Stanford



Mert Pilanci

Associate Professor of Electrical Engineering

Bio

BIO

Mert Pilanci is an associate professor of Electrical Engineering at Stanford University. He received his Ph.D. in Electrical Engineering and Computer Science from UC Berkeley in 2016. Prior to joining Stanford, he was an assistant professor of Electrical Engineering and Computer Science at the University of Michigan. In 2017, he was a Math+X postdoctoral fellow working with Emmanuel Candès at Stanford University. His research interests are in neural networks, machine learning, optimization, and information theory.

ACADEMIC APPOINTMENTS

- Associate Professor, Electrical Engineering

HONORS AND AWARDS

- CAREER Award, National Science Foundation (2023)
- Early Career Award, U.S. Army Research Office (2021)
- International Conference on Acoustics, Speech, & Signal Processing (ICASSP) Best Paper Award, IEEE (2021)
- Best Poster Award, Conference on the Mathematical Theory of Deep Neural Networks (2020)
- Faculty Research Award, Facebook (2020)
- Faculty Research Award, Adobe (2019)
- Terman Faculty Fellow, Stanford University (2018)
- Math+X Postdoctoral Fellowship, Simons Foundation (2016)
- PhD Fellowship, Microsoft Research (2013)
- Signal Processing and Communications Applications Conference Best Paper Award, IEEE (2010)

PROGRAM AFFILIATIONS

- Stanford SystemX Alliance

PROFESSIONAL EDUCATION

- Postdoctoral Fellow, Stanford University (2017)
- PhD, University of California, Berkeley , Electrical Engineering and Computer Science (2016)

LINKS

- Homepage: https://stanford.edu/~pilanci/

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Dr. Pilanci's research interests include neural networks, machine learning, mathematical optimization, information theory and signal processing.

Teaching

COURSES

2026-27

- Convex Optimization II: CME 364B, EE 364B (Spr)
- Introductory Research Seminar in Electrical Engineering: EE 301 (Aut)
- Quantization and Signal Processing for AI: EE 269 (Win)

2025-26

- Convex Optimization II: CME 364B, EE 364B (Spr)
- Introductory Research Seminar in Electrical Engineering: EE 301 (Aut)
- Signal Processing and Quantization for Machine Learning: EE 269 (Win)

2024-25

- Convex Optimization II: CME 364B, EE 364B (Spr)
- Introductory Research Seminar in Electrical Engineering: EE 301 (Aut)

2023-24

- Convex Optimization II: CME 364B, EE 364B (Spr)
- Introductory Research Seminar in Electrical Engineering: EE 301 (Aut)
- Signal Processing for Machine Learning: EE 269 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Amirhossein Afsharrad, Felipe Areces, Daniel Birger Gunnar Cederberg, Onat Dalmaz, Ibrahim Gulluk, Jerry Liu, Ryan Po, Marina Qian, Naomi Sagan, Maximilian Schaller, Irmak Sivgin, Yonatan Urman, Ridvan Yesiloglu, Orr Zohar

Postdoctoral Faculty Sponsor

Zhe Li, Saber Malekmohammadi

Doctoral Dissertation Advisor (AC)

Calvin Ang, Sungyoon Kim, Fangzhao Zhang

Master's Program Advisor

Liang Ji, Shreya Ramanujam, Hakeem Shindy, Haowen Wang, Yijia Wang

Doctoral (Program)

Amirhossein Afsharrad, Mete Erdogan, Dorsa Fathollahi, Miria Feng, Ibrahim Gulluk, Sungyoon Kim, Marc Moussa Nasser, Prateek Verma

