journal on Scientific Computing*. Volume 36. No 5. S237-S266. 2015.
25. “Near Minimax Line Spectral Estimation.” *IEEE Transactions on Information Theory*. Volume 61. No 1. 499-512. 2015.
26. “Robust Efficiency and Actuator Saturation Explain Healthy Heart Rate Control and

- Variability.” Na Li, Jerry Cruz, Chenghao Simon Chien, Somayeh Sojoudi, Benjamin Recht, David Stone, Marie Csete, Daniel Bahmiller, John C. Doyle. *Proceedings of the National Academy of Sciences*. Volume 111. No. 33. E3476-85. 2014.
27. “Blind Deconvolution using Convex Programming.” Ali Ahmed, Benjamin Recht, and Justin Romberg. *IEEE Transactions on Information Theory*. Vol 60, no 3, pages 1711-1732. 2014.
28. “Improvement in fast particle track reconstruction with robust statistics.” M. G. Aartsen, *et al.* *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*. Vol 736, no 1, pages 143-149. 2014.
29. “Compressed Sensing off the Grid.” Gongguo Tang, Badri Bhaskar, Parikshit Shah, and Benjamin Recht. *IEEE Transactions on Information Theory*. Vol 59, no 11, pages 7465-7490. 2013.
30. “Atomic Norm Denoising with Applications to Line Spectral Estimation.” Badri Narayan Bhaskar, Gongguo Tang, and Benjamin Recht. *IEEE Transactions on Signal Processing*. Vol 61, no 23, pages 5987-5999. 2013.
31. “Decomposition Methods for Large Scale LP Decoding.” Siddharth Barman, Xishuo Liu, Stark C. Draper, and Benjamin Recht. *IEEE Transactions on Information Theory*. Vol 59, no 12, pages 7870-7886. 2013.
32. “Parallel Stochastic Gradient Algorithms for Large-Scale Matrix Completion.” Benjamin Recht and Christopher Ré. *Mathematical Programming Computation*. Vol 5, no 2, pages 201-226. 2013.
33. “Alterations in Cerebrospinal Fluid Proteins in a Presymptomatic Primary Glioma Model.” John C. Whitin, Taichang Jang, Milton Merchant, Tom T-S. Yu, Kenneth Lau, Benjamin Recht, Harvey J. Cohen, and Lawrence Recht. *PLOS One*. Vol. 7, no 11, e49724. doi:10.1371/journal.pone.0049724
34. “The Convex Geometry of Linear Inverse Problems.” Venkat Chandrasekaran, Benjamin Recht, Pablo A. Parrilo, and Alan Willsky. *Foundations of Computational Mathematics*. Vol. 12, no 6, pages 805-849. 2012.
35. “Simple Bounds for Recovering Low-complexity Models.” Emmanuel Candès and Benjamin Recht. *Mathematical Programming*, Ser A. Vol. 141, no 1. Pages 577--589. 2013.
36. “Probability of Unique Integer Solution to a System of Linear Equations.” Olvi Mangasarian and Benjamin Recht. *European Journal of Operational Research*. Vol. 214, no 1, pages 27—30. 2011.
37. “Null space conditions and thresholds for rank minimization.” Benjamin Recht, Weiyu Xu, and Babak Hassibi. *Mathematical Programming*. Ser B. Vol. 127, pages 175–202. 2011.
38. “Tensor completion and low-n-rank tensor recovery via convex optimization.” Silvia Gandy, Benjamin Recht and Isao Yamada. *Inverse Problems*, Vol. 25, no 3. 025010. 2011.
39. “A Simpler Approach to Matrix Completion.” Benjamin Recht. *Journal of Machine Learning Research*, Vol. 12, pages 3413—3430. 2011.
40. “Exact Matrix Completion via Convex Optimization.” Emmanuel Candès and Benjamin Recht. *Foundations of Computational Mathematics*. Vol. 9, no 6, pages 717–772. 2009. (*Communications of the ACM Research Highlight*, Vol. 55 no. 6, pages 111-119, 2012.)
41. “Guaranteed Minimum Rank Solutions to Linear Matrix Equations via Nuclear Norm

Minimization.” Benjamin Recht, Maryam Fazel, and Pablo A. Parrilo. *SIAM Review*. Vol 52, no 3, pages 471-501. 2010.

42. “Gliomas undergo a distinct phenotypic change at the time of MRI detection.” Taichang Jang, Binulal Sathy, Yi-Hua Hsu, Milton Merchant, Benjamin Recht, Chen Chang, and Lawrence Recht. *Journal of Neurosurgery*. Vol 108, no 4, pages 782-790. 2008.

43. “Learning to Transform Time Series with a Few Examples.” Ali Rahimi, Benjamin Recht, and Trevor Darrell. *IEEE Transactions on Pattern Analysis and Machine Intelligence*. Vol 29, no 10, pages 1759-1775. 2007.

44. “Distributed Control of Systems over Discrete Groups.” Benjamin Recht and Raffaello D’Andrea. *IEEE Transactions on Automatic Control*. Vol 49, no 9, pages 1446-1452. 2004.

45. “Efficient Discrete Approximations of Quantum Gates.” Aram W. Harrow, Benjamin Recht, and Isaac L. Chuang. *Journal of Mathematical Physics*. Vol 43, no 9, pages 4445-4451. 2002.

