Zhengchao Wan

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Education

The Ohio State University — **Columbus, OH, USA**
Ph.D. in Mathematics — *2016-2021*
Advisor: Facundo Mémoli

Peking University — **Beijing, China**
B.S. in Mathematics — *2012-2016*
Advisor: Bin Dong

Employment

University of California San Diego — **La Jolla, CA, USA**
Postdoctoral Scholar — *2022-Present*
Mentors: Gal Mishne, Yusu Wang

Research Interests

Optimal Transport, Metric Geometry, Spectral Geometry, Topological Data Analysis

Publications

Papers in Journals and Peer-Refereed Conferences

Aziz Burak Gülen, Facundo Mémoli, Zhengchao Wan, and Yusu Wang. A generalization of the persistent Laplacian to simplicial maps. *To appear in 39th International Symposium on Computational Geometry (SoCG). arXiv preprint arXiv:2302.03771.*, 2023.

Samantha Chen, Sunhyuk Lim, Facundo Mémoli, Zhengchao Wan, and Yusu Wang. Weisfeiler-Lehman meets Gromov-Wasserstein. In *International Conference on Machine Learning (ICML)*, pages 3371–3416. PMLR, 2022.

Facundo Mémoli, Zhengchao Wan, and Yusu Wang. Persistent laplacians: Properties, algorithms and implications. *SIAM Journal on Mathematics of Data Science*, 4(2):858–884, 2022.

Facundo Mémoli, Zane Smith, and Zhengchao Wan. The Gromov-Hausdorff distance between ultrametric spaces: its structure and computation. *To appear in Journal of Computational Geometry. arXiv preprint arXiv:2110.03136.*, 2021.

Facundo Mémoli and Zhengchao Wan. On p-metric spaces and the p-Gromov-Hausdorff distance. *p-Adic Numbers, Ultrametric Analysis and Applications*, 14(3):173–223, 2022.

Zhengchao Wan. A novel construction of Urysohn universal ultrametric space via the Gromov-Hausdorff ultrametric. *Topology and its Applications*, 300:107759, 2021.

Facundo Mémoli, Zane Smith, and Zhengchao Wan. The Wasserstein transform. In *International Conference on Machine Learning (ICML)*, pages 4496–4504. PMLR, 2019.

Preprints

Tristan Brugère, Zhengchao Wan, and Yusu Wang. Distances for Markov chains, and their differentiation. *arXiv preprint arXiv:2302.08621*, 2023.

Mitchell Black, Amir Nayyeri, Zhengchao Wan, and Yusu Wang. Understanding oversquashing in GNNs through the lens of effective resistance. *arXiv preprint arXiv:2302.06835*, 2023.

Samantha Chen, Sunhyuk Lim, Facundo Mémoli, Zhengchao Wan, and Yusu Wang. The Weisfeiler-Lehman distance: Reinterpretation and connection with GNNs. *arXiv preprint arXiv:2302.00713*, 2023.

Gal Mishne, Zhengchao Wan, Yusu Wang, and Sheng Yang. The numerical stability of hyperbolic representation learning. *arXiv preprint arXiv:2211.00181*, 2022.

Sunhyuk Lim, Facundo Memoli, Zhengchao Wan, Qingsong Wang, and Ling Zhou. Some results about the Tight Span of spheres. *arXiv preprint arXiv:2112.12646*, 2021.

Facundo Mémoli, Axel Munk, Zhengchao Wan, and Christoph Weitkamp. The ultrametric Gromov-Wasserstein distance. *arXiv preprint arXiv:2101.05756*, 2021.

Facundo Mémoli and Zhengchao Wan. Characterization of Gromov-type geodesics. *arXiv preprint arXiv:2105.05369*, 2021.

Kun Jin, Facundo Mémoli, and Zhengchao Wan. The Gaussian transform. *arXiv preprint arXiv:2006.11698*, 2020.

Computational Software / Expository Webpages

Persistent Laplacian (with F. Mémoli and Y. Wang)
https://github.com/ndag/Persistent-Laplacian

Gromov-Hausdorff distances between ultrametric spaces (with F. Mémoli and Z. Smith)
https://github.com/ndag/ultrametrics

The ultrametric Gromov-Wasserstein distances (with F. Mémoli, A. Munk and C. Weitkamp)
https://github.com/ndag/uGW

Talks

Computational Persistence 2022 *Oct. 2022*
Persistent Laplacians: properties, algorithms and implications

International Conference on Machine Learning (ICML) 2022 *July 2022*
Weisfeiler-Lehman meets Gromov-Wasserstein

Topology, Geometry and Data Analysis seminar at Ohio State *Oct. 2021*
The Gromov-Hausdorff distance between ultrametric spaces

Geometry and Topology meet Data Analysis and Machine Learning (GTDAML 2021) *July 2021*
Persistent Laplacians: properties, algorithms and implications

Seminar at Centre for Topological Data Analysis, Oxford University *May 2021*
Persistent Laplacians: properties, algorithms and implications

Algebraic Topology: Methods, Computation, and Science (hosted by AATRN) *Jan. 2021*
Computing the Gromov-Hausdorff distance between ultrametric spaces

Topology, Geometry, and Applications - Graduate Students Seminar at Ohio State *Oct. 2020*
Urysohn universal ultrametric space

Geometry, Topology and Data Seminar, Florida State University *Nov. 2019*
The Wasserstein transform

Topology, Geometry, and Applications - Graduate Students Seminar at Ohio State *Sep. 2019*
Gromov-Hausdorff distance between ultrametric spaces

Air Force Research Lab in Dayton, Ohio *July 2019*
The Wasserstein transform

Poster Presentations

Conference on the Mathematical Theory of Deep Neural Networks *Nov 2022*
A numerical comparison between Lorentz and Poincaré models for representation learning

TILOS Annual Retreat / Industry Day *Oct 2022*
WL-based distance for directed graphs with attributes and Markov chain metric spaces

International Conference on Machine Learning (ICML) 2019 *June 2019*
The Wasserstein transform

GTDAML2019, the Ohio State University *May 2019*
The Wasserstein transform

Geometric Data Analysis, University of Chicago *May 2019*
The Wasserstein transform

Honors and Awards

Special Graduate Assignments, the Ohio State University *Spring 2020*

Travel Award, ICML2019 *June 2019*

Alumina Yizheng Distinguished Scholar Award, Peking University *Oct. 2014*

Jiang Zehan Scholarship, Peking University *Sep. 2013*

Teaching Experiences

MATH 1172, the Ohio State University *Spring 2021*
Engineering Mathematics A

MATH 1172, the Ohio State University *Autumn 2018*
Engineering Mathematics A

Mini-Course, Peking University *Summer 2016*
Information Geometry

Professional Services

Organization of activities

Midwest Student Conference GTDAML2019, the Ohio State University *June 2019*
Co-organizer

Referee

Journals
Analysis and Geometry in Metric Spaces
Computational Geometry: Theory and Applications
Discrete & Computational Geometry
Journal of Combinatorial Optimization
SIAM Journal on Applied Algebra and Geometry
Conferences
Symposium on Computational Geometry (2021, 2022, 2023)

ACM-SIAM Symposium on Discrete Algorithms (2019, 2023)
Conference on the Mathematical Theory of Deep Neural Networks (2022)