Publications

PUBLICATIONS

- **Pretraining and the lasso** *JOURNAL OF THE ROYAL STATISTICAL SOCIETY SERIES B-STATISTICAL METHODOLOGY*
  Craig, E., Pilanci, M., Le Menestrel, T., Narasimhan, B., Rivas, M. A., Gullaksen, S., Dehghannasiri, R., Salzman, J., Taylor, J., Tibshirani, R.
  2025
- **The Convex Landscape of Neural Networks: Characterizing Global Optima and Stationary Points via Lasso Models** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Ergen, T., Pilanci, M.
  2025; 71 (5): 3854-3870
- **Overparameterized ReLU Neural Networks Learn the Simplest Model: Neural Isometry and Phase Transitions** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Wang, Y., Hua, Y., Candes, E. J., Pilanci, M.
  2025; 71 (3): 1926-1977
- **Disentangling Speech Representations Learning With Latent Diffusion for Speaker Verification** *IEEE TRANSACTIONS ON AUDIO SPEECH AND LANGUAGE PROCESSING*
  Li, Z., Mak, M., Chien, J., Pilanci, M., Jin, Z., Meng, H.
  2025; 33: 3896-3907
- **Spectral-Aware Low-Rank Adaptation for Speaker Verification**
  Li, Z., Mak, M., Pilanci, M., Lee, H., Meng, H., IEEE
  IEEE.2025
- **Adaptive Large Language Models via Attention Shortcuts**
  Verma, P., Pilanci, M., IEEE
  IEEE.2025
- **ConvexECG: Lightweight and Explainable Neural Networks for Personalized, Continuous Cardiac Monitoring**
  Ansari, R., Cao, J., Bandyopadhyay, S., Narayan, S. M., Rogers, A. J., Pilanci, M., IEEE
  IEEE.2025
- **Disentangling Speaker and Content in Pre-trained Speech Models with Latent Diffusion for Robust Speaker Verification**
  Li, Z., Mak, M., Chien, J., Pilanci, M., Fin, Z., Meng, H., Int Speech Commun Assoc
  ISCA-INT SPEECH COMMUNICATION ASSOC.2025: 1108-1112
- **Subtractive Training for Music Stem Insertion Using Latent Diffusion Models**
  Villa-Renteria, I., Wang, M., Shah, Z., Li, Z., Kim, S., Ramachandran, N., Pilanci, M., IEEE
  IEEE.2025
- **Mutual Information-Enhanced Contrastive Learning With Margin for Maximal Speaker Separability** *IEEE TRANSACTIONS ON AUDIO SPEECH AND LANGUAGE PROCESSING*
  Li, Z., Mak, M., Pilanci, M., Meng, H.
  2025; 33: 2961-2972
- **Neural spectrahedra and semidefinite lifts: global convex optimization of degree-two polynomial activation neural networks in polynomial-time** *MATHEMATICAL PROGRAMMING*
  Bartan, B., Pilanci, M.
  2024
- **Gradient Coding With Iterative Block Leverage Score Sampling** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Charalambides, N., Pilanci, M., Hero, A. O.
  2024; 70 (9): 6639-6664
- **Optimal Neural Network Approximation of Wasserstein Gradient Direction via Convex Optimization\ast** *SIAM JOURNAL ON MATHEMATICS OF DATA SCIENCE*
  Wang, Y., Chen, P., Pilanci, M., Li, W.

2024; 6 (4): 978-999

- **Iterative Sketching for Secure Coded Regression** *IEEE JOURNAL ON SELECTED AREAS IN INFORMATION THEORY*
  Charalambides, N., Mahdavifar, H., Pilanci, M., Hero, A. O.
  2024; 5: 148-161
- **Power-Managed Data Centers for Sustainable Computing**
  Zeger, E., Bambos, N., Pilanci, M.
  edited by Valenti, M., Reed, D., Torres, M.
  IEEE.2024: 2833-2839
- **M-IHS: An accelerated randomized preconditioning method avoiding costly matrix decompositions** *LINEAR ALGEBRA AND ITS APPLICATIONS*
  Ozaslan, I. K., Pilanci, M., Arikan, O.
  2023; 678: 57-91
- **Coil sketching for computationally efficient MR iterative reconstruction.** *Magnetic resonance in medicine*
  Oscanoa, J. A., Ong, F., Iyer, S. S., Li, Z., Sandino, C. M., Ozturkler, B., Ennis, D. B., Pilanci, M., Vasanawala, S. S.
  2023
- **Sketching the Krylov subspace: faster computation of the entire ridge regularization path (May, 10.1007/s11227-023-05309-w, 2023)** *JOURNAL OF SUPERCOMPUTING*
  Wang, Y., Pilanci, M.
  2023
- **Distributed Sketching for Randomized Optimization: Exact Characterization, Concentration, and Lower Bounds** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Bartan, B., Pilanci, M.
  2023; 69 (6): 3850-3879
- **Sketching the Krylov subspace: faster computation of the entire ridge regularization path** *JOURNAL OF SUPERCOMPUTING*
  Wang, Y., Pilanci, M.
  2023
- **Path Regularization: A Convexity and Sparsity Inducing Regularization for Parallel ReLU Networks**
  Ergen, T., Pilanci, M.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023
- **Matrix Compression via Randomized Low Rank and Low Precision Factorization**
  Saha, R., Srivastava, V., Pilanci, M.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023
- **Fixing the NTK: From Neural Network Linearizations to Exact Convex Programs**
  Dwaraknath, R., Ergen, T., Pilanci, M.
  edited by Oh, A., Neumann, T., Globerson, A., Saenko, K., Hardt, M., Levine, S.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2023
- **Adaptive and Oblivious Randomized Subspace Methods for High-Dimensional Optimization: Sharp Analysis and Lower Bounds** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Lacotte, J., Pilanci, M.
  2022; 68 (5): 3281-3303
- **Computational Polarization: An Information-Theoretic Method for Resilient Computing** *IEEE TRANSACTIONS ON INFORMATION THEORY*
  Pilanci, M.
  2022; 68 (4): 2211-2238
- **A Data-Driven Waveform Adaptation Method for Mm-Wave Gait Classification at the Edge** *IEEE SIGNAL PROCESSING LETTERS*
  Hor, S., Pilanci, M., Arbabian, A.

