Sarah Dean

https://sdean.website   sdean@cornell.edu

RESEARCH INTERESTS	*I study the interplay between optimization, machine learning, and dynamics in real-world systems with the goal of understanding the fundamentals of data-driven methods for control and decision-making. My research is grounded in collaborative projects ranging from robotics to recommendation systems.*

ACADEMIC POSITIONS

Assistant Professor, Department of Computer Science   Jan 2022 – present
Cornell University, Ithaca, NY.

Postdoctoral Scholar, Paul G. Allen School of Computer Science & Engineering   Aug 2021 – Dec 2021
University of Washington, Seattle, WA.
Advised by Prof. Jamie Morgenstern.

EDUCATION

University of California, Berkeley
Ph.D., Electrical Engineering and Computer Science, August 2021.
   Thesis: *Reliable Machine Learning in Feedback Systems, advised by Prof. Benjamin Recht.*
M.S., Electrical Engineering and Computer Science, May 2019.

University of Pennsylvania
B.S.E., Electrical Engineering and Mathematics, May 2016.

HONORS AND AWARDS

Best Paper Finalist, *Conference on Robot Learning*	2020
Best Paper Award, *NeurIPS Joint Workshop on AI for Social Good*	2019
Best Paper Award, *International Conference of Machine Learning*	2018
Best Student Paper in Imaging Systems, *OSA Imaging Applied Optics Congress*	2018
Tong Leong Lim Pre-Doctoral Prize, *UC Berkeley EECS Department*	2018
Atwater Kent Prize in Electrical Engineering, *University of Pennsylvania*	2016
Albert P. Godsho Engineering Prize, *University of Pennsylvania*	2016
Hugo Otto Wolf Memorial Prize, *University of Pennsylvania*	2016
E. Stuart Eichert, Jr. Memorial Prize for Electrical Engineering, *University of Pennsylvania*	2015
Good Teaching Award, *UPenn Math Department*	2015

GRANTS AND FELLOWSHIPS

AWS Cloud Computing Grant, *Center for Data Science for Enterprise & Society*	2024
2030 Project Fast Grant for Expanding Weather Data Coverage, *Cornell Atkinson*	2024
NSF OAC Grant (co-PI), *Frameworks: arXiv as an accessible large-scale open research platform*	2024
NSF CCF Medium Grant (lead PI), *Machine Learning Markets: Dynamics, Competition, and Interventions*	2023
Research Award, *LinkedIn*	2023
Bias and Transparency in AI Award, *Mozilla Technology Fund*	2023
Gift for Recommendations with Long-Term Strategic Objectives, *Wayfair*	2022
Research Gift, *Meta*	2022
Center for Longterm Cybersecurity Project Grant, *UC Berkeley*	2020
Social Science Matrix Research Grant, *UC Berkeley*	2019
Center for Longterm Cybersecurity Seed Grant, *UC Berkeley*	2019
NSF Graduate Research Fellowship	2016
Berkeley Fellowship, *UC Berkeley*	2016
Tau Beta Pi Fellowship	2016

TEACHING

Instructor, *Cornell University CS Department*.
· Introduction to Machine Learning, Fall 2024. Co-teaching with Thorsten Joachims and John Thickstun.
· Machine Learning in Feedback Systems, Fall 2022 and 2023.
· Introduction to Reinforcement Learning, Spring 2022-2024.

Graduate Student Instructor, *University of California, Berkeley EECS Department*.
· EECS Anti-Racism and Social Justice Course Development, Fall 2020.
· Statistical Learning Theory, Fall 2019.
· Introduction to Machine Learning, Fall 2018.

Teaching Assistant, *John's Hopkins Center for Talented Youth at Skidmore College*.

- Electrical Engineering, Summer 2016.

Teaching Assistant, *University of Pennsylvania ESE Department.*
- Digital Audio Basics, Spring 2014, 2016.
- Introduction to Electrical and Systems Engineering. Fall 2013, 2014, 2015.

Teaching Assistant, *University of Pennsylvania Math Department.*
- Integral Calculus, Spring 2016.
- Multivariate Calculus, Fall 2014, Spring 2015.

Tutor, *University of Pennsylvania.*
- Multivariate Calculus, Spring 2013, Fall 2013, Spring 2014.
- Linear Algebra and Differential Equations, Fall 2013, Spring 2014.

INTERNSHIPS	Research Intern at Canopy	Summer 2019

Explored concepts relating to user agency and developed a computationally efficient audit of model "reachability."

SERVICE AND LEADERSHIP

Steering Comittee for Northeast Systems and Control Workshop (2024–present). **Organizing Committee** for Workshop on Decision Making for Information Retrieval and Recommender Systems at WWW (2023) and Recommendation Ecosystems Workshop: Modeling, Optimization, and Incentive Design at AAAI (2024). **Publications Chair** for L4DC (2023).