46. “Physical One-Way Functions.” Ravikanth Pappu, Benjamin Recht, Jason Taylor, and Neil Gershenfeld, *Science*. Vol 297, no 5589, pages 2026-2030. 2002.

## Refereed Conference Proceedings

1. “Towards Psychologically-Grounded Dynamic Preference Models.” Mihaela Curmei, Andreas A Haupt, Benjamin Recht, and Dylan Hadfield-Menell. In *Proceedings of the 16th ACM Conference on Recommender Systems*, 2022.

2. “Plenoxels: Radiance fields without neural networks.” Sara Fridovich-Keil, Alex Yu, Matthew Tancik, Qinhong Chen, Benjamin Recht, and Angjoo Kanazawa. In *CVPR 2022*.

3. “Towards robust data-driven control synthesis for nonlinear systems with actuation uncertainty.” Andrew J Taylor, Victor D Dorobantu, Sarah Dean, Benjamin Recht, Yisong Yue, and Aaron D Ames. In *Proceedings of the 60th IEEE Conference on Decision and Control (CDC)*. 2021.

4. “Do Image Classifiers Generalize Across Time?” Vaishaal Shankar, Achal Dave, Rebecca Roelofs, Deva Ramanan, Benjamin Recht, and Ludwig Schmidt. In *ICCV 2021*.

5. “Representation matters: Assessing the importance of subgroup allocations in training data.” Esther Rolf, Theodora T. Worledge, Benjamin Recht, and Michael Jordan. In *ICML 2021*.

6. “Quantifying availability and discovery in recommender systems via stochastic reachability.” Mihaela Curmei, Sarah Dean, and Benjamin Recht. In *ICML 2021*.

7. “Certainty equivalent perception-based control.” Sarah Dean and Benjamin Recht. In *Learning for Dynamics and Control*. 2021.

8. “Measuring Robustness to Natural Distribution Shifts in Image Classification.” Rohan Taori, Achal Dave, Vaishaal Shankar, Nicolas Carlini, Benjamin Recht, and Ludwig Schmidt. In *Advances in Neural Information Processing Systems*. 2020.

9. “Guaranteeing Safety of Learned Perception Modules via Measurement-Robust Control Barrier Functions.” Sarah Dean, Andrew J. Taylor, Ryan K. Cosner, Benjamin Recht, and Aaron D. Ames. In *Conference on Robotic Learning*. 2020.

10. “numpywren: serverless linear algebra.” Vaishaal Shankar, Karl Krauth, Qifan Pu, Eric Jonas, Shivaram Venkataraman, Ion Stoica, Benjamin Recht, and Jonathan Ragan-Kelley. In *Proceedings of ACM Symposium on Cloud Computing*. 2020.

11. "Evaluating Machine Accuracy on ImageNet." Vaishaal Shankar, Rebecca Roelofs, Horia Mania, Alex Fang, Benjamin Recht, and Ludwig Schmidt. In *Proceedings of the International Conference of Machine Learning*. 2020.
12. "The Effect of Natural Distribution Shift on Question Answering Models." John Miller, Karl Krauth, Benjamin Recht, and Ludwig Schmidt. In *Proceedings of the International Conference of Machine Learning*. 2020.
13. "Neural Kernels Without Tangents." Vaishaal Shankar, Alex Fang, Wenshuo Guo, Sara Fridovich-Keil, Ludwig Schmidt, Jonathan Ragan-Kelley, and Benjamin Recht. In *Proceedings of the International Conference of Machine Learning*. 2020.
14. "Post-Estimation Smoothing: A Simple Baseline for Learning with Side Information." Esther Rolf, Michael I. Jordan, Benjamin Recht. In *AISTATS 2020*.
15. "Robust Guarantees for Perception-Based Control." Sarah Dean, Nikolai Matni, Benjamin Recht, and Vickie Ye. In *Proceedings of the 2<sup>nd</sup> Annual Conference on Learning for Dynamics and Control*. 2020.
16. "Recommendations and User Agency: The Reachability of Collaboratively-Filtered Information." Sarah Dean, Sarah Rich, and Benjamin Recht. In *Proceedings of the Conference on Fairness, Accountability, and Transparency*. 2020.
17. "Model Similarity Mitigates Test Set Overuse." Horia Mania, John Miller, Ludwig Schmidt, Moritz Hardt, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2019.
18. "A Meta-Analysis of Overfitting in Machine Learning." Rebecca Roelofs, Vaishaal Shankar, Benjamin Recht, Sara Fridovich-Keil, Moritz Hardt, John Miller, and Ludwig Schmidt. In *Advances in Neural Information Processing Systems*. 2019.
19. "Finite-time Analysis of Approximate Policy Iteration for the Linear Quadratic Regulator." Karl Krauth, Stephen Tu, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2019.
20. "Do ImageNet Classifiers Generalize to ImageNet?" Benjamin Recht, Rebecca Roelofs, Ludwig Schmidt, and Vaishaal Shankar. In *Proceedings of the International Conference on Machine Learning*. 2019.
21. "Certainty Equivalent Control of LQR is Efficient." Horia Mania, Stephen Tu, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2019.
22. "Learning Linear Dynamical Systems with Semi-Parametric Least Squares." Max Simchowitz, Ross Boczar, and Benjamin Recht. In *Conference on Learning Theory*. 2019.
23. "The Gap Between Model-Based and Model-Free Methods on the Linear Quadratic Regulator: An Asymptotic Viewpoint." Stephen Tu and Benjamin Recht. In *Conference on Learning Theory*. 2019.
24. "Do ImageNet Classifiers Generalize to ImageNet?" Benjamin Recht, Rebecca Roelofs, Ludwig Schmidt, and Vaishaal Shankar. In *Proceedings of the International Conference on Machine Learning*. 2019.
25. "Safely Learning to Control the Constrained Linear Quadratic Regulator." Sarah Dean, Stephen Tu, Nikolai Matni, and Benjamin Recht. In *Proceedings of the American Control Conference*.