2022; 29: 26-30

- **Fast Convex Optimization for Two-Layer ReLU Networks: Equivalent Model Classes and Cone Decompositions**
  Mishkin, A., Sahiner, A., Pilanci, M.
  edited by Chaudhuri, K., Jegelka, S., Song, L., Szepesvari, C., Niu, G., Sabato, S.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2022
- **Neural Fisher Discriminant Analysis: Optimal Neural Network Embeddings in Polynomial Time**
  Bartan, B., Pilanci, M.
  edited by Chaudhuri, K., Jegelka, S., Song, L., Szepesvari, C., Niu, G., Sabato, S.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2022
- **Secure Linear MDS Coded Matrix Inversion**
  Charalambides, N., Pilanci, M., Hero, A. O., IEEE
  IEEE.2022
- **Unraveling Attention via Convex Duality: Analysis and Interpretations of Vision Transformers**
  Sahiner, A., Ergen, T., Ozturkler, B., Pauly, J., Mardani, M., Pilanci, M.
  edited by Chaudhuri, K., Jegelka, S., Song, L., Szepesvari, C., Niu, G., Sabato, S.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2022: 19050-19088
- **Approximate Function Evaluation via Multi-Armed Bandits**
  Baharav, T. Z., Cheng, G., Pilanci, M., Tse, D.
  edited by Camps-Valls, G., Ruiz, F. J., Valera
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2022: 108-135
- **Scale-Equivariant Unrolled Neural Networks for Data-Efficient Accelerated MRI Reconstruction**
  Gunel, B., Sahiner, A., Desai, A. D., Chaudhari, A. S., Vasanawala, S., Pilanci, M., Pauly, J.
  edited by Wang, L., Dou, Q., Fletcher, P. T., Speidel, S., Li, S.
  SPRINGER INTERNATIONAL PUBLISHING AG.2022: 737-747
- **Convex Geometry and Duality of Over-parameterized Neural Networks** *Convex Geometry and Duality of Over-parameterized Neural Networks*
  Ergen, T., Pilanci, M.
  2021
- **Linear Predictive Coding for Acute Stress Prediction from Computer Mouse Movements.** *Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference*
  Kim, L. H., Goel, R., Liang, J., Pilanci, M., Paredes, P. E.
  2021; 2021: 7465-7469
- **APPROXIMATE WEIGHTED CR CODED MATRIX MULTIPLICATION**
  Charalambides, N., Pilanci, M., Hero, A. O., IEEE
  IEEE.2021: 5095-5099
- **CONVEX NEURAL AUTOREGRESSIVE MODELS: TOWARDS TRACTABLE, EXPRESSIVE, AND THEORETICALLY-BACKED MODELS FOR SEQUENTIAL FORECASTING AND GENERATION**
  Gupta, V., Bartan, B., Ergen, T., Pilanci, M., IEEE
  IEEE.2021: 3890-3894
- **Boost AI Power: Data Augmentation Strategies with Unlabeled Data and Conformal Prediction, a Case in Alternative Herbal Medicine Discrimination with Electronic Nose** *IEEE Sensors Journal*
  Liu, L., Zhan, X., Wu, R., Guan, X., Wang, Z., Pilanci, M., Luo, Z., Li, G., Wang, Y.
  2021: 1-11
- **Convex Geometry and Duality of Over-parameterized Neural Networks** *JOURNAL OF MACHINE LEARNING RESEARCH*
  Ergen, T., Pilanci, M.
  2021; 22
- **Revealing the Structure of Deep Neural Networks via Convex Duality**
  Ergen, T., Pilanci, M.

