

VIVAK PATEL

vivakpatel.org · vivak.patel@wisc.edu

POSITIONS *Assistant Professor of Statistics*, August 2018
University of Wisconsin – Madison (Madison, Wisconsin, USA)

EDUCATION *PhD in Statistics*, September 2013 to August 2018
University of Chicago (Chicago, Illinois, USA)

MASt in Mathematics, October 2012 to July 2013
University of Cambridge, Churchill College (Cambridge, UK)

BS in Applied Physics and Biomathematics, September 2008 to May 2012
Rutgers University (New Brunswick, New Jersey, USA)

PUBLICATIONS Vivak Patel, Shushu Zhang and Bowen Tian. “Global Convergence and Stability of Stochastic Gradient Descent.” Accepted to NeurIPS 2022.

Vivak Patel. “Stopping criteria for, and strong convergence of, stochastic gradient descent on Bottou-Curtis-Nocedal functions.” *Mathematical Programming* (2021): 1-42.

Vivak Patel, Mohammad Jahangoshahi, and Daniel Adrian Maldonado. “An implicit representation and iterative solution of randomly sketched linear systems.” *SIAM Journal on Matrix Analysis and Applications* 42.2 (2021): 800-831.

Liam Johnston, and Vivak Patel. “Second-Order Sensitivity Methods for Robustly Training Recurrent Neural Network Models.” *IEEE Control Systems Letters* 5, no. 2 (2020): 529-534.

Jinyi Wang, and Vivak Patel. “Reduced-Memory Kalman Based Stochastic Gradient Descent.” *Proceedings of 12th OPT Workshop on Optimization and Machine Learning* (2020).

Daniel Adrian Maldonado, Vishwas Rao, Mihai Anitescu, and Vivak Patel. “Sequential Bayesian parameter estimation of stochastic dynamic load models.” *Electric Power Systems Research* 189 (2020).

Yuji Saikai, Vivak Patel, and Paul D. Mitchell. “Machine learning for optimizing complex site-specific management.” *Computers and Electronics in Agriculture* 174 (2020). <https://doi.org/10.1016/j.compag.2020.105381>

Vivak Patel, Daniel Adrian Maldonado, and Mihai Anitescu. “Semiparametric estimation of solar generation.” 2018 IEEE Power & Energy Society General Meeting (PESGM). IEEE, 2018.

Daniel Adrian Maldonado, Vivak Patel, Mihai Anitescu and Alex Fluek. “A statistical approach to dynamic load modelling and identification with high frequency measurements.” 2017 IEEE Power & Energy Society General Meeting. IEEE, 2017.

Vivak Patel. “Kalman-based stochastic gradient method with stop condition and

insensitivity to conditioning.” SIAM Journal on Optimization 26.4 (2016): 2620-2648.

MANUSCRIPTS Vivak Patel and Albert S. Berahas. “Gradient Descent in the Absence of Global Lipschitz Continuity of the Gradients: Convergence, Divergence and Limitations of its Continuous Approximation.” Submitted.

Nathaniel Pritchard and Vivak Patel. “Towards Practical Large-scale Randomized Iterative Least Squares Solvers through Uncertainty Quantification.” Submitted.

Vivak Patel, Mohammad Jahangoshahi and Daniel Adrian Maldonado. “Randomized Block Adaptive Linear System Solvers.” Submitted.

Vivak Patel, Mohammad Jahangoshahi and Daniel Adrian Maldonado. “Convergence of Adaptive, Randomized, Iterative Linear Solvers.” Submitted.

Nathaniel Pritchard and Vivak Patel. “Residual Tracking and Stopping for Iterative Random Sketching.” Submitted.

Vivak Patel. “Counterexamples for Noise Models of Stochastic Gradients.” Submitted.

Liam Johnston and Vivak Patel. “Learning Longer Time Dependencies in Recurrent Neural Networks via Penalized Backpropagation.” In Preparation.

Shushu Zhang and Vivak Patel. “Stochastic Approximation for Data Assimilation with High-Frequency Observations.” In Preparation.

Vivak Patel and Shushu Zhang. “Stochastic Gradient Descent on Nonconvex Functions with General Noise Models.” In Preparation.