2019.

26. Minimax Lower Bounds for H-infinity-Norm Estimation. Stephen Tu, Ross Boczar, and Benjamin Recht. In *Proceedings of the American Control Conference*. 2019.
27. “Regret Bounds for Robust Adaptive Control of the Linear Quadratic Regulator.” Sarah Dean, Horia Mania, Nikolai Matni, Benjamin Recht, Stephen Tu. In *Advances in Neural Information Processing Systems*. 2018.
28. “Simple random search provides a competitive approach to reinforcement learning.” Horia Mania, Aurelia Guy, Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2018.
29. “Finite-Data Performance Guarantees for the Output-Feedback Control of an Unknown System.” Ross Boczar, Nikola Matni, and Benjamin Recht. In *Proceedings of the 57th Conference on Decision and Control*. 2018.
30. “Least-Squares Temporal Difference Learning for the Linear Quadratic Regulator.” Stephen Tu and Benjamin Recht. In *Proceedings of the International Conference on Machine Learning*. 2018.
31. “Learning Without Mixing: Towards A Sharp Analysis of Linear System Identification.” Max Simchowitz, Horia Mania, Stephen Tu, Michael I. Jordan, and Benjamin Recht. In *Conference on Learning Theory*, 2018.
32. “Optimal Path and Illumination Design for Multiframe Motion Deblurring.” Sarah Dean, Zachary Phillips, Laura Waller, and Benjamin Recht. In *OSA Imaging and Applied Optics Congress*. 2018.
33. “On the Gap Between Strict-Saddles and True Convexity.” Max Simchowitz, Ahmed El Alaoui, Benjamin Recht. In *STOC* 2018.
34. “The Marginal Value of Adaptive Gradient Methods in Machine Learning”. Ashia C. Wilson, Rebecca Roelofs, Mitchell Stern, Nathan Srebro, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2017.
35. “Occupy the Cloud: Distributed computing for the 99%.” Eric Jonas, Shivaram Venkataraman, Ion Stoica, Benjamin Recht. In *Proceedings of ACM Symposium on Cloud Computing*. 2017.
36. “Breaking Locality Accelerates Block Gauss-Seidel.” Stephen Tu, Shivaram Venkataraman, Ashia C. Wilson, Alex Gittens, Michael I. Jordan, Benjamin Recht. In *Proceedings of the International Conference on Machine Learning*. 2017.
37. “Understanding Deep Learning Requires Rethinking Generalization.” Chiyuan Zhang, Samy Bengio, Moritz Hardt, Benjamin Recht, Oriol Vinyals. In *5th International Conference on Learning Representations*, 2017.
38. “KeystoneML: Optimizing Pipelines for Large-Scale Advanced Analytics.” Evan R. Sparks, Shivaram Venkataraman, Tomer Kaftan, Michael J. Franklin, and Benjamin Recht. In *IEEE International Conference on Data Engineering*, 2017.
39. “The Power of Adaptivity in Identifying Statistical Alternatives.” Kevin Jamieson, Daniel Haas, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2016.
40. “CYCLADES: Conflict-free Asynchronous Machine Learning.” Xinghao Pan, Maximilian Lam, Stephen Tu, Dimitris Papailiopoulos, Ce Zhang, Michael I. Jordan, Kannan Ramchandran,

