Max Simchowitz

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Education

Massachusetts Institute of technology, Cambridge, MA, USA   **2021 - present**

     Postdoctoral Fellow, *CSAIL*,
     Host: Russ Tedrake and the Robot Locomotion Group.

University of California, Berkeley, Berkeley, CA, USA   **2015 - 2021**

     Ph.D., *Electrical Engineering and Computer Science*
     Advisors: Benjamin Recht and Michael I. Jordan

Princeton University, Princeton, NJ, USA   **June 2015**

     A.B., *Mathematics*, Summa Cum Laude.

Awards

Best Paper Finalist, *Robotics Science and Systems (RSS)*, 2023.
Outstanding Paper Award, *International Conference on Machine Learning (ICML)*, 2022.
Open Philanthropy AI Fellowship, *Good Ventures Foundation*, 2019.
Best Paper Award, *International Conference on Machine Learning (ICML)*, 2018.
Berkeley Fellowship *University of California, Berkeley and by the Rose Hill Foundation,* 2018.
Tong Leong Lim Pre-Doctoral Prize, *University of California, Berkeley*, 2017.
NSF GRFP Fellowship, *NSF*, 2015-2017.
George B. Covington Prize for Excellence in Mathematics, *Princeton University*, 2015.
Phi Beta Kappa, Early Induction (Top 2% of Graduating Class), *Princeton University*, 2014.
Shapiro Prize for Academic Excellence, *Princeton University*, 2012 & 2013.
Manfred Pyka Memorial Prize for Physics, *Princeton University*, 2012.
Quin Morton '36 Prize for Writing, *Princeton University*, 2012.

Award-Winning Publications

"Non-Euclidean Motion Planning with Graphs of Geodesically-Convex Sets," Thomas Cohn, Mark Petersen, Max Simchowitz, Russ Tedrake. *Robotics Science and Systems (RSS)*, 2023. **Best Paper Finalist**.

"Do Differentiable Simulators Give Better Policy Gradients?," H.J. Terry Suh, Max Simchowitz, Kaiqing Zhang, Russ Tedrake. *International Conference on Machine Learning (ICML)*, 2022. **Outstanding Paper Award.**

"Balancing Competing Objectives for Welfare-Aware Machine Learning with Imperfect Data," Esther Rolf, Max Simchowitz, Sarah Dean, Lydia T. Liu, Daniel Bjrkegren, Moritz Hardt, Joshua Blumenstock. *The NeurIPS Joint Workshop on AI for Social Good,*, 2019. **Best paper award.**

"Delayed Impact of Fair Machine Learning," Lydia T. Liu, Sarah Dean, Esther Rolf, Max Simchowitz, Moritz Hardt. *International Conference on Machine Learning (ICML)*, 2018. **Best Paper Award.**

Journal Publications

"Do Differentiable Simulators Give Better Policy Gradients?" H.J. Terry Suh, Max Simchowitz, Kaiqing Zhang, Russ Tedrake. *Journal of Machine Learning Research (JMLR)*, *Special Edition*, 2023 (to appear).

"Exploration and Incentives in Reinforcement Learning," Max Simchowitz, Aleksandrs Slivkins. *Operations Research*, 2023 (to appear). ArXiv: 2103.00360

"First-order Methods Almost Always Avoid Saddle Points," Jason D. Lee, Ioannis Panageas, Georgios Piliouras, Max Simchowitz, Michael I. Jordan, Benjamin Recht". *Mathematical Programming (pg. 1-27)*, 2019. ArXiv: 1710.07406

2023

"Non-Euclidean Motion Planning with Graphs of Geodesically-Convex Sets," Thomas Cohn, Mark Petersen, Max Simchowitz, Russ Tedrake. *Robotics Science and Systems (RSS)*, 2023. ArXiv: 2305.06341. **Best Paper Finalist**.

"Oracle-Efficient Smoothed Online Learning for Piecewise Continuous Decision Making," Adam Block, Max Simchowitz, Sasha Rakhlin. *Conference on Learning Theory (COLT)*, 2023. ArXiv: 2302.05430.

