# Dhruv Kohli

 Google Scholar
 dhkohli@ucsd.edu
 https://dhruvkohli.github.io

## Education

2021–25   **Ph.D.**, Computational Mathematics, University of California San Diego
          Advisors: Alex Cloninger and Gal Mishne
2018-20   **M.S.**, Computational Mathematics, University of California San Diego
2012-16   **B.Tech.**, Mathematics & Computing, Indian Institute of Technology Guwahati

## Research Interests

My research focuses on developing novel algorithms to analyze and uncover meaningful structures within high-dimensional data. My overarching objective is to obtain low-dimensional representations of the data by decomposing it into well-behaved regions that are easy to parameterize. To advance these goals, I often utilize tools from differential geometry, spectral graph theory, optimization, and optimal transport. In addition to providing stability and convergence guarantees for these algorithms, my work also focuses on their efficient and scalable implementation.

## Publications

### Preprints

1. **Kohli**[†]**, Dhruv**, Robertson[†], S., Cloninger, A. & Mishne, G. Robust local approximation of data using gradients of Laplacian eigenvectors (2024).
   – In preparation.

2. **Kohli, Dhruv**, He, J., Holtz, C., Mishne, G. & Cloninger, A. Robust estimation of boundary using doubly stochastic scaling of Gaussian kernel. *arXiv:2411.18942* (2024).

3. **Kohli, Dhruv**, Nieuwenhuis, J. S., Cloninger, A., Mishne, G. & Narain, D. RATS: Unsupervised manifold learning using low-distortion alignment of tangent spaces. *bioRxiv* (2024).

4. **Kohli, Dhruv**, Cloninger, A. & Mishne, G. Tearing and Repulsion Enabled Registration of Point Clouds (2024).

5. **Kohli, Dhruv**, Mishne, G. & Cloninger, A. Non-degenerate Rigid Alignment in a Patch Framework. *arXiv:2303.11620* (2023).

6. Robertson[†], S., **Kohli**[†]**, Dhruv**, Mishne, G. & Cloninger, A. On a Generalization of Wasserstein Distance and the Beckmann Problem to Connection Graphs. *arXiv:2312.10295* (2023).

### Journal Articles

1. **Kohli, Dhruv**, Cloninger, A. & Mishne, G. LDLE: Low Distortion Local Eigenmaps. *Journal of Machine Learning Research* **22,** 1–64 (2021).

2. **Kohli, Dhruv** & Rabin, J. M. Asymmetric expansion preserves hyperbolic convexity. *Journal of Geometry* **111,** 33 (2020).

3. **Kohli, Dhruv** & Rabin, J. M. Radial expansion preserves hyperbolic convexity and radial contraction preserves spherical convexity. *Journal of Geometry* **110,** 1–13 (2019).

† equal contribution

**Peer-reviewed Conference Proceedings**

1. **Kohli, Dhruv**, Das, B. C., Gopalakrishnan, V. & Iyer, K. N. *Learning rotation invariance in deep hierarchies using circular symmetric filters* in *2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (2017), 2846–2850.

**Patents**

1. Ichapurapu, R., Inti, D. L. N. S., **Kohli, Dhruv** & Subramanian, A. *Interactive physical placement of devices for optimal motion sensing using channel state information (CSI)*. US Patents 12120534-B1 (2024).

# Software

pyLDLE2  Our python package containing implementation of (a) linear and spectral methods for constructing low-dimensional local views of the data, and (b) spectral, semidefinite, and other iterative techniques for globally aligning these local views.

# Awards & Honors

2021–25    UCSD Halıcıoğlu Data Science Institute (HDSI) PhD Fellowship
2021–25    UCSD Department of Mathematics, James B. Ax Fellowship
2017       Ranked 18 across country in entrance exam for Master in Statistics organized by Indian Statistical Institute, Kolkata
2014       Ranked 1 across the country in CUDA Coding Challenge India organized by Nvidia in High Performance Computing Conference [Code]

# Conferences & Presentations

**Talks**

Mar 2024   Tear and repulsion enabled registration of point clouds for manifold learning. *Dagstuhl Seminar 24122 on Low-Dimensional Embeddings of High-Dimensional Data: Algorithms and Applications* (Wadern, Germany).

Apr 2023   A bottom-up manifold learning framework to embed closed and non-orientable manifolds into their intrinsic dimensions. *Southern California Applied Mathematics Symposium* (UC Irvine).

**Posters**

Oct 2024   Tear and repulsion enabled registration of point clouds. *SIAM Conference on Mathematics of Data Science* (Atlanta, US).

Sep 2024   Robust estimation of boundary using doubly stochastic kernel. *NSF site visit*, *The Institute for Emerging CORE Methods in Data Science (EnCORE)* (UC San Diego).

Mar 2023   Reliable neural manifold decoding using low-distortion alignment of tangent spaces. *Computational and Systems Neuroscience (COSYNE)* (Montreal, Canada).

Oct 2022   Fast alignment of local eigenmaps for a guaranteed low distortion global embedding. *Fall Fourier Talks*, *Norbert Wiener Center* (University of Maryland).

Mar 2021   Low Distortion Local Eigenmaps. *SoCal ML and NLP Symposium* (UC San Diego).

## Industrial Experience

| | |
|---|---|
| 2024 | PhD AI research intern, GM Cruise, Remote, US. |
| 2020-21 | Software engineer (ML), Amazon.com Services, Inc., Sunnyvale, US. |
| 2016-17 | Software engineer (ML), Samsung Research Institute, Bangalore, India. |
| 2015 | Research Intern, Microsoft Research, Bangalore, India. |
| 2014 | International Neuroinformatics Coordinating Facility via Google Summer of Code. |

## Teaching Assistant Experience

| | |
|---|---|
| DSC 205 | Geometry of Data |
| MATH 170A | Numerical Linear Algebra |
| MATH 170B | Numerical Approximation and Nonlinear Equations |
| MATH 183 | Statistical Methods |
| MATH 20E | Vector Calculus |
| MATH 11 | Calculus Based Probability and Statistics |

## Reviewer

| | |
|---|---|
| 2024 | SIAM Journal on Mathematics of Data Science |