

Employment / Education

CV — short, public ver.

July 2023 -	KAIST (Korea Advanced Institute of Science and Technology), South Korea Assistant Professor (tenure-track) Department of Mathematical Sciences Graduate School of AI for Math (August 2025 -)	
2020-2023	Duke University , NC, USA	William W. Elliott Assistant Research Professor
2020	The Ohio State University , OH, USA	Ph.D. in Mathematics
2014	Seoul National University , South Korea	B.S.in Mathematics Education

Current research interests

Applied and Computational Topology, Topology-Geometry-Algebra in Machine Learning, Representation theory of Algebras, AI for Math

Publications

[Link to Google Scholar Profile](#)

Preprints and peer-reviewed research articles

In every publication, author names are listed in alphabetical order.

19. Super-Polynomial Growth of the Generalized Persistence Diagram (with D. Kim, W. Lee) 2026
(accepted) *Journal of Computational Geometry*, **Special issue for a selection of papers from SoCG 2025**
18. Barcoding Invariants and Their Comparison (with E.G. Escobar) 2026
Last update in June 2026 [arXiv.2412.04995v2](#) (37 pages)
17. Interleaving distance as a Galois-Edit distance (with W. Seong) 2026
Last update in April 2026 [arXiv.2509.24233](#) (35 pages)
16. Limit Theorems for Verbose Persistence Diagrams (with J-H. Jo, C. Park) 2025
[arXiv.2509.11256](#) (33 pages)
15. Super-Polynomial Growth of the Generalized Persistence Diagram (with D. Kim, W. Lee) 2025
Proceedings of the 41th Int. Symp. on Computational Geometry (SoCG '25)
[arXiv.2412.04889](#) (24 pages)
14. Sparsification of the Generalized Persistence Diagrams for Scalability through Gradient Descent (with M. Carrière, S.Kim), 2025
Proceedings of the 41th Int. Symp. on Computational Geometry (SoCG '25)
[arXiv.2412.05900](#) (20 pages)
13. The Generalized Rank Invariant: Möbius invertibility, Discriminating Power, and Connection to Other Invariants (with N. Clause and F. Mémoli) 2024
Last update in July 2024, [arXiv.2207.11591v5](#) (62 pages)
12. Bigraded Betti numbers and generalized persistence diagrams (with S. Moore), 2024
Journal of Applied and Computational Topology, Vol. 8, pp. 727–760, [Journal](#), [arXiv](#)
11. Computing generalized rank invariant for 2-parameter persistence modules via zigzag persistence and its applications (with T. Dey, F. Mémoli) 2023
Discrete & Computational Geometry, Vol. 71, pp. 67–94, [Journal](#), [arXiv](#)
Special issue for a selection of papers from SoCG 2022
10. Extracting persistent clusters in dynamic data via Möbius inversion, (with F. Mémoli) 2023
Discrete & Computational Geometry, Vol. 71, pp. 1276–1342, [Journal](#), [arXiv](#)

9. Interleaving by parts: Join decompositions of interleavings and join-assemblage of geodesics (with F. Mémoli, A. Stefanou),
Order, Vol. 41, pp. 497–537, [Journal](#), [arXiv](#) 2023
8. Computing generalized rank invariant for 2-parameter persistence modules via zigzag persistence and its applications (with T. Dey, F. Mémoli)
Proceedings of the 38th Int. Symp. on Computational Geometry (SoCG), 17 pages, [Link](#) 2022
7. Elder-rule-staircodes for augmented metric spaces (with C. Cai, F. Mémoli, Y. Wang)
SIAM Journal of Applied Algebra and Geometry, 5 (3) pp. 417–454 (38 pages), [Journal](#), [arXiv](#). 2021
6. Generalized persistence diagrams for persistence modules over posets (with F. Mémoli)
Journal of Applied and Computational Topology, 5, pp. 533–581 (48 pages), [Journal](#), [arXiv](#). 2021
5. Spatiotemporal persistent homology for dynamic metric spaces (with F. Mémoli)
Discrete & Computational Geometry, 66, pp.831–875 (44 pages) [Journal](#), [arXiv](#). 2021
4. The Persistent Topology of Dynamic Data
Ph.D. Thesis (244 pages), [Link](#) 2020
3. Analysis of dynamic graphs and dynamic metric spaces via zigzag persistence (with F. Mémoli, Z. Smith*)
Proceedings of The Abel Symp. 2018: Topological Data Analysis, pp.371-389 (18 pages), [Link](#) 2020
2. Elder-rule-staircodes for augmented metric spaces (with C. Cai, F. Mémoli, Y. Wang)
Proceedings of the 36th Int. Symp. on Computational Geometry (SoCG) (17 pages), [Link](#) 2020
1. Formigrams: Clustering Summaries of Dynamic Data (with F. Mémoli)
Proceedings of the 30th Canadian Conf. on Computational Geometry (CCCG) (9 pages) [Link](#) 2018