"Tackling Combinatorial Distribution Shift: A Matrix Completion Perspective," Max Simchowitz, Abhishek Gupta, Kaiqing Zhang. *Conference on Learning Theory (COLT)*, 2023. ArXiv: 2307.06457

"Statistical Learning under Heterogenous Distribution Shift," Max Simchowitz, Anurag Ajay, Pulkit Agrawal, Akshay Krishnamurthy. *International Conference on Machine Learning (ICML)*, 2023. ArXiv: 2302.13934.

"The Power of Learned Locally Linear Models for Nonlinear Policy Optimization," Daniel Pfrommer, Max Simchowitz, Tyler Westenbroek, Nikolai Matni, Stephen Tu. *International Conference on Machine Learning (ICML)*, 2023. ArXiv: 2305.09619.

"Learning to Extrapolate: A Transductive Approach" Aviv Netanyahu, Abhishek Gupta, Max Simchowitz, Kaiqing Zhang, Pulkit Agrawal. *International Conference on Representation Learning (ICLR)*, 2023. ArXiv: 2304.14329.

2022

"Efficient and Near-Optimal Smoothed Online Learning for Generalized Linear Functions," Adam Block, Max Simchowitz. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2022. ArXiv: 2205.13056

"Globally Convergent Policy Search over Dynamic Filters for Output Estimation," Jack Umenberger, Max Simchowitz, Juan C. Perdomo, Kaiqing Zhang, Russ Tedrake. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2022. ArXiv: 2202.11659

"Do Differentiable Simulators Give Better Policy Gradients?" H.J. Terry Suh, Max Simchowitz, Kaiqing Zhang, Russ Tedrake. *International Conference on Machine Learning (ICML)*, 2022. ArXiv: 2202.00817. **Outstanding Paper Award.**

"Reward-Free RL is No Harder Than Reward-Aware RL in Linear Markov Decision Processes," Andrew Wagenmaker, Yifang Chen, Max Simchowitz, Simon S. Du, Kevin Jamieson. *International Conference on Machine Learning (ICML)*, 2022. ArXiv: 2201.11206. **Spotlight**.

"First-Order Regret in Reinforcement Learning with Linear Function Approximation: A Robust Estimation Approach," Andrew Wagenmaker, Yifang Chen, Max Simchowitz, Simon S. Du, Kevin Jamieson. *International Conference on Machine Learning (ICML)*, 2022. ArXiv: 2112.03432. **Oral Presentation**.

"Beyond No Regret: Instance-Dependent PAC Reinforcement Learning," Andrew Wagenmaker, Max Simchowitz, Kevin Jamieson. *Conference on Learning Theory (COLT)*, 2022. ArXiv: 2108.02717.

2021

"Bayesian decision-making under misspecified priors with applications to meta-learning," Max Simchowitz, Christopher Tosh, Akshay Krishnamurthy, Daniel Hsu, Thodoris Lykouris, Miroslav Dudk, Robert E. Schapire. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2021. ArXiv: 2103.00360. **Spotlight**.

"Stabilizing Dynamical Systems via Policy Gradient Methods," Juan C. Perdomo, Jack Umenberger, Max Simchowitz. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2021.

"Online Control of Unknown Time-Varying Dynamical Systems," Edgar Minasyan, Paula Gradu,

Max Simchowitz, Elad Hazan. *Conference on Neural Informtion Processing Systems (NeurIPS)*. Neurips, 2021. ArXiv: TODO.

"On Stability of Nonlinear Receding Horizon Control: A Geometric Perspective," Tyler Westenbroek, Max Simchowitz, Michael I. Jordan, S. Shankar Sastry. *Conference on Decision and Control (CDC)*, 2021. ArXiv: 2103.15010.

"Task-Optimal Exploration in Linear Dynamical Systems," Andrew Wagenmaker, Max Simchowitz, Kevin Jamieson. *International Conference on Machine Learning (ICML)*, 2021. ArXiv: 2102.05214

"Towards a Dimension-Free Understanding of Adaptive Linear Control," Juan C. Perdomo, Max Simchowitz, Alekh Agarwal, Peter Bartlett. *Conference on Learning Theory (COLT)*, 2021. ArXiv: 2103.10620

"Corruption Robust Exploration in Episodic Reinforcement Learning," Thodoris Lykouris, Max Simchowitz, Aleksandrs Slivkins, Wen Sun. *Conference on Learning Theory (COLT)*, 2021 (extended abstract). ArXiv: 1911.08689.