- Chris Re, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2016.
41. “Detecting change in depressive symptoms from daily wellbeing questions, personality, and activity.” Orianna Demasi, Adrián Aguilera, Benjamin Recht. In *Wireless Health*, 2016.
42. “Ernest: Efficient Performance Prediction for Large Scale Advanced Analytics.” Shivaram Venkataraman, Zongheng Yang, Michael J Franklin, Benjamin Recht, and Ion Stoica. In *Networked Systems Design and Implementation*, 2016.
43. “Train Faster, Generalize Better: Stability of Stochastic Gradient Descent.” Moritz Hardt, Benjamin Recht, and Yoram Singer. In *Proceedings of the International Conference on Machine Learning*, 2016.
44. “Low-rank Solutions of Linear Matrix Equations via Procrustes Flow.” Stephen Tu, Ross Boczar, Mahdi Soltanolkotabi, and Benjamin Recht. In *Proceedings of the International Conference on Machine Learning*, 2016.
45. “Gradient Descent Converges to Minimizers.” Jason D. Lee, Max Simchowitz, Michael I. Jordan, and Benjamin Recht. In *Proceedings of the Conference on Learning Theory (COLT)*, 2016.
46. “Best-of-K Bandits.” Max Simchowitz, Kevin Jamieson, and Benjamin Recht. In *Proceedings of the Conference on Learning Theory (COLT)*, 2016.
47. “Ernest: Efficient Performance Prediction for Large Scale Advanced Analytics.” Shivaram Venkataraman, Zongheng Yang, Michael J Franklin, Benjamin Recht, and Ion Stoica. In *Proceedings of the 13<sup>th</sup> USENIX Symposium on Networked System Design and Implementation*, 2016.
48. “Parallel Correlation Clustering on Big Graphs.” Xinghao Pan, Dimitris Papailiopoulos, Samet Oymak, Benjamin Recht, Kannan Ramchandran, and Michael I. Jordan. In *Advances in Neural Information Processing Systems*, 2015.
49. “Exponential Convergence Bounds using Integral Quadratic Constraints.” Ross Boczar, Laurent Lessard, and Benjamin Recht. In *Proceedings of the 54<sup>th</sup> Conference on Decision and Control*. 2015.
50. Robert Nishihara, Laurent Lessard, Benjamin Recht, Andrew Packard, and Michael I. Jordan. “A General Analysis of the Convergence of ADMM.” In *International Conference on Machine Learning*. 2015.
51. “Sparse Recovery Over Continuous Dictionaries: Just Discretize.” Gongguo Tang, Badri Narayan Bhaskar, and Benjamin Recht. In *Proceedings of the Asilomar Conference on Signals, Systems, and Computers*. 2013.
52. “Factoring Nonnegative Matrices with Linear Programs.” Victor Bittorf, Benjamin Recht, Christopher Re, and Joel A. Tropp. In *Advances in Neural Information Processing*. 2012.
53. “Query Complexity of Derivative-free Optimization” Kevin Jamieson, Robert Nowak, and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2012.
54. “Linear System Identification via Atomic Norm Regularization.” Parikshit Shah, Badri Narayan Bhaskar, Gongguo Tang, and Benjamin Recht. In *51<sup>st</sup> Annual Conference on Decision and Control*. 2012.
55. “Security of Point-of-Sale Systems.” WesLee Frisby, Benjamin Moench, Benjamin Recht,



- Thomas Ristenpart. In *Proceedings of the 6<sup>th</sup> USENIX Workshop on Offensive Technologies*. 2012.
56. "Beneath the Valley of the Noncommutative Arithmetic-Geometric Mean Inequality: conjectures, case-studies, and consequences." Benjamin Recht and Christopher Re. In *Proceedings of the Conference on Learning Theory (COLT)*. 2012.
57. "Towards a Unified Architecture for in-RDBMS Analytics." Xixuan Feng, Arun Kumar, Benjamin Recht, and Christopher Re. In *Proceedings of the ACM SIGMOD Conference*. 2012.
58. "Tight Measurement Bounds for Exact Recovery of Structured Sparse Signals." Nikhil Rao, Benjamin Recht, and Robert Nowak. In *Proceedings of the Fifteenth International Conference on Artificial Intelligence and Statistics*. 2012.
59. "HOGWILD!: A Lock-Free Approach to Parallelizing Stochastic Gradient Descent." Feng Niu, Benjamin Recht, Christopher Ré, and Stephen J. Wright. In *Advances in Neural Information Processing Systems*. 2011.
60. "Decomposition Methods for Large Scale Linear Programming Decoding." Siddharth Barman, Stark Draper, Xishuo Liu, and Benjamin Recht. In *Proceedings of the Forty-Ninth Annual Allerton Conference on Communication, Control, and Computing*. 2011.
61. "Atomic Norm Denoising with Applications to Line Spectral Estimation." Badri Bhaskar and Benjamin Recht. In *Proceedings of the Forty-Ninth Annual Allerton Conference on Communication, Control, and Computing*. 2011.
62. "A Framework for Incorporating General Domain Knowledge into Latent Dirichlet Allocation using First-Order Logic." David Andrzejewski, Xiaojin Zhu, Mark Craven, and Benjamin Recht. In *Proceedings of the 22<sup>nd</sup> International Joint Conference on Artificial Intelligence*. 2011.
63. "Dimensionality reduction: beyond the Johnson-Lindenstrauss bound." Yair Bartal, Benjamin Recht, and Leonard Schulman. In *Proceedings of the ACM-SLAM Symposium on Discrete Algorithms*. 2011.
64. "Practical Large-Scale Optimization for Max-Norm Regularization" Jason Lee, Benjamin Recht, Ruslan Salakhutdinov, Nathan Srebro, and Joel A. Tropp. In *Advances in Neural Information Processing Systems*. 2010.
65. "Transduction with Matrix Completion: Three Birds with One Stone." Andrew Goldberg, Xiaojin Zhu, Benjamin Recht, Junming Sui, and Robert Nowak. In *Advances in Neural Information Processing Systems*. 2010.
66. "Online Identification and Tracking of Subspaces from Highly Incomplete Information." Laura Balzano, Robert Nowak, and Benjamin Recht. In *Proceedings of the 48<sup>th</sup> annual Allerton Conference on Communication, Control, and Computing*. 2010.
67. "High-Dimensional Matched Subspace Detection When Data are Missing" Laura Balzano, Robert Nowak, and Benjamin Recht. In *Proceedings of the IEEE International Symposium on Information Theory*. 2010.
68. "Sample Complexity for 1-bit Compressed Sensing and Sparse Classification." Ankit Gupta, Robert Nowak, and Benjamin Recht. In *Proceedings of the IEEE International Symposium on Information Theory*. 2010.
69. "Learning kernels from indefinite similarities," Yihua Chen, Maya R. Gupta, and Benjamin