Expository Articles (peer-reviewed)

2. 데이터의 모양을 담는 바코드
KIAS Webzine, Horizon, [Link](#) 2024
1. Persistence over posets (with F. Mémoli)
Notices of the American Mathematical Society 70 (8), pp.1214-1225 (11 pages), [Link](#) 2023

Extended Abstracts

Stable signatures for dynamic metric spaces via persistent homology (with F. Mémoli) in *Statistics for Data with Geometric Structure. Oberwolfach Report*, 3, pp.169-172. [Link](#) 2018

Computational software / Expository webpages

(* Graduate students, ** Undergraduate students)

4. Spatiotemporal persistent homology (with N. Clause*) Software ([Github](#)) 2020
3. Elder-rule-staircodes (with C. Cai*, F. Memoli, Y. Wang) Software ([Github](#)) 2020
2. Classification of collective behaviors via zigzag persistent homology (with Z. Smith** and F. Mémoli)2019
[Expository webpage](#)
1. Formigramator (with D. Verano**): Software (a web-based GUI) 2019

Grants and Awards

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| Excellent Teaching Award 우수강의상, College of Natural Sciences, KAIST | July 2025 |
| Outstanding Young Scientist Grant 우수신진연구, National Research Foundation of Korea | 2025-2028 |

Academic Service

Program Committee for the 42nd International Symposium on Computational Geometry (SoCG 2026)

Speaker Selection Committee, Applied Algebraic Topology Research Network (AATRN) July 2025- July 2027

Scientific Committee, Algebraic Topology: Methods, Computation, & Science (ATMCS11) 2025

Co-organizer of Asia Pacific Seminar on Applied Topology and Geometry December 2024-
(with Emerson G. Escolar, Yasu Hiraoka, Vanessa Robins, Kelin Xia, D Yogeshwaran)

Event Organization

Co-organizer of Special Session on *Applications of Topology and Geometry in Data Analysis* in KMS Annual Meeting 2026 (with S. Lim) October 2026

Organizer of 2026 Mini ToGeDA workshop at KAIST January 2026

Co-organizer of Special Session on *Applications of Topology and Geometry in Data Analysis* in KMS Annual Meeting 2025 (with S. Lim) October 2025

Co-organizer of Special Session on *Applications of Topology and Geometry in Data Analysis* in KMS Annual Meeting 2024 (with S. Lim) October 2024

Co-organizer of AMS Special Session on *Applied Topology: Theory, Algorithms, and Applications* in Joint Mathematics Meetings 2024 (with J. Bush, A. McCleary, S. Percival, I. Yoon) January 2024

Co-organizer of Workshop on Algebraic Combinatorics and Category Theory in Topological Data Analysis (Co-organizers: A. McCleary, A. Patel, F. Mémoli) March 2022

Chair of the organizing committee: The 1st Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning
(Co-organizers: S. Chowdhury, S. Lim, L. Polanco, K. Singhal, Z. Wan, L. Zhou) June 2019

Referee

Journals and proceedings

Several journals are intentionally omitted from the public CV to ensure anonymity.

