

Melanie Weber

Education

Princeton University, Ph.D. in Applied Mathematics (advisor: Charles Fefferman) 2021
University of Leipzig, B.Sc./M.Sc. in Mathematics 2016

Appointments

Assistant Professor, Applied Mathematics and Computer Science, Harvard University 2023-
Hooke Research Fellow, Mathematical Institute, University of Oxford 2021-22
Research Fellow, Simons Institute for the Theory of Computing, Berkeley 2021

Honors and Awards

Alfred P. Sloan Research Fellow in Mathematics 2024
AAAI New Faculty Highlights 2024
IMA Leslie Fox Prize in Numerical Analysis 2023
Simons-Berkeley Fellowship, Simons Foundation 2021
Hooke Fellowship, University of Oxford 2021
C. V. Starr Fellowship, Princeton University 2016

Selected Work

B. Kiani, L. Fesser, M. Weber (2024): Unitary Convolutions for Learning on Graphs and Groups. *Advances in Neural Information Processing Systems (NeurIPS)*, spotlight (top 3% submissions)

B. Kiani, J. Wang, M. Weber (2024): Hardness of Learning Neural Networks under the Manifold Hypothesis. *Advances in Neural Information Processing Systems (NeurIPS)*, spotlight (top 3% submissions)

Z. Shumaylov, P. Zaika, J. Rowbottom, F. Sherry, M. Weber, C.-B. Schönlieb (2024): Lie Algebra Canonicalization: Equivariant Neural Operators under arbitrary Lie Groups. arXiv:2410.02698

A. Cheng, M. Weber (2024): Structured Regularization for Constrained Optimization on the SPD Manifold with side information. *Allerton Conference on Communication, Control, and Computing*.

A. Cheng*, V. Dixit*, M. Weber (2024): Disciplined Geodesically Convex Programming. arXiv:2407.05261

B. Kiani*, T. Le*, H. Lawrence*, S. Jegelka, M. Weber (2024): On the Hardness of Learning under Symmetries. *International Conference on Learning Representations (ICLR)*, spotlight (top 5% submissions)

L. Fesser, M. Weber (2024): Effective Structural Encodings via Local Curvature Profiles. *International Conference on Learning Representations (ICLR)*

L. Fesser*, S. Serrano de Haro Ivanetz*, K. Devriendt, M. Weber, R. Lambiotte (2024): Augmentations of Forman's Ricci curvature and their applications in community detection. *Journal of Physics: Complexity*, vol. 5(3).

L. Fesser, M. Weber (2023): Mitigating Over-smoothing and Over-squashing using Augmentations of Forman-Ricci Curvature. *Learning on Graphs Conference (LoG)*.

Y. Tian*, Z. Lubberts*, M. Weber (2023): Curvature-based Clustering on Graphs. arXiv:2307.10155

N. Garcia Trillos*, M. Weber* (2023): Continuum Limits of Ollivier's Ricci Curvature on data clouds: pointwise consistency and global lower bounds. arXiv:2307.02378

M. Weber, S. Sra (2023): Global optimality for Euclidean CCCP under Riemannian convexity. *International Conference on Machine Learning (ICML)*

M. Weber, S. Sra (2022): Riemannian Optimization via Frank-Wolfe Methods. *Mathematical Programming*

M. Weber, S. Sra (2022): Computing Brascamp-Lieb Constants through the lens of Thompson Geometry. arXiv:2208.05013

J. Carruth, M. Eggl, C. Fefferman, C. Rowley, M. Weber (2022): Controlling Unknown Linear Dynamics with Bounded Multiplicative Regret. *Revista Matemática Iberoamericana*, vol. 38 (7), 2185–2216.

M. Weber, S. Sra (2021): Projection-free nonconvex stochastic optimization on Riemannian manifolds. *IMA Journal on Numerical Analysis*, vol 42(4), pages 3241–3271.

C. Fefferman, B. Guillen Pegueroles, C. W. Rowley, M. Weber (2021): Optimal Control with Learning on the fly. *Revista Matemática Iberoamericana*, vol. 37(1).

M. Weber, M. Zaheer, A. Singh Rawat, A. Menon, S. Kumar (2020): Robust large-margin learning in hyperbolic space. *Advances in Neural Information Processing Systems (NeurIPS)*

M. Weber (2020): Neighborhood Growth Determines Geometric Priors for Relational Representation Learning. *International Conference on Artificial Intelligence and Statistics (AISTATS)*

M. Weber, E. Saucan and J. Jost (2018): Coarse Geometry of Evolving Networks. *Journal of Complex Networks*. vol. 6(5), pp. 706-732.

M. Weber, E. Saucan and J. Jost (2017): Characterizing Complex Networks with Forman-Ricci Curvature and Associated Geometric Flows. *Journal of Complex Networks*, vol. 5 (4), 527-550.

Teaching

APMTH220: Geometric Methods for Machine Learning

Spring 2023, 2024, 2025

APMTH121: Introduction to Optimization

Fall 2024

Selected Invited Lectures

2024: Conference on the Mathematical Theory of Deep Neural Networks (DeepMath), Korea Institute for Advanced Study, Tufts, Harvard CMSA Big Data Conference, Harvard-Smithsonian Center for Astrophysics, IMSA AI and Pure Mathematics Conference, KTH Stockholm, Zuse Institute Berlin, Imperial College London, AAAI Conference on Artificial Intelligence, Banff International Research Station, University of Virginia, University of Cambridge

2023: University of Edinburgh, Mathematics and Machine Learning Conference, Simons Institute for the Theory of Computing, Northeastern University Network Science Institute, University of Minnesota, ICML Workshop on Topology Algebra and Geometry in Machine Learning, Sampling Theory and Applications Conference, UC Santa Barbara

2022: SIAM Workshop on Network Science, University of Washington, KTH Stockholm, Banach Center, IBM-Oxford Symposium, AI-UK

2021: Simons Institute for the Theory of Computing, KU Leuven Institute for Artificial Intelligence, Microsoft Research, One World Seminar Series: Mathematics of Machine Learning