- Recht, In *Proceedings of the International Conference on Machine Learning*. 2009.
70. "Necessary and Sufficient Conditions for Success of the Nuclear Norm Heuristic for Rank Minimization." Benjamin Recht, Weiyu Xu, and Babak Hassibi. In *Proceedings of the 47th IEEE Conference on Decision and Control*. 2008.
71. "Determining Interconnections in Biochemical Networks Using Linear Programming." Elias August, Antonis Papachristodoulou, Benjamin Recht, Mark Andrew James Roberts, and Ali Jadbabaie. In *Proceedings of the 47th IEEE Conference on Decision and Control*. 2008.
72. "Weighted Sums of Random Kitchen Sinks: Replacing minimization with randomization in Learning." Ali Rahimi and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2008.
73. "Uniform Approximation of Functions with Random Bases." Ali Rahimi and Benjamin Recht. In *Proceedings of the 46th Annual Allerton Conference on Communication, Control, and Computing*. 2008.
74. "Random Features for Large-Scale Kernel Machines." Ali Rahimi and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2007.
75. "Guaranteed Minimum Rank Solutions to Linear Matrix Equations via Nuclear Norm Minimization." Benjamin Recht, Maryam Fazel, and Pablo A. Parrilo. In *Proceedings of the 45th Annual Allerton Conference*. 2007.
76. "Determining Interconnections in Chemical Reaction Networks." Antonis Papachristodoulou and Benjamin Recht. In *Proceedings of the American Control Conference*. 2007.
77. "Estimating Observation Functions in Dynamical Systems using Unsupervised Regression." Ali Rahimi and Benjamin Recht. In *Advances in Neural Information Processing Systems*. 2006.
78. "Interaction Techniques for Musical Performance with Tabletop Tangible Interfaces." James Patten, Benjamin Recht, and Hiroshi Ishii. In *Advances in Computer Entertainment*. 2006.
79. "Learning Appearance Manifolds from Video." Ali Rahimi, Benjamin Recht, and Trevor Darrell. In *Computer Vision and Pattern Recognition*. 2005.
80. "Clustering with Normalized Cuts is Clustering with a Hyperplane." Ali Rahimi and Benjamin Recht. In *Statistical Learning in Computer Vision*. 2004.
81. "Exploiting Symmetry for the Distributed Control of Spatially Interconnected Systems." Benjamin Recht and Raffaello D'Andrea. In *Proceedings of the 42nd IEEE Conference on Decision and Control*. 2003.
82. "Musically Expressive Sound Textures from Generalized Audio." Benjamin Recht and Brian Whitman. In *Proceedings of the 6th International Conference on Digital Audio Effects*. 2003.
83. "Audiopad: A Tag-based Interface for Musical Performance." James Patten, Benjamin Recht, Hiroshi Ishii. In *Proceedings of the Conference on New Interfaces for Musical Expression*. 2002.

## Invited Talks

1. Plenary Talk. Machine Learning for Health (ML4H). New Orleans, December 2022.
2. University of Chicago Applied Mathematics Colloquium. November 2022.
3. Electrical and Systems Engineering Colloquium. University of Pennsylvania. September 2022.
4. Columbia Data Science Special Seminar, September 2022.
5. MIT LIDS Special Seminar, September, 2022.
6. MIT LIDS Colloquium, October, 2021.
7. Colloquium, MaLGa, University of Genova, July 2021.
8. Plenary Address. IFAC World Congress, July 2020.
9. Plenary Session. Information Theory and Applications Conference. February 2020.
10. Panelist, LIDS @ 80. Cambridge, MA. November 2020.
11. Plenary Address. 8th IFAC Workshop on Distributed Estimation and Control in Networked Systems. Chicago. September 2019.
12. ADSI Summer Workshop: Algorithmic Foundations of Learning and Control. University of Washington. August 2019.
13. Keynote Speaker, Midwest Machine Learning Symposium. June 2019.
14. Stanford Robotics Seminar. May 2019.
15. Computer Science Colloquium. University of British Columbia. May 2019.
16. Plenary. Information Theory and Applications. San Diego. February 2019.
17. Tutorial. Conference on Robotic Learning. Zurich. October 2018.
18. Princeton Day of Optimization. September 2018.
19. Tutorial. International Conference on Machine Learning. Stockholm. July 2018.
20. Machine Learning Summer School. University of Genoa. June 2018.
21. BIMoS Distinguished Lecture. TU Berlin. May 2018.
22. Max Planck Institute of the Mathematical Sciences. MPI Leipzig. April 2018.
23. Control Seminar Series. ETH Zurich. April 2018.
24. Deepmind. April 2018.
25. Department of Engineering, Information, and Communication Technologies. Pompeu Fabra University. March 2018.
26. Department of Economics and Business. Pompeu Fabra University. March 2018.
27. Department of Automatic Control. Lund University. February 2018.
28. Department of Mathematics, TU Berlin. January 2018.
29. MIT LIDS Seminar. December 2017.
30. Toyota Technological Institute at Chicago Colloquium. November 2017.
31. Columbia Data Science Colloquium. September 2017.
32. International Conference on Learning Representations (ICLR 2017). Keynote. April 2017.
33. NYU Center for Data Science. Math and Data Seminar. April 2017.
34. Bloomberg CTO DataScience Speaker Series. April 2017.

