Sarah Dean

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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 work can be broadly categorized into two thrusts: ***guaranteeing safety in feedback control*** *and* ***ensuring values in social-digital systems****. My research is grounded in collaborative projects in robotics, recommendation systems, and developmental economics.*

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

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 Reinforcement Learning, Spring 2022.

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 within a closed-loop recommender system and developed a computationally efficient audit of model "reachability."

Infrastructure Quality Engineer Intern at Palantir — Summer 2015
Created a relevant automated test suite for Nexus Peering, a data sharing technology. Tested and wrote regression tests for a front end web form product.

Service and Leadership

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. *Preference Dynamics Under Personalized Recommendations.*
   Sarah Dean and Jamie Morgenstern.
2. *Reward Reports for Reinforcement Learning.*
   Thomas Krendl Gilbert, Sarah Dean, Tom Zick, Nathan Lambert, Aarson Snoswell.
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.

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.

Conference Papers

1. *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.
2. *Quantifying Availability and Discovery in Recommender Systems via Stochastic Reachability.*
   International Conference on Machine Learning (ICML), 2021.
   Mihaela Curmei, Sarah Dean, and Benjamin Recht.

3. *Certainty-Equivalent Perception-Based Control.*
   Learning for Dynamics and Control (L4DC), 2021.
   Sarah Dean and Benjamin Recht.
4. *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.
5. *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.
6. *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.
7. *Robust Guarantees for Perception-Based Control.*
   Learning for Dynamics and Control (L4DC), 2020.
   Sarah Dean, Nikolai Matni, Benjamin Recht, and Vickie Ye.
8. *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.
9. *Safely Learning to Control the Constrained Linear Quadratic Regulator.*
   American Controls Conference (ACC), 2019.
   Sarah Dean, Stephen Tu, Nikolai Matni, and Benjamin Recht.
10. *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.
11. *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.

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. *Designing Recommender Systems with Reachability in Mind.*
   Participatory Approaches to Machine Learning Workshop at ICML 2020.
   Sarah Dean, Mihaela Curmei, and Benjamin Recht.
2. *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.
3. *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.
4. *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.

Invited Talks

- *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.
- *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.