Area Chair for NeuRIPS, ICML, and L4DC. **Conference reviewer** for ALT, ACC, CDC, ICML, ITCS, L4DC, and NeurIPS. **Journal reviewer** for IEEE-TAC, JMLR, SIMODS, and Springer Machine Learning.

Co-founder of Graduates for Engaged and Extended Scholarship in Computing and Engineering (geesegraduates.org), a cross-disciplinary group that aims to give graduate students a constructive place to reflect on issues of society and technology and **organizer** of affiliated panel and speaker events.

Women in Computer Science and Engineering lunch coordinator, 2018. **WITI@UC Women in Tech Symposium** planning committee, 2019.

Volunteer mentor for students in elementary school (Bay Area Scientists in Schools, 2017), middle school (Be A Scientist, 2016), high school (CalMentors, 2020), and college (BAIR Undergraduate Mentoring Program, 2017).

PUBLICATIONS

PREPRINTS

1. *Accounting for AI and Users Shaping One Another: The Role of Mathematical Models.* arXiv:2404.12366
   Sarah Dean, Evan Dong, Meena Jagadeesan, Liu Leqi.

2. *Initializing Services in Interactive ML Systems for Diverse Users.* arXiv:2312.11846
   Avinandan Bose, Mihaela Curmei, Daniel L Jiang, Jamie Morgenstern, Sarah Dean, Lillian J Ratliff, Maryam Fazel.

3. *Do Offline Metrics Predict Online Performance in Recommender Systems?* arXiv:2011.07931.
   Karl Krauth, Sarah Dean, Alex Zhao, Wenshuo Guo, Mihaela Curmei, Benjamin Recht, and Michael I. Jordan.

CONFERENCE PAPERS

1. *Harm Mitigation in Recommender Systems under User Preference Dynamics.*
   ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD), 2024.
   Jerry Chee, Shankar Kalyanaraman, Sindu K Ernala, Udi Weinsberg, Sarah Dean, Stratis Ioannidis.

2. *Learning from Streaming Data when Users Choose.*
   International Conference on Machine Learning (ICML), 2024.
   Jinyan Su, Sarah Dean.

3. *Random Features Approximation for Control-Affine Systems.*
   Learning for Dynamics and Control (L4DC), 2024.
   Kimia Kazemian, Yahya Sattar, Sarah Dean.

4. *Strategic Usage in a Multi-Learner Setting.*
   International Conference on Artificial Intelligence and Statistics (AISTATS), 2024.
   Eliot Seo Shekhtman, Sarah Dean.

5. *Emergent specialization from participation dynamics and multi-learner retraining.*
   International Conference on Artificial Intelligence and Statistics (AISTATS), 2024.
   Sarah Dean, Mihaela Curmei, Lillian J. Ratliff, Jamie Morgenstern, Maryam Fazel.

6. *Ranking with Long-Term Constraints*
   ACM International Conference on Web Search and Data Mining (WSDM), 2024.
   Kianté Brantley, Zhichong Fang, Sarah Dean, Thorsten Joachims.

7. *Online Convex Optimization with Unbounded Memory.*
   Advances in Neural Information Processing Systems (NeurIPS), 2023.
   Raunak Kumar, Sarah Dean, Robert D. Kleinberg.

8. *Reward Reports for Reinforcement Learning.*
   AAAI/ACM Conference on AI, Ethics, and Society (AIES), 2023.
   Thomas Krendl Gilbert, Sarah Dean, Tom Zick, Nathan Lambert, Aaron Snoswell, Soham Mehta.

9. *Perception-Based Sampled-Data Optimization of Dynamical Systems .*
   IFAC World Congress, 2023.
   Liliaokeawawa Cothren, Gianluca Bianchin, Sarah Dean, Emiliano Dall'Anese.

10. *Modeling Content Creator Incentives on Algorithm-Curated Platforms.*
    International Conference on Learning Representations, 2023.
    Jiri Hron, Karl Krauth, Michael I. Jordan, Niki Kilbertus, Sarah Dean.

11. *Preference Dynamics Under Personalized Recommendations.*
    ACM Conference on Economics and Computation, 2022.
    Sarah Dean and Jamie Morgenstern.

12. *Towards Robust Data-Driven Control Synthesis for Nonlinear Systems with Actuation Uncertainty.*
    IEEE Conference on Decision and Control (CDC), 2021.
    Andrew J. Taylor, Victor D. Dorobantu, Sarah Dean, Benjamin Recht, Yisong Yue, and Aaron D. Ames.

