CONTACT INFORMATION

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206 Church St. SE
Minneapolis, MN 55455
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EDUCATION

Ph.D in Mathematics
Yale University, May 2015
Dissertation Title: Topics in Metric Approximation
Advisor: Ronald R. Coifman

M.S./M.Phil. in Mathematics
Yale University, May 2013

B.S. in Mathematics, *with honors*
University of Chicago, June 2010

ACADEMIC POSITIONS

Assistant Professor
University of Minnesota, Twin Cities, 2018 – Present

Postdoctoral Research Associate
Princeton University, 2015 – 2018

PUBLICATIONS

- William Leeb. Optimal singular value shrinkage for operator norm loss: Extending to non-square matrices. *Statistics and Probability Letters* 178, 10919 (2022).
- Tamir Bendory, Dan Edidin, William Leeb and Nir Sharon. Dihedral multi-reference alignment. *IEEE Transactions on Information Theory* 68(5) 3489-3499 (2022).
- William Leeb. Rapid evaluation of the spectral signal detection threshold and Stieltjes transform. *Advances in Computational Mathematics* 47(4), 1-29 (2021).
- William Leeb. A note on identifiability conditions in confirmatory factor analysis. *Statistics and Probability Letters* 178, 10919 (2021).
- William Leeb. Matrix denoising for weighted loss functions and heterogeneous signals. *SIAM Journal on Mathematics of Data Science* 3(3), 987-1012 (2021).
- William Leeb and Elad Romanov. Optimal spectral shrinkage and PCA with heteroscedastic noise. *IEEE Transactions on Information Theory* 67(5), 3009-3037 (2021).
- Tamir Bendory, Ariel Jaffe, William Leeb, Nir Sharon and Amit Singer. Super-resolution multi-reference alignment. Accepted to *Information and Inference* (2021).
- Edgar Dobriban, William Leeb and Amit Singer. Optimal prediction in the linearly transformed spiked model. *Annals of Statistics* 48(1), 491-513 (2020).

- William Leeb and Vladimir Rokhlin. On the numerical solution of fourth-order linear two-point boundary value problems. *SIAM Journal on Scientific Computation* 42(3), A1789-A1808 (2020).
- Tamir Bendory, Nicolas Boumal, William Leeb, Eitan Levin and Amit Singer. Multi-target detection with application to cryo-electron microscopy. *Inverse Problems* 35(10), 104003 (2019).
- Emmanuel Abbe, Tamir Bendory, William Leeb, João Pereira, Nir Sharon and Amit Singer. Multireference alignment is easier with an aperiodic translation distribution. *IEEE Transactions on Information Theory* 65(6), 3565-3584 (2019).
- William Leeb. Approximating snowflake metrics by trees. *Applied and Computational Harmonic Analysis* 45(2), 405-424 (2018).
- Jerrod Ankenman and William Leeb. Mixed Hölder matrix discovery via wavelet shrinkage and Calderón-Zygmund decompositions. *Applied and Computational Harmonic Analysis* 45(3), 551-596 (2018).
- William Leeb. The mixed Lipschitz space and its dual for tree metrics. *Applied and Computational Harmonic Analysis* 44(3), 584-610 (2018).
- William Leeb and Ronald Coifman. Hölder-Lipschitz norms and their duals on spaces with semigroups, with applications to Earth Mover's Distance. *Journal of Fourier Analysis and Applications*, 22(4), 910-953 (2016).

PRE-PRINTS / TECHNICAL REPORTS

- Matan Gavish, William Leeb and Elad Romanov. Matrix Denoising with Partial Noise Statistics: Optimal Singular Value Shrinkage of Spiked F-Matrices. arXiv 2211.00986 (2022).
- Tamir Bendory, Nicolas Boumal, William Leeb, Eitan Levin and Amit Singer. Toward single-particle reconstruction without particle picking: Breaking the detection limit. arXiv:1810.00226 (2022).
- William Leeb. On the robustness of certain norms. arXiv 2101.10867 (2021).
- William Leeb. Properties of Laplacian Pyramids for Extension and Denoising. arXiv 1909.07974 (2019).