edited by Meila, M., Zhang, T.
JMLR-JOURNAL MACHINE LEARNING RESEARCH.2021

- **Global Optimality Beyond Two Layers: Training Deep ReLU Networks via Convex Programs**
  Ergen, T., Pilanci, M.
  edited by Meila, M., Zhang, T.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2021
- **Adaptive Newton Sketch: Linear-time Optimization with Quadratic Convergence and Effective Hessian Dimensionality**
  Lacotte, J., Wang, Y., Pilanci, M.
  edited by Meila, M., Zhang, T.
  JMLR-JOURNAL MACHINE LEARNING RESEARCH.2021
- **Boost AI Power: Data Augmentation Strategies with Unlabelled Data and Conformal Prediction, a Case in Alternative Herbal Medicine Discrimination with Electronic Nose** *IEEE Sensors Journal*
  Liu, L., et al
  2021
- **WEIGHTED GRADIENT CODING WITH LEVERAGE SCORE SAMPLING**
  Charalambides, N., Pilanci, M., Hero, A. O., IEEE
  IEEE.2020: 5215–19
- **Weighted Gradient Coding with Leverage Score Sampling** *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*
  Charalambides, N., Pilanci, M., Hero, A. O.
  2020
- **Convex Geometry of Two-Layer ReLU Networks: Implicit Autoencoding and Interpretable Models** *23rd International Conference on Artificial Intelligence and Statistics (AISTATS)*
  Ergen, T., Pilanci, M.
  2020
- **Optimal Randomized First-Order Methods for Least-Squares Problems**
  Lacotte, J., Pilanci, M.
  arXiv:2002.09488 .
  2020
- **Convex Duality of Deep Neural Networks**
  Ergen, T., Pilanci, M.
  arXiv:2002.09773.
  2020
- **Convex Geometry and Duality of Over-parameterized Neural Networks**
  Ergen, T., Pilanci, M.
  arXiv:2002.11219.
  2020
- **Neural Networks are Convex Regularizers: Exact Polynomial-time Convex Optimization Formulations for Two-Layer Networks**
  Pilanci, M., Ergen, T.
  International Conference on Machine Learning (ICML), 2020.
  2020
- **Convex Geometry of Two-Layer ReLU Networks: Implicit Autoencoding and Interpretable Models**
  Ergen, T., Pilanci, M.
  edited by Chiappa, S., Calandra, R.
  ADDISON-WESLEY PUBL CO.2020: 4024–32
- **Limiting Spectrum of Randomized Hadamard Transform and Optimal Iterative Sketching Methods**
  Lacotte, J., Liu, S., Dobriban, E., Pilanci, M.
  International Conference on Machine Learning (ICML), 2020.

