

# Zhengchao Wan

✉ zcwan@ucsd.edu • 🌐 <https://zhengchaow.github.io>

## Education

---

### The Ohio State University

*Ph.D. in Mathematics*

Advisor: Facundo Mémoli

Columbus, OH, USA

2016-2021

### Peking University

*B.S. in Mathematics*

Advisor: Bin Dong

Beijing, China

2012-2016

## Employment

---

### University of California San Diego

*Postdoctoral Scholar*

Mentors: Gal Mishne, Yusu Wang

La Jolla, CA, USA

2022-Present

## Research Interests

---

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

## Publications

---

### Papers in Journals and Peer-Refereed Conferences.....

Facundo Mémoli and Zhengchao Wan. Characterization of Gromov-type geodesics. *To appear in Differential Geometry and its Applications*. *arXiv preprint arXiv:2105.05369*, 2023.

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.

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

---

**TDA Conference at University of Florida**

Feb. 2023

*A generalization of the persistent Laplacian to simplicial maps*

**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*

<b>Topology, Geometry, and Applications - Graduate Students Seminar at Ohio State</b> <i>Gromov-Hausdorff distance between ultrametric spaces</i>	<i>Sep. 2019</i>
<b>Air Force Research Lab in Dayton, Ohio</b> <i>The Wasserstein transform</i>	<i>July 2019</i>

## Poster Presentations.....

<b>Conference on the Mathematical Theory of Deep Neural Networks</b> <i>A numerical comparison between Lorentz and Poincaré models for representation learning</i>	<i>Nov 2022</i>
<b>TILOS Annual Retreat / Industry Day</b> <i>WL-based distance for directed graphs with attributes and Markov chain metric spaces</i>	<i>Oct 2022</i>
<b>International Conference on Machine Learning (ICML) 2019</b> <i>The Wasserstein transform</i>	<i>June 2019</i>
<b>GTDAML2019, the Ohio State University</b> <i>The Wasserstein transform</i>	<i>May 2019</i>
<b>Geometric Data Analysis, University of Chicago</b> <i>The Wasserstein transform</i>	<i>May 2019</i>

## Honors and Awards

<b>Special Graduate Assignments, the Ohio State University</b>	<i>Spring 2020</i>
<b>Travel Award, ICML2019</b>	<i>June 2019</i>
<b>Alumina Yizheng Distinguished Scholar Award, Peking University</b>	<i>Oct. 2014</i>
<b>Jiang Zehan Scholarship, Peking University</b>	<i>Sep. 2013</i>

## Teaching Experiences

<b>MATH 1172, the Ohio State University</b> <i>Engineering Mathematics A</i>	<i>Spring 2021</i>
<b>MATH 1172, the Ohio State University</b> <i>Engineering Mathematics A</i>	<i>Autumn 2018</i>
<b>Mini-Course, Peking University</b> <i>Information Geometry</i>	<i>Summer 2016</i>

## Professional Services

### Organization of activities.....

<b>Midwest Student Conference GTDAML2019, the Ohio State University</b> <i>Co-organizer</i>	<i>June 2019</i>
--	------------------

### 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)