2020

"Making Non-Stochastic Control (Almost) as Easy as Stochastic," Max Simchowitz. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2020. ArXiv: 2006.05910.

"Learning a Linear Quadratic Regular from Nonlinear Observations," Zak Mhammedi, Dylan Foster, Max Simchowitz, Dipendra Misra, Akshay Krishnamurthy, Sasha Rakhlin, John Langford. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2020. ArXiv: 2010.03799.

"Constrained episodic reinforcement learning in concave-convex and knapsack setting," Kiant Brantley, Miroslav Dudik, Thodoris Lykouris, Sobhan Miryoosefi, Max Simchowitz, Aleksandrs Slivkins, Wen Sun. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2020. ArXiv: 2006.05051.

"Naive Exploration is Optimal for Online LQR", Max Simchowitz, Dylan Foster. *International Conference on Machine Learning (ICML)*, 2020. ArXiv: 2001.09576.

"Logarithmic Regret for Online Control with Adversarial Disturbances", Dylan Foster, Max Simchowitz. *International Conference on Machine Learning (ICML)*, 2020. ArXiv: 2003.00189

"Reward-Free Exploration for Reinforcement Learning," Chi Jin, Akshay Krishnamurthy, Max Simchowitz, Tiancheng Yu. *International Conference on Machine Learning (ICML)*, 2020. ArXiv: 2002.02794.

"Improper Learning for Nonstochastic Control," Max Simchowitz, Karan Singh, Elad Hazan. *Conference on Learning Theory (COLT)*, 2020. ArXiv: 2001.09254.

"The gradient complexity of linear regression," Mark Braverman, Elad Hazan, Max Simchowitz, Blake Woodworth. *Conference on Learning Theory (COLT)*, 2020. ArXiv: 1911.02212.

"Balancing Competing Objectives with Noisy Data: Score-Based Classifiers for Welfare-Aware Machine Learning," Esther Rolf, Max Simchowitz, Sarah Dean, Lydia T. Liu, Daniel Björkegren, Moritz Hardt, Joshua Blumenstock. *International Conference on Machine Learning (ICML)*, 2020. ArXiv: 2003.06740.

"A Successive-Elimination Approach to Adaptive Robotic Source Seeking," Esther Rolf, David Fridovich-Keil, Max Simchowitz Benjamin Recht, Claire Tomlin. *IEEE Transactions on Robotics*, 2020. ArXiv: 1809.10611

2019

"Non-Asymptotic Gap-Dependent Regret Bounds for Tabular MDPs," Max Simchowitz, Kevin Jamieson. *Conference on Neural Informtion Processing Systems (NeurIPS)*, 2019. ArXiv: 1905.03814.

"Learning Linear Dynamical Systems with Semi-Parametric Least Squares," Max Simchowitz, Ross Boczar, Benjamin Recht. *Conference on Learning Theory (COLT)*, 2019. ArXiv: 1902.00768

2018

"The Implicit Fairness Criterion of Unconstrained Learning," Lydia Liu, Max Simchowitz, Moritz Hardt. *International Conference on Machine Learning (ICML)*, 2019. ArXiv: 1808.10013.

"Delayed Impact of Fair Machine Learning," Lydia T. Liu, Sarah Dean, Esther Rolf, Max Simchowitz, Moritz Hardt. *International Conference on Machine Learning (ICML)*, 2018. ArXiv: 1803.04383. **Best Paper Award.**

"Learning Without Mixing: Towards A Sharp Analysis of Linear System Identification," Max Simchowitz, Horia Mania, Stephen Tu, Benjamin Recht, Michael I. Jordan. *Conference on Learning Theory (COLT)*, 2018. ArXiv: 1802.08334

"Tight Query Complexity Lower Bounds for PCA via Finite Sample Deformed Wigner Law," Max Simchowitz, Ahmed El Alaoui, Benjamin Recht. *Symposium on the Theory of Computing (STOC)*, 2018. ArXiv: 1804.01221.

