Sara Fridovich-Keil

sarafk@stanford.edu

Academic Employment

Stanford University June 2023-present

NSF Mathematical Sciences Postdoctoral Research Fellow in Electrical Engineering

- Mentors: Gordon Wetzstein, Mert Pilanci

Education

University of California, Berkeley 2018-2023

PhD in Electrical Engineering and Computer Sciences

- Dissertation: Photorealistic Reconstruction from First Principles
- Advisor: Benjamin Recht
- Committee: Angjoo Kanazawa, Laura Waller, Rebecca Roelofs (Google Brain)

Princeton University 2014-2018

Bachelor of Science in Electrical Engineering, *summa cum laude*

- Advisor: Peter J. Ramadge GPA: 3.98
- Certificates (Minors): Applications of Computing, Robotics and Intelligent Systems

Research

My current research focus is at the intersection of signal processing, optimization, and machine learning, particularly for solving inverse problems in computer vision as well as medical and scientific imaging. My research in inverse problems includes both applied and theoretical aims to improve the quality, computational efficiency, interpretability, and reliability of reconstruction methods. I am also interested in improving our understanding of how neural networks work, so that they can be made more robust to distribution shifts between training and test data.

I have initiated joint projects with researchers at UC Berkeley, Google Brain, Lawrence Livermore National Laboratory, UC San Diego, the University of Southern California, and Princeton University. I also enjoy collaborating with and mentoring interested undergraduate students and early-stage PhD students.

Publications

Preprints

- **S. Fridovich-Keil** and B. Recht, "Approximately Exact Line Search," 2020.

Conferences

- A. Mai, D. Verbin, F. Kuester, and **S. Fridovich-Keil**. "Neural Microfacet Fields for Inverse Rendering," *ICCV*, 2023.
- **S. Fridovich-Keil***, G. Meanti*, F. Warburg, B. Recht, and A. Kanazawa. "K-Planes: Explicit Radiance Fields in Space, Time, and Appearance," *CVPR*, 2023.
- **S. Fridovich-Keil**, B. Bartoldson, J. Diffenderfer, B. Kailkhura, and P.-T. Bremer, "Models Out of Line: A Fourier Lens on Distribution Shift Robustness," *NeurIPS*, 2022.
- V. Vasudevan, B. Caine, R. Gontijo Lopes, **S. Fridovich-Keil**, and R. Roelofs, "When Does Dough Become a Bagel? Analyzing the Remaining Mistakes on ImageNet," *NeurIPS*, 2022.
- **S. Fridovich-Keil**, R. Gontijo Lopes, and R. Roelofs, "Spectral Bias in Practice: The Role of Function Frequency in Generalization," *NeurIPS*, 2022.
- **S. Fridovich-Keil***, A. Yu*, M. Tancik, Q. Chen, B. Recht, and A. Kanazawa, "Plenoxels: Radiance Fields Without Neural Networks," *CVPR*, 2022. *Most downloaded paper on arXiv during the week after it was uploaded*.
- M. Tancik*, P. Srinivasan*, B. Mildenhall*, **S. Fridovich-Keil**, N. Raghavan, U. Singhal, R. Ramamoorthi, J. Barron, and R. Ng, "Fourier Features Let Networks Learn High Frequency Functions in Low Dimensional Domains," *NeurIPS*, 2020.
- V. Shankar, A. Fang, W. Guo, **S. Fridovich-Keil**, L. Schmidt, J. Ragan-Kelley, and B. Recht, "Neural Kernels Without Tangents," *ICML*, 2020.

- R. Roelofs*, **S. Fridovich-Keil***, J. Miller, V. Shankar, M. Hardt, L. Schmidt, and B. Recht, "A Meta-Analysis of Overfitting in Machine Learning," *NeurIPS*, 2019.
- **S. Fridovich-Keil** and P. J. Ramadge, "Contact Surface Area: A Novel Signal for Heart Rate Estimation in Smartphone Videos," *IEEE GlobalSIP*, 2018. Based on senior thesis.

