Sara Fridovich-Keil

sfk@gatech.edu; sarafridov.github.io

Academic Employment

Georgia Institute of Technology June 2025-present

Assistant Professor, School of Electrical and Computer Engineering

Stanford University June 2023-May 2025

NSF Mathematical Sciences Postdoctoral Research Fellow in Electrical Engineering

- Mentors: Mert Pilanci, Gordon Wetzstein

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
- 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 computational imaging. My research includes both applied and theoretical aims to improve the quality, computational and memory 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 efficient and more robust to distribution shifts.

Publications

Preprints

- N. Kim and **S. Fridovich-Keil**, "Grids Often Outperform Implicit Neural Representations," 2025.
- M. Lou, K. Verchand, **S. Fridovich-Keil**, and A. Pananjady, "Accurate, Provable, and Fast Nonlinear Tomographic Reconstruction: A Variational Inequality Approach," 2025.
- A. Levy, E. Chan, **S. Fridovich-Keil**, F. Poitevin, E. Zhong, and G. Wetzstein, "Solving Inverse Problems in Protein Space Using Diffusion-Based Priors," 2024.
- A. Ghosh, G. Wetzstein, M. Pilanci, and **S. Fridovich-Keil**, "Volumetric Reconstruction Resolves Off-Resonance Artifacts in Static and Dynamic PROPELLER MRI," 2023.
- **S. Fridovich-Keil**, F. Valdivia, G. Wetzstein, B. Recht, and M. Soltanolkotabi, "Gradient Descent Provably Solves Nonlinear Tomographic Reconstruction," 2023.
- **S. Fridovich-Keil** and B. Recht, "Approximately Exact Line Search," 2020.

Conferences

- I. Sivgin*, **S. Fridovich-Keil***, G. Wetzstein, and M. Pilanci, "Geometric Algebra Planes: Convex Implicit Neural Volumes," ICML, 2025.
- Y. Lin*, X.-Y. Pan*, **S. Fridovich-Keil**, and G. Wetzstein, "ThermalNeRF: Thermal Radiance Fields," *ICCP*, 2024.
- 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. *Cited >600 times.*
- **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*. *Cited >2000 times.*
- 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. *Cited >3000 times.*
- V. Shankar, A. Fang, W. Guo, **S. Fridovich-Keil**, L. Schmidt, J. Ragan-Kelley, and B. Recht, "Neural Kernels Without Tangents," *ICML*, 2020. *Cited >100 times.*
- 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. *Cited >200 times.*
- **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 undergraduate 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

- N. Kim and **S. Fridovich-Keil**, "Uncertainty Quantification for Inverse Problems with Generative Priors under Distribution Shift," *Statistical Frontiers in LLMs and Foundation Models (at NeurIPS)*, 2024.
- 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]

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

- "Volume Representations for Inverse Problems" at Optica COSI August 2025
- "Accurate, Provable, and Fast Nonlinear Tomographic Reconstruction" at SampTA July 2025
- "Volume Representations for Inverse Problems" at ICCP July 2025
- "Accurate, Provable, and Fast Nonlinear Tomographic Reconstruction" at INFORMS

APS Conference July 2025
- "Volume Representations for Inverse Problems" at CVPR workshop on neural fields June 2025
- "Accurate, Provable, and Fast Nonlinear Tomographic Reconstruction" at NIST April 2025
- "White-Box Computational Imaging" at Georgia Tech Research Institute February 2025
- "Geometric Algebra Planes: Convex Implicit Neural Volumes" at MIT CSAIL, hosted by Prof. Polina Golland November 2024
- "Thermal Radiance Fields: Regularization for Sensor Fusion" (talk and poster) at SIAM Conference on Mathematics of Data Science October 2024
- "ThermalNeRF: Thermal Radiance Fields" at IMSI Workshop on Computational Imaging August 2024
- "Gradient Descent Provably Solves Nonlinear Tomographic Reconstruction" at INFORMS Optimization Society conference March 2024
- "White-Box Computational Imaging: Measurements to Images to Insights" at UC Berkeley Photobears seminar January 2024
- "White-Box Computational Imaging: Measurements to Images to Insights" at Stanford SCIEN seminar January 2024
- "Gradient Descent Provably Solves Nonlinear Tomographic Reconstruction" at the Joint Mathematics Meeting Special Session on Mathematics of Computer Vision January 2024
- "Photorealistic Reconstruction from First Principles" at UC San Diego, Pixel Café Seminar Series, invited by Prof. Ravi Ramamoorthi December 2023
- "K-Planes: Explicit Radiance Fields in Space, Time, and Appearance" at Bay Area Computer Vision Day poster session September 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

- Foundations of Computational Imaging (Georgia Tech, graduate level special topics course) Fall 2025
- 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 281A) 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

Mentoring

I've had the privilege to work with wonderful undergraduate, masters, and PhD students.

Current Mentees

- Namhoon Kim, PhD student at Georgia Tech
- Rohan Sanda, undergraduate student at Stanford advised by Gordon Wetzstein
- Irmak Sivgin, PhD student at Stanford advised by Mert Pilanci
- Yvette Lin, masters student at Stanford
- Vi Tran, undergraduate alumna from Laura Waller's lab at UC Berkeley (now software engineer at Robinhood)
- Shamus Li, undergraduate alumnus from Laura Waller's lab UC Berkeley (now PhD student advised by Kristina Monakhova at Cornell)

Past Mentees

- Xin-Yi Pan, masters student at Stanford
- Annesha Ghosh, undergraduate student at UC Berkeley
- Fabrizio Valdivia, undergraduate student at the University of Nevada, Las Vegas, and SUPERB REU alumnus
- Alex Mai, PhD student at UC San Diego co-advised by Falko Kuester and Ravi Ramamoorthi
- Alex Yu, undergraduate alumnus from UC Berkeley (now co-founder at Luma AI)
- Qinhong Chen, undergraduate alumnus from UC Berkeley (now software engineer at Google)

Service and Outreach

In the Research Field

- IEEE Signal Processing Society Computational Imaging Technical Committee, member for 3-year term 2025-2027
- ICASSP 2026, area chair
- ICCP 2025, area and session chair
- Sampling Theory and Applications (SampTA 2025), special session co-organizer
- Conference on Parsimony and Learning (CPAL 2025), local chair at Stanford
- Invited reviewer for NeurIPS, ICML, ICLR, CVPR, ICCV, ICCP, SIGGRAPH, IROS, ACM Transactions on Graphics, ACM Computing Surveys, IEEE Transactions on Visualization and Computer Graphics, IEEE Transactions on Image Processing, IEEE Open Journal of Signal Processing, SIAM Journal on Mathematics of Data Science, Computer Graphics Forum, International Journal of Computer Vision, and International Journal of Computer Assisted Radiology and Surgery
- SciPy guest contributor

At the University

- Electrical Engineering Graduate Student Association (Berkeley 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 Berkeley 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 Community

- Bay Area Scientists in Schools (BASIS, Volunteer) 2018-2023
  - 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

Career Development

- EECS Rising Stars, hosted by Georgia Tech November 2023
- Duke Engineering Future Faculty of Innovation and Excellence (DEFINE) October 2023
- 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

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

- SIAM Early Career Member
- Phi Beta Kappa (early induction)
- Tau Beta Pi Engineering Honor Society