Algebras and Representation Theory
Computational Geometry: Theory and Applications
Discrete & Computational Geometry
Foundations of Data Science
International Mathematics Research Notices (IMRN)
Journal of Applied and Computational Topology
Journal of Approximation Theory
Journal of the Korean Society for Industrial and Applied Mathematics
International Symposium on Computational Geometry (SoCG) in '19, '20, '21, '22, '23, '24, '25, '26
Annual ACM-SIAM Symposium on Discrete Algorithms (SODA) in '23
Research in Computational Topology (Springer)
SIAM Journal of Applied Algebra and Geometry

Research Proposals

A research proposal from a European country

Selected Talks

(■: invited, □: contributed, *: upcoming)

- * 2027 GRAPE (Geometric Representation theory in multiparameter Persistence) Research School at CIRM, France June 2027
- * 2027 CIMPA School on Topological Data Analysis, Lahore, Pakistan February 2027
- * Topological and Geometric Data Analysis with Industrial Applications, Fukuoka, Japan January 2027
- * TDA Week 2026 at Tohoku University, Japan November 2026
- * Korean Mathematical Society Annual Meeting at GIST, South Korea October 2026
- AIMS 2026 - Special Session on Topological Data Analysis, Athens, Greece July 2026
- Workshop on Topological Combinatorics at GIST, South Korea June 2026
- Topological Data Analysis and Representation Theory 2026 at Tohoku University, Japan February 2026
- ATMCS 12: Algebraic Topology: Methods, Computation, & Science in Leipzig, Germany January 2026
- Seminar, Department of Mathematical Sciences at Seoul National University, South Korea January 2026
- Bridging Algebraic Combinatorics, Topology, and Applications at Rutgers University, USA August 2025
- SoCG 2025: The 41th International Symposium on Computational Geometry in Kanazawa, Japan June 2025
- TDA Week 2025 at Kyoto University, Japan June 2025
- Applied Geometry and Topology for Data Sciences at SIMIS, Shanghai, China February 2025
- Workshop on TDA and Representation Theory at Kobe University, Japan February 2025
- Asia Pacific Seminar on Applied Topology and Geometry, online December 2024
- KSIAM Annual Meeting, Busan, South Korea December 2024
- The 4th SNU International Conference on Mathematics Education, South Korea November 2024
- Korean Mathematical Society Annual Meeting, South Korea October 2024
- Combinatorics and Topology Week at GIST, South Korea July 2024
- Seminar at National Institute for Mathematical Sciences (NIMS), South Korea May 2024
- Colloquium at Sungkyunkwan University, South Korea May 2024
- Colloquium at KAIST, South Korea April 2024
- The Banff International Research Station, Canada April 2024
- Workshop on Representation Theory and Topological Data Analysis
- Schloss Dagstuhl, Germany February 2024
- Workshop on Applied and Combinatorial Topology
- Workshop on TDA & ML at MINDS in POSTECH, South Korea January 2024
- Joint Mathematics Meetings 2024 in San Francisco January 2024
- Special Session on Persistence Diagrams and Beyond
- Seminar at MINDS in POSTECH, South Korea December 2023
- Korean Statistical Society Winter Meeting 2023 December 2023
- Special Session on Topological Data Analysis
- TDA Week 2023 at Kyoto University, Japan July 2023
- SoCG 2023: The 39th International Symposium on Computational Geometry in Dallas June 2023
- Workshop on Möbius inversions and Reeb Spaces
- Topological Data Analysis seminar at the University of Utah (virtual) April 2023
- AMS Southeastern Spring Sectional Meeting (Topological Persistence) at Georgia Tech March 2023
- Workshop on Computational Topology & Quantum Computing at AIMS (virtual) February 2023
- The Joint Mathematics Meetings 2023 (Applied Topology: Theory and Implementation) January 2023
- Applied Topology seminar at University at Albany, SUNY December 2022
- Algebra/Topology seminar at University at Albany, SUNY December 2022
- Colloquium at KAIST (virtual) November 2022
- Computational Persistence Workshop at Purdue University (virtual) November 2022
- International Conference on Advances in Interdisciplinary Statistics and Combinatorics October 2022
- ATMCS 10: Algebraic Topology: Methods, Computation, & Science at University of Oxford June 2022