SOFTWARE Daniel Adrian Maldonado and Vivak Patel. *A Randomize Linear Algebra Library*, github.com/numlinalg/RLinearAlgebra.jl

TALKS *Some Surprises about Stochastic Gradient Descent*, at IMS International Conference on Statistics and Data Science in Florence, Italy. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at NeurIPS 2022 in New Orleans, Louisiana. (2022)

Counter Examples for Stochastic Gradient Descent, at University of Houston in Houston, Texas. (2022)

Counter Examples for Stochastic Gradient Descent, at Rutgers University in New Brunswick, New Jersey. (2022)

Asymptotics of SGD with Nonconvex Objectives with General Noise Models, at the INFORMS Optimization Society Meeting in Greenville, South Carolina. (2022)

Randomized, Adaptive Linear System Solvers, at Institute of Mathematics & Its Applications Conference on Numerical Linear Algebra and Optimization in Birmingham, United Kingdom. (2022)

Consistency of Stochastic Gradient Descent, at the IMS Annual Meeting in London,

United Kingdom. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at the East Coast Optimization Meeting in Washington D.C. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at Copper Mountain Conference on Iterative Methods in Copper Mountain, Colorado. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at University of Michigan – Ann Arbor in Ann Arbor, Michigan. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at Northwestern University in Evanston, Illinois. (2022)

Global Convergence and Stability of Stochastic Gradient Descent, at Instituto de Ciencias Matemáticas in Madrid, Spain. (2022)

Incrementalizing Random Sketching for Solving Consistent Linear Systems, at Fast Direct Solvers in West Lafayette, Indiana. (2021)

Trade-offs In Nonconvexity And Noise Models In The Global Stability Of Stochastic Gradient Descent, at INFORMS Annual Meeting in Anaheim, California. (2021)

Recent Advances in the Theory of Stochastic Gradient Methods, at SIAM Conference on Optimization in Spokane, Washington. (2021)

Adaptive Stochastic Gradient Methods, at EUROPT in Toulouse, France. (2021)

Iterative Randomized Partial Orthogonalization for Row-Action Iterative Solvers, at SIAM Applied Linear Algebra in New Orleans, Louisiana. (2021)

On Consistency and Asymptotic Normality of Adaptive Stochastic Gradient Methods, at the East Coast Optimization Meeting in Fairfax, Virginia. (2021)

Adaptive Iterative Methods for Linear Systems, at University of California – Los Angeles's Department of Mathematics. (2021)

Adaptive Iterative Methods for Linear Systems, at University of Chicago's Committee on Computational and Applied Mathematics. (2021)

When do we stop SGD?, at Argonne National Laboratories's Division of Mathematics and Computer Science. (2020)

When do we stop SGD?, at University of Pittsburgh's Department of Statistics. (2020)

Practical Random Sketching, at *Data Science Down Under* in Newcastle, Australia. (2019)

Using Statistical Filters for Stochastic Optimization, at International Conference on Continuous Optimization in Berlin, Germany. (2019)

Using Statistical Filters to Solve Unconstrained Optimization Problems, at Advanced Inverse Problems in Grenoble, France. (2019)

Statistical Filtering for Optimization under Uncertainty, at Comp. and Method. Statistics in Pisa, Italy. (2018)

Stochastic Analogues to Deterministic Optimization Methods, at International Symposium on Mathematical Programming in Bordeaux, France. (2018)

Surrogates using Statistical Filters, at Conference on Iterative Methods in Copper Mountain, Colorado. (2018)

Generalizable Scientific Machine Learning, at DOE Advanced Scientific Computing Research's Scientific Machine Learning Workshop in Bethesda, Maryland. (2018)

Statistical Filtering for Optimization, at Optimization Methods and Software Conference in Havana, Cuba. (2017)

SGD: What drives convergence and divergence? at Optimization Methods and Software in Havana, Cuba. (2017)

A Statistical Theory of the Kalman Filter, at SIAM UQ Meeting in Lausanne, Switzerland. (2016)

Static Parameter Estimation using Kalman Filtering and Proximal Operators, by invitation at Argonne National Labs. (2015)