"Approximate Ranking from Pairwise Comparisons," Reinhard Heckel, Max Simchowitz, Kannan Ramchandran, Martin J. Wainwright. *Artificial Intelligence and Statistics Conference (AIS-TATS)*, 2018. ArXiv: 1801.01253

2017 and before

"The Simulator: Towards a Richer Understanding of Adaptive Sampling in the Moderate-Confidence Regime," Max Simchowitz, Kevin Jamieson, and Benjamin Recht. *Conference on Learning Theory (COLT)*, 2017. ArXiv: 1702.05186

"Best-of-K Bandits," Max Simchowitz, Kevin Jamieson, and Benjamin Recht. *Conference on Learning Theory (COLT)*, 2016. ArXiv: 1603.02752.

"Gradient Descent Converges to Minimizers," Jason D. Lee, Max Simchowitz, Michael I. Jordan, and Benjamin Recht. *Conference on Learning Theory (COLT)*, 2016. ArXiv: 1602.04915.

"Low-rank Solutions of Linear Matrix Equations via Procrustes Flow," Stephen Tu, Ross Boczar, Max Simchowitz, Mahdi Soltanolkotabi, Benjamin Recht. *International Conference on Machine Learning (ICML)*, 2016. ArXiv: 1507.03566.

WORKSHOP PROCEEDINGS

"Imitating Complex Trajectories: Bridging Low-Level Stability and High-Level Behavior," Adam Block, Daniel Pfrommer, Max Simchowitz. *Frontiers4LCD Workshop, International Conference on Machine Learning (ICML)*, 2023.

"Pathologies and Challenges of Using Differentiable Simulators in Policy Optimization for Contact-Rich Manipulation," H.J. Terry Suh, Max Simchowitz, Kaiqing Zhang, Russ Tedrake. *ICRA 2022 Workshop: Reinforcement Learning for Contact-Rich Manipulation*, 2022.

"Learning to Extrapolate: A Transductive Approach,". Aviv Netanyahu, Abhishek Gupta, Max Simchowitz, Kaiqing Zhang, Pulkit Agrawal. *NeurIPS Workshop on Distribution Shifts (Dist-Shift)*, 2022.

"Balancing Competing Objectives for Welfare-Aware Machine Learning with Imperfect Data," Esther Rolf, Max Simchowitz, Sarah Dean, Lydia T. Liu, Daniel Bjrkegren, Moritz Hardt, Joshua Blumenstock. *The NeurIPS Joint Workshop on AI for Social Good,*, 2019. **Best paper award.**

PREPRINTS

Additional preprints: https://msimchowitz.github.io/publications.html

INVITED TALKS

BLISS Seminar, University of California, Berkeley, April 2023.

Statistics Winter Workshop, University of Florida, January 2023.
Machine Learning Group, Johns Hopkins University, November 2020.
RL Theory Seminar, July 2020.
Robot Locomotion Group, MIT, April 2020
Asilomar Conference, November 2019.
Machine Learning Seminar, Microsoft Research NY, February 2019.
Machine Learning Seminar, University of Washington, May 2018.
Machine Learning Theory Seminar, Princeton University, April 2018.

TEACHING   Introduction to Machine Learning (CS 189/289A) *UC Berkeley*, Fall 2018. **Teaching Assistant.**

Convex Optimization and Approximation (EE 227C), *UC Berkeley*, Spring 2018. **Teaching Assistant.** https://ee227c.github.io/. *Link for course notes.*

Machine Learning in Feedback Systems (CS 6784-002), *Cornell University*, Fall 2022. **Guest Lecture**. Lecture #10.

SERVICE AND LEADERSHIP   **Conference Reviewing** Neural Information Processing Systems (NeurIPS) (Top 400 Reviewer, 2019), Conference on Learning Theorey (COLT), International Conference on Machine Learning (ICML), Symposium on the Theorey of Computing (STOC), Artificial Intelligence and Statistics (AIStats), Conference on Decision Making and Control (CDC).

Journal Reviewing Journal of Machine Learning Research (JMLR), *Editorial Board.*

Workshop Organization Organizer of ICML 2020 Workshop on the Theoretical Foundations of Reinforcement Learning.

OTHER RESEARCH POSITIONS

Research Intern, *Microsoft Research NY*	**June - August 2020**
Visiting Researcher, *MIT*	**January - June 2020**
Research Intern, *Microsoft Research NY*	**September - December 2019**
Visiting Researcher, *Princeton University*	**July - August 2019**