13. *Quantifying Availability and Discovery in Recommender Systems via Stochastic Reachability.*
    International Conference on Machine Learning (ICML), 2021.
    Mihaela Curmei, Sarah Dean, and Benjamin Recht.

14. *Certainty-Equivalent Perception-Based Control.*
    Learning for Dynamics and Control (L4DC), 2021.
    Sarah Dean and Benjamin Recht.

15. *AI Development for the Public Interest: From Abstraction Traps to Sociotechnical Risks.*
    IEEE International Symposium on Technology and Society (ISTAS), 2020.
    McKane Andrus, Sarah Dean, Thomas Krendl Gilbert, Nathan Lambert, and Tom Zick.

16. *Guaranteeing Safety of Learned Perception Modules via Measurement-Robust Control Barrier Functions.*
    Conference on Robot Learning (CoRL), 2020.
    Sarah Dean, Andrew Taylor, Ryan Cosner, Benjamin Recht, and Aaron Ames.

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

18. *Robust Guarantees for Perception-Based Control.*
    Learning for Dynamics and Control (L4DC), 2020.
    Sarah Dean, Nikolai Matni, Benjamin Recht, and Vickie Ye.

19. *Recommendations and User Agency: The Reachability of Collaboratively-Filtered Information.*
    Conference on Fairness, Accountability, and Transparency (FAccT), 2020.
    Sarah Dean, Sarah Rich, and Benjamin Recht.

20. *Safely Learning to Control the Constrained Linear Quadratic Regulator.*
    American Controls Conference (ACC), 2019.
    Sarah Dean, Stephen Tu, Nikolai Matni, and Benjamin Recht.

21. *Regret Bounds for Robust Adaptive Control of the Linear Quadratic Regulator.*
    Advances in Neural Information Processing Systems (NeurIPS), 2018.
    Sarah Dean, Horia Mania, Nikolai Matni, Benjamin Recht, and Stephen Tu.

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

Journal Articles

1. *Axes for Sociotechnical Inquiry in AI Research.*
   IEEE Transactions on Technology and Society, 2021.
   Sarah Dean, Thomas Krendl Gilbert, Nathan Lambert, and Tom Zick.

2. *High-throughput fluorescence microscopy using multi-frame motion deblurring.*
   Biomedical Optics Express, 2020.
   Zachary Phillips, Sarah Dean, Laura Waller, and Benjamin Recht.

3. *On the Sample Complexity of the Linear Quadratic Regulator.*
   Foundations of Computational Mathematics, 2019.
   Sarah Dean, Horia Mania, Nikolai Matni, Benjamin Recht, and Stephen Tu.

Whitepapers

1. *Choices, Risks, and Reward Reports: Charting Public Policy for Reinforcement Learning Systems.*
   Center for Long-Term Cybersecurity Whitepaper Series, 2022.
   Thomas Krendl Gilbert, Sarah Dean, Tom Zick, Nathan Lambert.

Workshop Papers

1. *Recommender Systems as Dynamical Systems: Interactions with Viewers and Creators.*
   Workshop on Recommendation Ecosystems: Modeling, Optimization and Incentive Design at AAAI, 2024.
   Sarah Dean, Evan Dong, Meena Jagadeesan, Liu Leqi.

2. *To ask or not to ask: Robot-assisted bite acquisition with human-in-the-loop contextual bandits.*
   Out-of-Distribution Generalization in Robotics at Conference on Robot Learning (CoRL), 2023.
   Rohan Banerjee, Sarah Dean, Tapomayukh Bhattacharjee.

3. *Random Features Approximation for Fast Data-Driven Control.*
   Gaussian Processes, Spatiotemporal Modeling, and Decision-making Systems NeuRIPS 2022.
   Kimia Kazemian and Sarah Dean.

4. *Cross-Dataset Propensity Estimation for Debiasing Recommender Systems.*
   Workshop on Distribution Shifts: Connecting Methods and Applications at NeurIPS 2022.
   Fengyu Li and Sarah Dean.

5. *Engineering a Safer Recommender System.*
   Responsible Decision Making in Dynamic Environments Workshop at ICML 2022.
   Liu Leqi and Sarah Dean.

6. *Reward Reports for Reinforcement Learning.*
   Responsible Decision Making in Dynamic Environments Workshop at ICML 2022.
   Thomas Krendl Gilbert, Sarah Dean, Tom Zick, Nathan Lambert, Aaron Snoswell.

7. *Designing Recommender Systems with Reachability in Mind.*
   Participatory Approaches to Machine Learning Workshop at ICML 2020.
   Sarah Dean, Mihaela Curmei, and Benjamin Recht.