Journals

- S. Patel*, **S. Fridovich-Keil***, S. A. Rasmussen, and J. L. Fridovich-Keil, "DAB-Quant: An Open-Source Digital System for Quantifying Immunohistochemical Staining with 3,3′-Diaminobenzidine (DAB)," *PLoS ONE*, 2022.

Workshops

- V. Tran, R. Cao, **S. Fridovich-Keil**, and L. Waller, "Multiplexed Pixels: Light Field Camera with Overlapping Views for High-Resolution 3D Reconstruction," *Computational Cameras and Displays (at CVPR)*, 2023.
- **S. Fridovich-Keil**, B. Bartoldson, J. Diffenderfer, B. Kailkhura, and P.-T. Bremer, "Models Out of Line: A Fourier Lens on Distribution Shift Robustness," *Principles of Distribution Shift (at ICML)*, 2022.
- V. Vasudevan, B. Caine, R. Gontijo Lopes, **S. Fridovich-Keil**, and R. Roelofs, "When Does Dough Become a Bagel? Analyzing the Remaining Mistakes on ImageNet," *Shift Happens (at ICML), 2022*.
- R. Roelofs*, **S. Fridovich-Keil***, J. Miller, V. Shankar, M. Hardt, L. Schmidt, and B. Recht, "A Meta-Analysis of Overfitting in Machine Learning," *Understanding and Improving Generalization in Deep Learning (at ICML)*, 2019.
- **S. Fridovich-Keil** and B. Recht, "Choosing the Step Size: Intuitive Line Search Algorithms with Efficient Convergence," *OPT (co-located with NeurIPS)*, 2019. [full version]

Honors and Awards

- NSF Mathematical Sciences Postdoctoral Research Fellowship 2023
- Demetri Angelakos Memorial Achievement Award, UC Berkeley 2022
- NSF Graduate Research Fellowship Program – three years of PhD funding 2019
- EECS Excellence Award, UC Berkeley – first year PhD funding 2018
- G. David Forney, Jr. Prize for communication sciences, systems, and signals at Princeton 2018
- Tau Beta Pi Prize for service to Princeton's School of Engineering and Applied Science 2018
- Barry M. Goldwater Scholarship for undergraduate research 2016
- Shapiro Prize for Academic Excellence – awarded to top ~2% of each Princeton class 2015, 2016
- Society of Women Engineers Fran O'Sullivan Women in Lenovo Leadership Scholarship 2014

Invited Presentations

- "Photorealistic Reconstruction from First Principles" at UC San Diego, Pixel Café Seminar Series, invited by Prof. Ravi Ramamoorthi December 2023
- "Photorealistic Reconstruction from First Principles" at Princeton University, lab meeting of Prof. Ellen Zhong July 2023
- "Photorealistic Reconstruction from First Principles" at Lawrence Livermore National Lab, Data Science Institute Seminar Series July 2023
- "3D Modeling: Machine Learning Meets Signal Processing" at Caltech, joint lab meeting of Prof. Katie Bouman and Prof. Pietro Perona December 2022
- "3D Modeling: Machine Learning Meets Signal Processing" at Stanford, lab meeting of Prof. Gordon Wetzstein October 2022
- "3D Modeling: Machine Learning Meets Signal Processing" at UC Berkeley, Learning Theory Seminar, invited by Prof. Yi Ma July 2022
- "Spectral Bias in Practice" at Shanghai Jiao Tong University, AI + Math Seminar, invited by Prof. Zhi-Qin John Xu December 2021
- "Spectral Bias in Practice" at Google Brain, Deep Phenomena Research Seminar November 2021
- "Spectral Bias in Practice" at Google Brain, Reliable Deep Learning Seminar November 2021
- "Fourier Features & Kernels: A First Step Towards Machine Learning in Medium Dimensions" at Aerospace Corporation, Data Science and AI Seminar August 2020