**SYMPOSIUM
ORGANIZING**

Analyzing Stochastic Gradient Methods: Noise, Nonconvexity and Dependency at IMS Annual Meeting in London, United Kingdom. (2022)

A Minisymposium on Moving Randomized Linear Algebra from Theory to Practice with Daniel Adrian Maldonado, at SIAM Applied Linear Algebra Conference in New Orleans, Louisiana. (2021)

A Minisymposium on Advances in the Nonconvex Theory of Stochastic Gradient Methods at SIAM Optimization Conference in Spokane, Washington. (2021)

TEACHING

Instructor, University of Wisconsin – Madison

- Statistical Methods I (Autumn 2019, Autumn 2020, Spring 2021, Autumn 2021, Autumn 2022)
- Statistical Learning Theory (Spring 2019, Spring 2020)
- Computational Statistics (Autumn 2018, Autumn 2019, Autumn 2020, Autumn 2021)

Instructor, University of Chicago

- Statistical Models and Methods (Winter 2015)

Teaching Assistant, University of Chicago

- Elementary Statistics (Spring 2016, Spring 2014)
- Sample Surveys (Autumn 2015)
- Optimization (Spring 2015)
- Numerical Linear Algebra (Autumn 2014)
- Nonparametric Inference (Winter 2013)

EXPERIENCE

Long Program Participant for Decision Making and Uncertainty, Institute for Mathematical and Statistical Innovation (March 2022 to May 2022)

Givens Associate, Argonne National Labs (Summer 2017, Summer 2016)
Supervisor: Mihai Anitescu, Ph.D.

Member of Energy and Environment Working Group, SAMSI (Summer 2016 to Summer 2017)

Summer Data Scientist, Qualia Health (Summer 2014)
Supervisor: David Beiser, M.D.

Research Assistant, Biomedical Engineering at Rutgers University (June 2009 to August 2012)
Supervisor: David Shreiber, Ph.D.

SERVICE

National Service

- Committee on Minorities in Statistics, American Statistical Association (since 2020)
- ASA Diversity Mentoring Program Mentor (since 2020)
- ASA StatFest Panelist (2022)

University-level Service, University of Wisconsin – Madison

- Wisconsin Science and Computing Emerging Research Stars (WISCERS) Mentor (since 2021)
- CDIS Red Talks Planning (2021)

Departmental Committees, University of Wisconsin – Madison

- Climate Committee (2021 to 2022)
- Awards and Outreach Committee (2020 to 2022)
- Seminar Committee (2018 to 2021)
- Ph.D Exam Committee (2019)
- Curriculum & Degree Requirement Committee (2018 to 2019)

Advising & Ph.D. Committees

- Yuji Saikai. Agricultural and Applied Economics. (Graduated 2020)
- Duzhe Wang. Statistics. (Graduated 2020)
- Manjusha Kancharla. Statistics. (Graduated 2022)
- Liam Johnston. Statistics.
- Nathaniel Pritchard. Statistics.
- Christian Varner. Statistics.

Reviewer

- *Calcolo*
- *Computational Statistics and Data Analysis*
- *INFORMS Journal on Optimization*
- *Journal of Machine Learning Research*
- *Journal of Mathematical Analysis and Applications*

- Journal of the American Statistical Association
- Mathematical Programming
- Mathematics of Operations Research
- Neural Networks
- SIAM Journal on Mathematics of Data Science
- SIAM Journal on Numerical Analysis
- SIAM Journal on Optimization
- SIAM Journal on Scientific Computing
- Statistical Computing and Data Analysis

AWARDS

Brian A. Millen Service Award, American Statistical Association (2022)

Graduate Council Travel Grant, University of Chicago (2017)

Harper Dissertation Fellowship, University of Chicago (2017)

Senior Consultant, University of Chicago, Dept. of Statistics (2017)

SIAM Travel Award, Society of Industrial and Applied Mathematicians (2016)

MEMBERSHIPS *American Statistical Association*, Member.

Royal Statistical Society, Member.

Institute of Mathematical Statistics, Member.

Society of Industrial and Applied Mathematicians, Member.

Mathematical Optimization Society, Member.

Stochastic Programming Society, Member.

IEEE, Member.

INFORMS, Member.