

Jakob Hansen

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Education

- 2020 Ph.D. Applied Mathematics and Computational Science
University of Pennsylvania
- 2017 M.A. Applied Mathematics and Computational Science
University of Pennsylvania
- 2015 B.S. Mathematics, B.S. Economics
Arizona State University

Experience

- 2020–2021 Visiting Assistant Professor
Ohio State University
- 2019 Instructor, Pre-Freshman Program Engineering Mathematics
University of Pennsylvania
- 2016 Teaching Assistant, Topological Data Analysis mini-course
IAS Park City Mathematics Institute Graduate Summer School
- 2014 ATR Center Intern
Air Force Research Laboratory

Research

Peer-Reviewed Journal Articles

1. J. Hansen and R. Ghrist. Opinion Dynamics on Discourse Sheaves. *SIAM Journal on Applied Mathematics* 81:5 (2021).
2. J. Hansen. Expansion in Matrix-Weighted Graphs. *Linear Algebra and its Applications* 630 (2021).
3. J. Hansen and R. Ghrist. Toward a Spectral Theory of Cellular Sheaves. *Journal of Applied and Computational Topology* 3:4 (2019).
4. R.A. Renaut, M. Horst, Y. Wang, D. Cochran, and J. Hansen. Efficient Estimation of Regularization Parameters via Downsampling and the Singular Value Expansion. *BIT Numerical Mathematics* 57:2 (2017).
5. J. Hansen, J. Hogue, G. Sander, R.A. Renaut, S.C. Popat. Non-negatively Constrained Least Squares and Parameter Choice by the Residual Periodogram for the Inversion of Electrochemical Impedance Spectroscopy Data. *Journal of Computational and Applied Mathematics* 278 (2015).

Conference and Workshop Publications

1. J. Hansen and T. Gebhart. Sheaf Neural Networks. NeurIPS Workshop: Topological Data Analysis and Beyond, 2020.
2. H. Riess and J. Hansen. Multidimensional Persistence Module Classification via Lattice-Theoretic Convolutions. NeurIPS Workshop: Topological Data Analysis and Beyond, 2020.

3. J. Hansen and R. Ghrist. Distributed Optimization with Sheaf Homological Constraints. Allerton Conference on Communication, Control, and Computing, 2019.
4. J. Hansen and R. Ghrist. Learning Sheaf Laplacians From Smooth Signals. IEEE International Conference on Acoustics, Sound, and Signal Processing, 2019.
5. J. Culbertson, D. Guralnik, J. Hansen, P. Stiller. Consistency Constraints for Overlapping Data Clustering. International Conference on Data Science, 2019.

Papers Under Review or Revision

1. T. Gebhart, J. Hansen, and P. Schrater. Knowledge Sheaves: A Sheaf-Theoretic Framework for Knowledge Graph Embedding.

Awards and Honors

- 2019 Carlitz-Zippin Prize, University of Pennsylvania Department of Mathematics (awarded for an exceptional Ph.D. thesis)
- 2015 National Science Foundation Graduate Research Fellowship Honorable Mention
Charles Wexler Mathematics Prize, Arizona State University (awarded to the outstanding senior mathematics student at ASU)
Dean's Medal, Economics, Arizona State University (awarded to the outstanding graduating economics student at ASU)
- 2014 Goldwater Scholarship

Presentations

- June 2021 Cellular Sheaves, Discrete Hodge Theory, and Applications
EPFL Applied Topology Seminar
- May 2021 Cellular Sheaves, Discrete Hodge Theory, and Applications
Oregon State University Applied Topology Seminar
- Sept 2020 Laplacians of Cellular Sheaves and their Applications
Ohio State University Topology, Geometry, and Data Analysis Seminar
- Feb 2020 Cellular Sheaves, Discrete Hodge Theory, and Applications
SUNY Albany Algebra and Topology Seminar
- Jan 2020 Laplacians of Cellular Sheaves and their Applications
University of Florida TDA Meeting
- Oct 2019 Cellular Sheaves, Discrete Hodge Theory, and Applications
CUNY Applied Topology and Data Analysis Seminar
- Sept 2019 Distributed Optimization with Sheaf Homological Constraints
Allerton Conference on Communication, Control, and Computing
Laplacians of Cellular Sheaves and their Applications
Union College Mathematics Conference
- June 2019 Sheaves in Dimensionality Reduction
Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning
- May 2019 From Connections to Relationships with Cellular Sheaves
SIAM Workshop on Network Science
Sheaf Laplacians as Sums of Semidefinite Matrices
Oxford Topological Data Analysis Seminar

- Sept 2018 Toward a Spectral Theory of Cellular Sheaves
Special Session in Applied Topology, AMS Eastern Sectional Meeting
- Aug 2014 Clustering with Hierarchical Sieves
AFRL ATR Center Summit
- Jan 2014 Improving Conditioning for the Electrochemical Impedance Spectroscopy
Inverse Problem
Special Session on Undergraduate Research in Applied Mathematics,
Joint Mathematics Meetings

Conference Participation

- Dec 2020 NeurIPS Workshop: Topological Data Analysis and Beyond
- Jan 2020 University of Florida TDA Meeting
- Sept 2019 Allerton Conference on Communication, Control, and Computing
- June 2019 Ohio State University Graduate Student Conference:
Geometry and Topology meet Data Analysis and Machine Learning
- May 2019 SIAM Workshop on Network Science
International Conference on Acoustics, Speech, and Signal Processing (ICASSP)
- Aug 2018 IMA Tutorial on Multiparameter Persistence
- May 2018 IMA Workshop: Bridging Statistics and Sheaves

Miscellaneous

- SheafLearning.jl: Julia package for learning sheaf Laplacians from data
- Programming Languages*: Python, Julia, \LaTeX , HTML/CSS.
- Fluent in Spanish.