35. MIT Machine Learning Seminar. March 2017.
36. ACM-SIAM Symposium on Discrete Algorithms (SODA17). Plenary. January 2017.
37. BIRS workshop on Applied Harmonic Analysis, Massive Data Sets, Machine Learning, and Signal Processing. October 2016.
38. Optimization Methods for the Next Generation of Machine Learning. ICML, June 2016.
39. Distinguished Lecture: Office of Naval Research. December 2015.
40. MIT LIDS Seminar, November 2015.
41. Princeton Joint Applied and Computational Mathematics and Computer Sciences Colloquium. September 2015.
42. Strata 2015. Hardcore Data Science track. September 2015.
43. University of Washington/Microsoft Research Summer Institute 2015. August, 2015.
44. Google Tech Talk. New York, April 2015.
45. Spotify Tech Talk. New York, April 2015.
46. Twitter Tech Talk. San Francisco, April 2015.
47. Semiplenary, Conference on the Foundations of Computational Mathematics, Montevideo, Uruguay. December, 2014.
48. Keynote, Bay Area Machine Learning Symposium, October, 2014.
49. Columbia Department of Electrical Engineering. October 2014.
50. Strata NYC. October 2014.
51. Simons Institute for the Theory of Computing. Workshop on Semidefinite Optimization, Approximation and Applications. September 2014.
52. SIAM Annual Meeting, Workshop on Sparse Representations. July 2014.
53. Centre de Recerca Matemàtica, Facultat de Ciències. UAB, Bellaterra (Barcelona). Workshop on the Foundations of Learning Theory. June 2014.
54. Theory of Computing Colloquium. Massachusetts Institute of Technology, April 2014.
55. Google Tech Talk. Mountain View, March 2014.
56. INFORMS Conference on Optimization. Austin, March 2014.
57. Stochastic Gradient Methods. IPAM. February 2014.
58. Semidefinite Programming and Graph Algorithms. ICERM, February 2014.
59. NIPS workshop on Large Scale Matrix Analysis and Inference, December 2013.
60. NIPS workshop on Greedy Algorithms, Frank-Wolfe and Friends, December 2013.
61. GlobalSIP 2013 Symposium on Low-Dimensional Models and Optimization in Signal Processing. December 2013.
62. McGovern Institute for Brain Research Workshop on Learning Data Representation. MIT, November 2013.
63. Princeton ORIE colloquium, October, 2013.
64. Simons Institute workshop on Succinct Data Representations and Applications, September 2013.
65. Simons Institute Bootcamp on Big Data, September 2013.

66. Duke Workshop on Sensing and Analysis of High-Dimensional Data, July 2013.
67. Applied Math Colloquium. University of Wisconsin-Madison. April 2013.
68. ISE colloquium. University of Illinois. March 2013.
69. LIDS Seminar. Massachusetts Institute of Technology. November 2012.
70. FOCS Workshop on Randomized Numerical Linear Algebra (RandNLA): Theory and Practice. October 2012.
71. NYU Numerical Analysis and Scientific Computing Seminar. October 2012.
72. University of Edinburgh. Mathematics Department. June 2012.
73. West Coast Optimization Meeting. Seattle, May 2012.
74. Microsoft Research. May 2012.
75. Computer Science Colloquium. University of Washington. May 2012.
76. DSP Seminar. Rice University. April 2012.
77. Probabilistic Techniques and Algorithms. Austin, Texas. April 2012.
78. IMA Workshop on Machine Learning: Theory and Computation. Minneapolis. March, 2012.
79. Electrical Engineering Colloquium. UCLA. March 2012.
80. Applied Math Colloquium, Caltech. February 2012.
81. NIPS workshop on Optimization. Sierra Nevada, Spain. December 2011.
82. Mathematics Colloquium. University of Wisconsin-Madison. November 2011.
83. Computer Science Seminar. Duke University. November 2011.
84. Applied Algebra Days. University of Wisconsin-Madison. October 2011.
85. Statistics Colloquium. University of Wisconsin-Madison. September 2011.
86. Duke Workshop on Sensing and Analysis of High-Dimensional Data. Durham, North Carolina. July 2011
87. Foundations of Computational Mathematics. Budapest. July 2011.
88. Workshop on Sublinear Algorithms. Bertinoro International Center for Informatics, Italy. May 2011.
89. Optimization and Applications Seminar. ETH, Zurich. May 2011.
90. ORIE Colloquium. Cornell University. April 2011.
91. Tutte Seminar Colloquium. Department of Combinatorics and Optimization. University of Waterloo. April 2011.
92. Workshop on Sparse and Low-Rank Approximation. Banff International Research Station for Mathematical Innovation and Discovery. March 2011.
93. Georgia Tech CSIP Seminar. February 2011.
94. Georgia Tech Stochastics Seminar. February 2011.
95. Wharton High Dimensional Statistics Seminar, University of Pennsylvania. February 2011.
96. Workshop on Sparse Statistics, Optimization and Machine Learning. Banff International Research Station for Mathematical Innovation and Discovery. January 2011.
97. US-Mexico Workshop on Optimization and Applications. Oaxaca, January 2011.