2020

- **Weighted Gradient Coding with Leverage Score Sampling** *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*
  Charalambides, N., Pilanci, M., Hero, A. O.
  2020
- **Convex Geometry of Two-Layer ReLU Networks: Implicit Autoencoding and Interpretable Models** *23rd International Conference on Artificial Intelligence and Statistics (AISTATS)*
  Ergen, T., Pilanci, M.
  2020
- **Optimal Randomized First-Order Methods for Least-Squares Problems**
  Lacotte, J., Pilanci, M.
  arXiv:2002.09488 .
  2020
- **Convex Duality of Deep Neural Networks**
  Ergen, T., Pilanci, M.
  arXiv:2002.09773.
  2020
- **Convex Geometry and Duality of Over-parameterized Neural Networks**
  Ergen, T., Pilanci, M.
  arXiv:2002.11219.
  2020
- **Neural Networks are Convex Regularizers: Exact Polynomial-time Convex Optimization Formulations for Two-Layer Networks**
  Pilanci, M., Ergen, T.
  International Conference on Machine Learning (ICML), 2020.
  2020
- **Convex Geometry of Two-Layer ReLU Networks: Implicit Autoencoding and Interpretable Models**
  Ergen, T., Pilanci, M.
  edited by Chiappa, S., Calandra, R.
  ADDISON-WESLEY PUBL CO.2020: 4024–32
- **High-Dimensional Optimization in Adaptive Random Subspaces**
  Lacotte, J., Pilanci, M., Pavone, M.
  edited by Wallach, H., Larochelle, H., Beygelzimer, A., d'Alche-Buc, F., Fox, E., Garnett, R.
  NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2019
- **Convex Optimization for Shallow Neural Networks**
  Ergen, T., Pilanci, M., IEEE
  IEEE.2019: 79–83
- **Distributed Black-Box Optimization via Error Correcting Codes**
  Bartan, B., Pilanci, M., IEEE
  IEEE.2019: 246–52
- **Straggler Resilient Serverless Computing Based on Polar Codes**
  Bartan, B., Pilanci, M., IEEE
  IEEE.2019: 276–83
- **Faster Least Squares Optimization**
  Lacotte, J., Pilanci, M.
  arXiv:1911.02675.
  2019
- **Straggler Resilient Serverless Computing Based on Polar Codes** *57th Annual Allerton Conference on Communication, Control, and Computing*

Bartan, B., Pilanci, M.
2019

- **Distributed Black-Box Optimization via Error Correcting Codes** *57th Annual Allerton Conference on Communication, Control, and Computing*
  Bartan, B., Pilanci, M.
  2019
- **High-Dimensional Optimization in Adaptive Random Subspaces** *Neural Information Processing Systems (NeurIPS)*
  Lacotte, J., Pilanci, M., Pavone, M.
  2019
- **Fast and Robust Solution Techniques for Large Scale Linear System of Equations**
  Ozaslan, I. K., Pilanci, M., Arikan, O., IEEE
  IEEE.2019
- **CONVEX RELAXATIONS OF CONVOLUTIONAL NEURAL NETS**
  Bartan, B., Pilanci, M., IEEE
  IEEE.2019: 4928–32
- **ITERATIVE HESSIAN SKETCH WITH MOMENTUM**
  Ozaslan, I., Pilanci, M., Arikan, O., IEEE
  IEEE.2019: 7470–74
- **NEWTON SKETCH: A NEAR LINEAR-TIME OPTIMIZATION ALGORITHM WITH LINEAR-QUADRATIC CONVERGENCE** *SIAM JOURNAL ON OPTIMIZATION*
  Pilanci, M., Wainwright, M. J.
  2017; 27 (1): 205–45
- **Randomized sketches for kernels: Fast and optimal non-parametric regression** *Annals of Statistics*
  Yang, Y., Pilanci, M., Wainwright, M. J.
  2017
- **Iterative Hessian sketch: Fast and accurate solution approximation for constrained least-squares** *Journal of Machine Learning Research (JMLR)*
  Pilanci, M., Wainwright, M. J.
  2016
- **Sparse learning via Boolean relaxations** *Mathematical Programming*
  Pilanci, M., Wainwright, M. J., El Ghaoui, L.
  2015
- **Randomized Sketches of Convex Programs With Sharp Guarantees** *IEEE Transactions on Information Theory*
  Pilanci, M., Wainwright, M. J.
  2015
- **Expectation Maximization Based Matching Pursuit**
  Gurbuz, A., Pilanci, M., Arikan, O., IEEE
  IEEE.2012: 3313-3316
- **Structured Least Squares Problems and Robust Estimators** *IEEE TRANSACTIONS ON SIGNAL PROCESSING*
  Pilanci, M., Arikan, O., Pinar, M. C.
  2010; 58 (5): 2453-2465
- **Structured least squares problems and robust estimators** *IEEE Transactions on Signal Processing*
  Pilanci, M., Arikan, O., Pinar, M. C.
  2010
- **A Novel Technique for a Linear System of Equations Applied to Channel Equalization**
  Pilanci, M., Arikan, O., Oguz, B., Pinar, M. C., IEEE
  IEEE.2009: 230-+