TALKS / PRESENTATIONS

- Robust Metrics by Integration. SIAM Conference on Mathematics of Data Science (MDS22), Minisymposium on Geometric Distances and Robust Data Analysis. September, 2022.
- New Methods for Low-Rank Matrix Denoising. Oden Institute, University of Texas at Austin. May 10, 2022.
- New Methods for Low-Rank Matrix Denoising. Yale University Applied Math Seminar. December 15, 2021.
- New Methods for Low-Rank Matrix Denoising. Duke University Applied Math and Analysis Seminar. December 14, 2021.
- Matrix Denoising with Weighted Loss. KTH Royal Institute of Technology. April 12, 2021.
- Matrix Denoising with Weighted Loss. Computational and Applied Mathematics Colloquium, University of Chicago. March 18, 2021.
- Matrix Denoising with Weighted Loss. Data Science Seminar, Institute for Mathematics and its Applications. September 22, 2020.
- Missing Data in the High Noise Regime. Virtual poster session, Workshop on Missing Data Challenges in Computation, Statistics, and Applications. Institute for Advanced Study. September 10, 2020.

- Matrix Denoising with Weighted Loss. SIAM Conference on Mathematics of Data Science (MDS20, virtual conference), Minisymposium on High-Dimensional PCA in the High-Noise Regime. June 24, 2020.
- Matrix Denoising with Weighted Loss. Mathematics of Data and Decisions Seminar, University of California, Davis. March 10, 2020.
- Matrix Estimation in the Spiked Model with Heteroscedastic Noise. Computational Harmonic Analysis and Data Science Workshop, BIRS. Oaxaca, Mexico. October 29, 2019.
- New Methods for Denoising and CTF Correction. Poster session, Computational Cryo-EM Summer Workshop. Flatiron Institute. August 8, 2019.
- Dual Norms on Product Spaces. International Congress on Industrial and Applied Mathematics (ICIAM), Minisymposium on Distance Metrics and Mass Transfer Between High Dimensional Point Clouds. Valencia, Spain. July 17, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. Center for Computational Mathematics Seminar, Flatiron Institute. New York, NY. May 29, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. IDeAS Seminar, Princeton University. Princeton, NJ. May 28, 2019.
- Matrix Denoising and PCA with Heteroscedastic Noise. Applied Math and Computer Science Colloquium, University of Pennsylvania. Philadelphia, PA. May 24, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Applied Math Seminar, Yale University. New Haven, CT. April 23, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Probability Seminar, University of Minnesota. Minneapolis, MN. April 19, 2019.
- Optimal Spectral Shrinkage and PCA with Heteroscedastic Noise. Analysis Seminar, University of Missouri. Columbia, MO. March 19, 2019.
- SIAM 5-Minute Faculty Research Showcase, University of Minnesota. March 6, 2019.
- The Role of the Translation Distribution in Multireference Alignment. Data Science Seminar, Institute for Mathematics and its Applications. September 17, 2018.
- Prediction in the Linearly Transformed Spiked Model. Fourth Conference of the International Society of Nonparametric Statistics (ISNPS). Salerno, Italy. June 12, 2018.
- Optimal Prediction in the Linearly Transformed Spiked Model. Data Science Seminar, Institute for Mathematics and its Applications. December 8, 2017.
- MRA is Easier with an Aperiodic Translation Distribution. Simons Foundation, New York. November 10, 2017.
- PCA from Noisy, High-Dimensional and Linearly-Corrupted Observations. Poster session, Modern Advances in Computational and Applied Mathematics Workshop, Yale University. June 9, 2017.
- PCA from Linearly Reduced Measurements: The Diagonal Case. Applied Mathematics Seminar, Yale University. December 13, 2016.
- Earth Mover's Distance and Equivalent Metrics. Machine Learning Seminar, Yale University. February 17, 2016.
- The Mixed Hölder Condition, with Applications to the Analysis of Multidimensional Databases. Simons Foundation, New York. January 29, 2016.