- SoCG 2022: The 38th International Symposium on Computational Geometry in Berlin June 2022
Title: *Computing generalized rank invariant for 2-parameter persistence modules via zigzag persistence*
- The CMS Summer Meeting at Memorial University in St. Johns, Canada June 2022
- Geometry-Topology seminar at Oregon State (virtual) April 2022
- Workshop on Algebraic Combinatorics and Category Theory in Topological Data Analysis (virtual)
- AMS Southeastern Spring Sectional Meeting, U of Virginia (canceled due to pandemic) March 2022
- AMS Southeastern Fall Sectional Meeting, U of Alabama (virtual) November 2021
- Topology and Data seminar, U of Oklahoma (virtual) November 2021
- Metrics in Multiparameter Persistence at Lorentz Center in Netherland (virtual) July 2021
- Topological Insight in Neuroscience at MSRI, Berkeley (virtual) May 2021
- Topological Data Analysis at IMSI, Chicago (virtual) April 2021
- Topological Data Analysis seminar at Purdue University (virtual) March 2021
- DynamIC seminar at Imperial College London (virtual) March 2021
- Second Symposium on Machine Learning and Dynamical Systems, Fields Institute (virtual). Sept. 2020
- The Grad-Faculty seminar at Duke Univ (virtual). September 2020
- SoCG 2020: The 36th International Symposium on Computational Geometry (virtual) June 2020
Title: *Elder-rule-staircodes for augmented metric spaces*
- ATMCS 9: Algebraic Topology: Methods, Computation, and Science (hosted by AATRN) June 2020
- The University of Florida Topological Data Analysis workshop January 2020
- The Joint Mathematics Meetings 2020 in Denver, CO (Special Session on Applied Topology) Jan. 2020

Graduate Students and Postdocs

KAIST

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| Sungchae Kim 김성채
Yonghee Lee 이용희
Junwon You 유준원
Dongheon Kim 김동헌
Hyeongseop Jeong 정형섭
Donghan Kim 김동한
– We coauthored Item 15 in Publications
Jeonghwi Joe 조경휘 (co-advised by Prof. Cheolwoo Park)
– We coauthored Item 16 in Publications
Seunghyun Kim 김승현
– We coauthored Item 14 in Publications | M.S. Program, Fall 2026–
Integrated M.S.–Ph.D. Program, Fall 2026–
Postdoc, March 2026–
Integrated M.S.–Ph.D. Program, Fall 2025–
Integrated M.S.–Ph.D. Program, Fall 2025–
Integrated M.S.–Ph.D. Program, Fall 2025–

M.S., 2025–2026

M.S., 2024–2025 |
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Teaching

KAIST

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| Combinatorial Topology (MAS 430)
Algebraic Topology 2 (MAS 532)
Algebraic Topology 1 (MAS 531)
Introduction to Linear Algebra (MAS 109)
Topology (MAS 331)
Topics in Mathematics (Introduction to Topological Data Analysis) (MAS 480)
Introduction to Contemporary Mathematics (MAS 491) —Two guest lectures | Fall 2026
Fall 2025
Spring 2025, Spring 2026
Fall 2024(course coordinator), Spring 2026
Spring 2024
Fall 2023
Fall 2023, Fall 2025 |
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Duke University

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| Probability (Math/Stat 230)
Combinatorics (Math 371) | Spring 2022-2023, Fall 2022
Fall 2021 |
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Linear Algebra and Differential Equations (Math 216D), 3 sections, Discussion Session TA Spring 2021
 Multivariable Calculus (Math 212D), 3 sections, Discussion Session TA Fall 2020

The Ohio State University

Introduction to Applied Algebraic Topology, Lecturer for 2 weeks Spring 2019
A substitute for the original lecturer Tom Needham
 Calculus for Engineers A (Math 1172), 2 sections, Discussion Session TA Fall 2016
 Calculus 2 (Math 1152), 2 sections, Discussion Session TA Spring 2016
 Calculus 3 and Topics for Engineers, Tutor Fall 2014, Spring 2015, Fall 2015
Tutored 4 hours per week at Math and Stat Learning Center at OSU

Outreach and service

Several items are intentionally omitted from the public CV to ensure anonymity.

Special Talk: Workshop for Young Mathematicians in Korea (WYMK 2026) August, 2026
 Special Talk: KAIST Undergraduate Math Colloquium October, 2025
 Special Lecture: The Four Seasons of Mathematics, Korea Science Academy of KAIST 수학 4계, 한국과학영재 학교 October 2025
 KAI-X Summer School in Mathematics, KAIST July 2024
 Science Culture Committee 과학문화위원회, College of Natural Sciences, KAIST 2023-2027