98. Annual meeting of the Canadian Mathematical Society. Vancouver, December 2010.
99. Duke Electrical Engineering Systems Seminar. November 2010.
100. IPAM Workshop on Modern Trends in Optimization and Its Application: Numerical Methods for Continuous Optimization. October 2010.
101. Workshop on Sparsity and Computation, Bonn, Germany. June 2010.
102. AIM workshop on tensors, March 2010.
103. Center for the Mathematics of Information Anniversary Workshop, November 2009
104. Toyota Technical Institute, October 2009
105. International Symposium on Mathematical Programming, Chicago, September 2009.
106. Controls Seminar. University of Santa Barbara, April 2009.
107. Computer Science Department. University of Wisconsin, April 2009.
108. Electrical Engineering Seminar. Princeton University, April 2009.
109. Electrical Engineering Seminar. Massachusetts Institute of Technology, April 2009.
110. DIMACS/DyDAn Workshop on Streaming, Coding, and Compressive Sensing, March 2009.
111. Computer Science Seminar. New York University, March 2009.
112. Electrical Engineering Seminar. University of California, Berkeley, March 2009.
113. Market Systems Seminar. University of Pennsylvania, March 2009.
114. Computer Science Seminar. University of Chicago, February 2009.
115. Complex Systems Seminar. Rice University, February 2009.
116. CS Theory Seminar. University of Washington, November 2008.
117. Workshop on Geometry and Algorithms. Princeton University, October 2008.
118. Asilomar Conference on Signals, Systems, and Computers, October 2008.
119. Electrical Engineering Seminar. University of California Los Angeles, October 2008.
120. Optimization Seminar. University of Wisconsin, Madison, September 2008.
121. Allerton Conference on Communication, Control, and Computing, September 2008.
122. University of Pennsylvania Learning Seminar, May 2008
123. Facebook, Palo Alto, CA, April 2008.
124. MIT LIDS Seminar, April 2008.
125. MIT Statistical Learning Theory and Applications, Guest Lecture, April 2008.
126. Pomona College Computer Science Seminar, April 2008.
127. Southern California Algebra and Optimization Day. Caltech, March 2008.
128. UC Berkeley CS Theory Seminar, March 2008.
129. MIT Statistical Learning Theory and Applications, Guest Lecture, April 2007.
130. AI Seminar, University of California, San Diego, October 2006.
131. Connections II: Workshop on Fundamentals of Network Science, Caltech, August 2006.

## Teaching Experience

- 132. Special Seminar Department of Neurology, University of Massachusetts, January 2005.
- 133. Center for Bits and Atoms, MIT, December 2004.
- 134. Connections Conference, Caltech, July 2004.
- 135. Stochastic Systems Group Seminar, MIT, February 2004.
- 136. Avogadro Scale Engineering Workshop, MIT, November 2003.
- 137. Center for Bits and Atoms, MIT, October 2003.
- 138. Dorkbot NYC, Columbia University, November 2002.

**CS189 – Introduction to Machine Learning.** University of California, Berkeley, Fall 2016, Fall 2018.

**CS281A – Statistical Learning Theory.** University of California, Berkeley, Fall 2014, 2019, 2020, 2021.

**CS281B – Topics in Statistical Learning Theory.** University of California, Berkeley, Spring 2017.

**EECS227C – Optimization for Modern Data Analysis.** University of California, Berkeley. Spring 2014–2016, 2019.

**CS294 – The Mathematics of Information and Data.** University of California, Berkeley. Fall 2013.

**CS525 – Linear Programming.** University of Wisconsin-Madison, Spring 2010, Fall 2011.

**CS726 – Nonlinear Optimization I.** University of Wisconsin-Madison, Fall 2010, Fall 2012.

**CS838 – Topics in Optimization: The Convex Geometry of High-Dimensional Data Analysis.** University of Wisconsin-Madison. Spring 2010.

**CDS213 - Robust Control.** California Institute of Technology, Winter 2007. Instructor: John Doyle. Delivered a series of lectures on Modern System Identification.

**The Nature of Mathematical Modeling.** Massachusetts Institute of Technology, Spring 2005. Instructor: Neil Gershenfeld. Wrote and delivered lectures on applications of convex optimization to mathematical modeling. Ran weekly recitation sections.

**Analysis.** University of Chicago, 1998-2000. Instructor: Diane Hermann. Ran weekly recitation sections and graded problem sets.

**Young Scholars Program.** University of Chicago, 1996-2000. Tutor at enrichment program for talented high school students in the Chicago Public Schools.