Teaching

- Graduate Student Instructor, Computability and Complexity (Berkeley CS 172) — Spring 2021
  - Held two weekly (remote) discussion sections and office hours, prepared course content, graded exams
- Graduate Student Instructor, Statistical Learning Theory (Berkeley EECS 281) — Fall 2019
  - Held weekly office hours, prepared homework and exams, graded exams
- Teaching Assistant, Building Real Systems (Princeton ELE 302, "Car Lab") — 2018
  - Assisted students with designing and building circuitry and programming PID control
- McGraw Center Head Tutor, Mathematics (Princeton) — 2015-2018
  - Tutored peers in multivariable calculus and linear algebra

Career Development

- NextProf Nexus Workshop, hosted by Georgia Tech College of Engineering — August 2023
- Rising Stars in Computational and Data Sciences, hosted by UT Austin Oden Institute, presentation on "Reliable Reconstruction" — April 2023
- Cornell ORIE Young Researchers Workshop, poster on "Plenoxels: Radiance Fields without Neural Networks" — October 2022

Outreach and Service

In the Community

- Bay Area Scientists in Schools (BASIS, Volunteer) — 2018-present
  - Teach electrical engineering lessons to elementary school classes
- Princeton Engineering Education for Kids (PEEK, Co-Leader) — 2014-2018
  - Lead hands-on engineering activities with students at local elementary and middle schools

At the University

- Electrical Engineering Graduate Student Association (EEGSA, Co-President) — 2021-2023
  - Survey graduate student experience and discuss results and recommendations as a student representative to the faculty committee on graduate matters
  - Survey students after the preliminary exam and report feedback to faculty
  - Start and maintain a collection of donated academic regalia students can borrow
- EECS Peers (Co-Organizer) — 2021-2023
  - Mentor fellow graduate students with regular office hours
- IEEE Panel on Research — 2022, 2023
  - Serve on annual panel of PhD students to help Berkeley undergraduates enter research
- Faculty Candidate Interviewing (Berkeley EECS) — 2022-2023
  - Serve on student panel to meet with faculty candidates and discuss advising, teaching, and diversity
- Women in Computer Science and Electrical Engineering (WiCSE, Co-President) — 2021-2022
  - Supported the community of women PhD students at Berkeley EECS
  - Outreach Co-Chair, 2019-2020: Organized mentoring for undergraduates and first-year PhD students, as well as lab tours and engineering activities for Girl Scouts
- Engineering Council (ECouncil, President) — 2015-2017
  - Oversaw Princeton ECouncil committees and events, including annual Excellence in Teaching Awards based on student voting
- School of Engineering Interactor — 2016-2017
  - Mentored incoming Princeton engineering students, and helped them choose courses

In the Research Field

- Invited reviewer for NeurIPS, ICML, ICLR, CVPR, ICCV, SIGGRAPH, ACM Transactions on Graphics, Computer Graphics Forum, IEEE Transactions on Visualization and Computer Graphics
- Delegated reviewer for JMLR, ICRA
- SciPy guest contributor

Industry Experience

- Google Brain Research Internship & Student Researcher (Remote) 2021-2022
  - Research on spectral bias of machine learning models, with Dr. Rebecca Roelofs
- Google Software Engineering Internship (Mountain View) 2018
  - Signal processing with sensor data as part of the Android team
- Google Software Engineering Internship (Mountain View) 2017
  - Project combining computer vision and graphics on the Geo team
- Microsoft Imagine Cup (World Finalist, team Pulse Pal) 2017
  - API to estimate heart rate and heart rate variability from a face video
- Google Engineering Practicum Internship (New York City) 2016
  - Designed and developed a desktop application for developer workflow

Skills

- Programming: I use Python and LaTeX regularly. In the past, I've used Julia, MATLAB, Java, C, JavaScript, Elm, R, Verilog, Mathematica, GLSL, and C++
- Languages: English (native), Spanish (proficient)

Professional Societies

- Association of Computing Machinery (ACM) joined 2023
- Phi Beta Kappa (early induction) joined 2017
- Tau Beta Pi Engineering Honor Society joined 2017