8. *Balancing Competing Objectives for Welfare-Aware Machine Learning with Imperfect Data.*
   AI for Social Good Workshop at NeurIPS 2019.
   Esther Rolf, Max Simchowitz, Sarah Dean, Lydia T. Liu, Daniel Bjorkegren, Moritz Hardt, and Joshua Blumenstock.

9. *Optimal Path and Illumination Design for Multiframe Motion Deblurring.*
   OSA Imaging and Applied Optics Congress 2018.
   Sarah Dean, Zachary Phillips, Laura Waller, and Benjamin Recht.

10. *A Broader View on Bias in Automated Decision-Making: Reflecting on Epistemology and Dynamics.* Workshop on fairness, accountability, and transparency in machine learning. (FAT/ML), 2018.
    Roel Dobbe, Sarah Dean, Thomas Gilbert, and Nitin Kohli.

- *Learning Preference Dynamics from Partial Observations*
  - ICML Workshop on Foundations of RL and Control, July 2024.
  - Princeton Workshop on Optimization, Learning, and Control, June 2024.
- *Learning Models of Dynamical Systems from Finite Observations*, IFAC Symposium on SysId Plenary, July 2024.
- *User Dynamics in Machine Learning Systems*
  - Princeton Networks & Cognition Workshop, June 2023.
  - Brookings Virtual Seminar on AI, Economics, and Public Policy, July 2023.
  - ICML Workshop on Humans, Algorithmic Decision-Making and Society, July 2024.
- *On Uniform Error Bounds and Guarantees for Perception-Based Control*, ACC Workshop on Safe & Robust Learning for Perception-based Planning and Control, May 2023.
- *Online Convex Optimization with Unbounded Memory*, ACC Workshop on Online Optimization Methods for Data-driven Feedback Control, May 2023.
- *Preference and Participation Dynamics in Learning Systems*
  - L4DC Keynote, June 2022.
  - Cornell AI Seminar, September 2022.
  - NYU Math and Data Seminar, February 2023.
  - Cornell Econometrics Reading Group, May 2023.
- *Feedback, Dynamics, and Safety in Machine Learning Systems*, NCCR Symposium on Socially responsible Automation, October 2022.
- *Data-driven Control and Decision-making in Feedback Systems*, Cornell CAM Colloquium, January 2022.
- *Towards Certifiably Safe Nonlinear Control with Sensor and Dynamics Uncertainties*
  - UCSD Dynamic Systems & Controls Seminar, December 2021.
  - CISS Invited Session on Safe Reinforcement Learning, March 2022.
  - Minisymposium on Learning from scarce data at SIAM Conference on Mathematics of Data Science, September 2022.
- *Quantifying Availability and Discovery in Recommender Systems via Reachability*, Cornell AI Seminar, September 2021.
- *Reliable Machine Learning in Feedback Systems*
  - Robotics Institute Seminar at Carnegie Mellon University, April 2021.
  - CS Department Colloquium at Princeton University, March 2021.
  - CS Seminar at Brown University, March 2021.
  - Allen School Colloquium at University of Washington, March 2021.
  - ECE Seminar at University of Michigan, March 2021.
  - CS Colloquium at NYU, March 2021.
  - ESE Spring Colloquium at University of Pennsylvania, March 2021.
  - ECE Seminar at University of Wisconsin at Madison, March 2021.
  - CS Seminar at Northeastern University, February 2021.
  - ECE Seminar at Cornell Tech, February 2021.
  - EECS Seminar at Massachusetts Institute of Technology, February 2021.
  - CSE Colloquium at University of Minnesota, February 2021.
  - MINDS Symposium on the Foundations of Data Science at Johns Hopkins University, February 2021.
  - CS Seminar at University of Chicago, February 2021.
  - CS Lecture at University of Texas at Austin, February 2021.
  - MS&E Seminar at Stanford University, January 2021.
  - CS Colloquium at Cornell University, January 2021.
  - Frontiers in Computing and Mathematical Sciences at California Institute of Technology, January 2021.
- *On the Sample Complexity of the Linear Quadratic Regulator*, RL Theory Virtual Seminar, May 2020.
- *Safe and Robust Perception-Based Control*
  - Stanford Robotics and Autonomous Systems Seminar, February 2020.
  - CDS Seminar at California Institute of Technology, February 2020.
- *Delayed Impact of Fair Machine Learning*, Sister Conferences Track at the International Joint Conferences on Artificial Intelligence, August 2019.
- *Guarantees for Learning-Enabled Control*, Interplay between Control, Optimization, and Machine Learning Workshop at the American Controls Conference, July 2019.
- *Safely Learning to Control the Linear Quadratic Regulator*, CITRIS/CPAR Control Theory and Automation Symposium, April 2019.