## **Students Advised**

1. Laura Balzano, PhD. Electrical Engineering. 2012. (Assistant Professor, U Michigan)
2. Badri Bhaskar, PhD. Electrical Engineering. 2013. (Research Scientist, Facebook)
3. Geoffery Schiebinger, PhD. Statistics. 2016. (Assistant Professor, University of British Columbia).
4. Nicholas Boyd, PhD. Statistics. 2018. (Post-doc, MIT Broad Institute)
5. Ashia Wilson, PhD. Statistics. 2018. (Assistant Professor, MIT)
6. Orianna DeMasi, PhD. EECS. 2019.
7. Ross Boczar. PhD. EECS. 2019. (Amazon)
8. Rebecca Roelofs, PhD. EECS. 2019. (Research Engineer, Google AI)
9. Stephen Tu, PhD. EECS. 2019. (Research Engineer, Google AI)
10. Horia Mania, PhD. EECS. 2020. (Post-doc, MIT)
11. Vaishaal Shankar. PhD. EECS. 2020. (Amazon)
12. Max Simchowitz (PhD. EECS. 2021)
13. Sarah Dean (PhD. EECS 2021)
14. Esther Rolf (PhD. EECS 2022)
15. John Miller (PhD. EECS 2022)
16. Sara Fridovich-Keil (PhD. EECS. Expected 2023)
17. Mihaela Curmei (PhD. EECS. Expected 2024)

## **Postdocs Mentored**

1. Parikshit Shah (Facebook Research)
2. Gongguo Tang (Assistant Professor, Colorado School of Mines)
3. Laurent Lessard (Assistant Professor, University of Wisconsin, Madison)
4. Mahdi Soltanolkotabi (Assistant Professor, USC)
5. Samet Oymak (Assistant Professor, UC Riverside)
6. Dimitris Papailiopoulos (Assistant Professor, University of Wisconsin, Madison)
7. Qingqing Huang (Google AI)
8. Kevin Jamieson (Assistant Professor, University of Washington)
9. Eric Jonas (Assistant Professor, University of Chicago)
10. Nikolai Matni (Assistant Professor, University of Pennsylvania)
11. Ludwig Schmidt (Assistant Professor, University of Washington)
12. Christopher Harshaw



## Awards

NIPS Test of Time Award, 2020.  
NIPS Test of Time Award, 2017.  
William O. Baker Award for Initiatives in Research, National Academy of Sciences, 2015.  
Okawa Foundation Research Grant, 2014.  
Presidential Early Career Awards for Scientists and Engineers, 2012 (awarded in 2014).  
Jamon Lecture Award, 2013.  
Lagrange Prize in Continuous Optimization. Awarded jointly by the Mathematical Optimization Society (MOS) and the Society for Industrial and Applied Mathematics (SIAM) for outstanding work in the area of continuous optimization over the past six years. 2012.  
Alfred P. Sloan Research Fellowship, 2012.  
Industrial Design Excellence Award, Industrial Designers Society of America, 2004.  
Best in Show, Best in Academic Category, and Best Interactivity in Designing Interactive Systems Design Competition, 2004.  
3rd place, Vida 6.0 Art & Artificial Life International Competition, 2003.  
MIT Presidential Fellowship, 2000-2001.  
Paul Cohen Prize as outstanding graduating senior in Mathematics, 2000.  
Goldwater Scholarship, 1998-2000.  
Phi Beta Kappa, 1999.  
University of Chicago College Honor Scholarship, 1996-2000.

## Professional Service

1. Founder and Program Chair, *Conference on Learning for Dynamics and Control*. 2019-2021.
2. Organizer of IPAM workshop on intersections between learning, optimization, and control. February, 2020.
3. Action Editor. *Journal of Machine Learning Research*. 2013-2020.
4. Editorial Board. *Mathematical Programming*. 2013-2015.
5. Organizer of IPAM workshop on stochastic gradient methods, February 2014.
6. Organizer of SILO workshop on the Mathematics of Information, June 2013, June 2015.
7. Organizer of workshop on optimization in machine learning, ICML 2012.
8. Editorial Board. *Journal of Machine Learning Research*. 2009-2013.
9. Cluster Chair, *International Symposium on Mathematical Programming*, 2012.

## Selected Exhibitions

1. "Rope and Sound" with Squid Labs. Cooper Hewitt Museum, New York. 2005.
2. "Frequency Reallocation Project." with Noah Vawter and Brian Whitman. Spectropolis Festival. New York. 2004.
3. "Concrete Music." with Brian Whitman, Noah Vawter, and Ethan Bordeaux. ARCO Festival. Madrid, Spain. 2004.
4. "Audiopad." with James Patten. Museu d'Art Contemporani de Barcelona, Barcelona Spain. 2003. Ars Electronica Center. Linz, Austria. 2003.
5. "a meow mix." with Ethan Bordeaux, Noah Vawter, and Brian Whitman. Cyberarts Festival. Boston, Massachusetts. 2003.

## Professional Music Experience

Extensive experience performing, composing, and producing electronic music. Released music on labels Barge Records, Kompakt, Beat Research, Three:four Recordings, and Unfoundsound. Performed throughout U.S. and Europe with The Fun Years, Localfields, Mike Uzzi, and The Dan Bensons Project.