- The Hölder-Lipschitz Space and its Dual. International Conference on Harmonic Analysis and Applications, City University of New York. June 5, 2015.
- Earth Mover's Distance and Equivalent Metrics. IDeAS Seminar, Princeton University. March 26, 2014.

PROFESSIONAL SERVICE

- Journal reviewer:
  - *Journal of Nonlinear Science*
  - *Forum of Mathematics, Sigma*
  - *Applied and Computational Harmonic Analysis*
  - *SIAM Journal on Mathematics of Data Science*
  - *Annals of Statistics*
  - *Information and Inference*
  - *Journal of Geometric Analysis*
  - *Real Analysis Exchange*
  - *IEEE Transactions on Information Theory*
  - *IEEE Transactions on Signal Processing*
  - *Inverse Problems*
  - *Journal of Fourier Analysis and Applications*
- Proposal reviewer:
  - The Pazy Foundation
- Proposal reviewer for the Undergraduate Research Opportunity Program (UROP) at the University of Minnesota, Twin Cities, 2020 - 2021
- Co-organizer of the IDeAS seminar, Princeton University, 2016 - 2018
- Co-organizer of the Data Science Seminar, Institute for Mathematics and its Applications, 2018 - present (with Jeffrey Calder and Gilad Lerman)
- Co-organizer of mini-symposium "High-Dimensional PCA in the High-Noise Regime", SIAM Conference on Mathematics of Data Science 2020 (with Edgar Dobriban and Amit Singer)
- Designed Math 2142, Elementary Linear Algebra, University of Minnesota, Twin Cities, 2020 (with Greg Anderson)
- Panelist, webinar for prospective students. April 20, 2021.
- Lecturer, UMN Summer School on Random Structures in Optimizations and Related Applications. June 25 and June 28 - June 30, 2021.

TEACHING EXPERIENCE

- **Instructor**
  Math 8600: Topics in Advanced Applied Mathematics
  University of Minnesota, Twin Cities
  Spring 2022, Fall 2022

- **Instructor**
  Math 2142: Elementary Linear Algebra
  University of Minnesota, Twin Cities
  Fall 2020, Spring 2021, Fall 2021
- **Instructor**
  Math 4242: Applied Linear Algebra
  University of Minnesota, Twin Cities
  Fall 2018, Spring 2019, Fall 2019, Spring 2020
- **Teaching Fellow**
  The Structure of Networks
  Yale University
  Spring 2014, Spring 2015
- **Grader**
  Differential Geometry
  Yale University
  Spring 2013
- **Instructor**
  Calculus of Functions of One Variable II
  Yale University
  Fall 2012, Fall 2013
- **Teaching Fellow**
  Linear Algebra with Applications
  Yale University
  Spring 2012
- **Tutor**
  Calculus, all levels
  Yale University
  Fall 2010

AWARDS / RECOGNITIONS

- **Thank a Teacher**
  University of Minnesota, Fall 2019 and Spring 2020
- **Phi Beta Kappa**
  University of Chicago, 2009 (elected Junior year)
- **Student Marshal**
  University of Chicago, 2009
- **Paul R. Cohen Prize**
  University of Chicago, 2010

FUNDING

- PI, BSF Award 2018230, 2019 – 2022. With Nir Sharon (PI, Tel Aviv University). $120,000 total/$60,000 Minnesota.
- Co-PI, NSF BIGDATA Award IIS-1837992, 2018 – 2022. With Amit Singer (PI, Princeton University) and Edgar Dobriban (Co-PI, University of Pennsylvania). $1,000,000 total/$333,333 Minnesota.
- Simons Collaboration on Algorithms and Geometry postdoctoral grant, 2015 – 2018.