ELIZABETH MUNCH

517-432-0619 ⋄ muncheli@msu.edu

Dept of Computational Mathematics, Science, and Engineering ⋄ Dept of Mathematics

Michigan State University ⋄ East Lansing, MI

EDUCATION

Duke University, *Durham, NC*
Ph.D. Dept. of Mathematics — May 2013
· Thesis: Applications of Persistent Homology to Time Varying Systems
M.A. Dept. of Mathematics — Dec 2010

University of Rochester, *Rochester, NY*
B.S. Mathematics, Summa Cum Laude, School of Arts and Sciences — May 2008
B.M. Harp Performance with High Distinction, Eastman School of Music — May 2008

RESEARCH EXPERIENCE

Michigan State University, *East Lansing, MI*
Dept. of Computational Mathematics, Science and Engineering (CMSE)
Dept. of Mathematics
Associate Professor — July 2022 – Present
Assistant Professor — Aug 2017 – July 2022

University at Albany – SUNY, *Albany, NY*
Dept. of Mathematics & Statistics
Assistant Professor — Sept 2014 – July 2017
Dept. of Computer Science
Affiliated Faculty — July 2015 – July 2017

University of Minnesota, *Minneapolis, MN*
Institute for Mathematics and Its Applications
Postdoctoral Fellow — Sept 2013 – Aug 2014

Duke University, *Durham, NC*
Dept. of Mathematics
Visiting Assistant Professor — June 2013 – Aug 2013
Graduate Research Assistant — Sept 2008 – May 2013

AWARDS AND HONORS

Withrow Teaching Excellence Award, College of Engineering, Michigan State University, 2023
NSF CAREER Award, 2022
Jo Rae Wright Fellowship for Outstanding Women in Science, Duke University, 2012-2013
Phi Beta Kappa, University of Rochester, May 2008
Performer's Certificate in Harp, May 2008
Lois S. Rogers Scholarship, Eastman School of Music, 2004-2008
Performer's Certificate, Eastman School of Music, 2008
Presser Scholarship, Eastman School of Music, 2007

PUBLICATIONS

Due to working in an interdisciplinary setting, my work follows many different conventions for authorship. Theoretical mathematics and theoretical computer science tend to be published alphabetically. Applied mathematics and other domain settings tend to be published in descending order of contribution, with graduate students and postdocs listed first; followed by PIs.

Preprints

[1] Erin Wolf Chambers, Ishika Ghosh, Elizabeth Munch, Sarah Percival, and Bei Wang. "Towards an Optimal Bound for the Interleaving Distance on Mapper Graphs". In: (Apr. 2025). DOI: 10.48550/ARXIV.2504.03865. arXiv: 2504.03865 [cs.CG].

[2] Elizabeth Munch, Elena Xinyi Wang, and Carola Wenk. "The Kinetic Hourglass Data Structure for Computing the Bottleneck Distance of Dynamic Data". In: (May 2025). DOI: 10.48550/ARXIV.2505.04048. arXiv: 2505.04048 [cs.DS].

[3] Erin Wolf Chambers, Elizabeth Munch, Sarah Percival, and Xinyi Wang. "A Distance for Geometric Graphs via the Labeled Merge Tree Interleaving Distance". In: (July 2024). DOI: 10.48550/ARXIV.2407.09442. arXiv: 2407.09442 [cs.DS].

[4] Dhananjay Bhaskar, Yanlei Zhang, Jessica Moore, Feng Gao, Bastian Rieck, Guy Wolf, Firas Khasawneh, Elizabeth Munch, J. Adam Noah, Helen Pushkarskaya, Christopher Pittenger, Valentina Greco, and Smita Krishnaswamy. "Neurospectrum: A Geometric and Topological Deep Learning Framework for Uncovering Spatiotemporal Signatures in Neural Activity". In: (2023). DOI: 10.1101/2023.03.22.533807. bioRxiv: 10.1101/2023.03.22.533807.

[5] Ty Easley, Kevin Freese, Elizabeth Munch, and Janine Bijsterbosch. "Using persistent homology to understand dimensionality reduction in resting-state fMRI". In: (June 2023). DOI: 10.48550/ARXIV.2306.13802. arXiv: 2306.13802 [cs.CG].

[6] Sarah McGuire, Elizabeth Munch, and Matthew Hirn. "NervePool: A Simplicial Pooling Layer". In: (2023). DOI: 10.48550/ARXIV.2305.06315. arXiv: 2305.06315 [cs.CG].

[7] Brian Bollen, Erin Wolf Chambers, Joshua Levine, and Elizabeth Munch. "Reeb Graph Metrics from the Ground Up". In: (2021). arXiv: 2110.05631 [cs.CG].

Journal Articles
Whenever possible, I post preprints of my papers to the arXiv. Where available, I include links to both the published versions (via DOI or URL), as well as to the arXiv posting.

[8] Erin W. Chambers, Elizabeth Munch, Sarah Percival, and Bei Wang. "Bounding the Interleaving Distance for Mapper Graphs with a Loss Function". In: *To appear: Journal of Applied and Computational Topology* (July 2025). DOI: 10.48550/ARXIV.2307.15130. arXiv: 2307.15130 [cs.CG].

[9] Elizabeth Munch. "An Invitation to the Euler Characteristic Transform". In: *The American Mathematical Monthly* 132.1 (2025), pp. 15–25. DOI: 10.1080/00029890.2024.2409616. arXiv: 2310.10395 [cs.CG].

[10] Rehab Alharbi, Erin Wolf Chambers, and Elizabeth Munch. "Realizable Piecewise Linear Paths of Persistence Diagrams with Reeb Graphs". en. In: *Computing in Geometry and Topology* (2024). DOI: 10.57717/CGT.V3I1.38. arXiv: 2107.04654 [cs.CG].

[11] Erik J. Amézquita, Michelle Y. Quigley, Patrick J. Brown, Elizabeth Munch, and Daniel H. Chitwood. "Allometry and volumes in a nutshell: Analyzing walnut morphology using three-dimensional X-ray computed tomography". In: *The Plant Phenome Journal* 7.1 (2024), e20095. DOI: 10.1002/ppj2.20095. bioRxiv: 10.1101/2023.09.26.559651.

[12] Ellen Gasparovic, Elizabeth Munch, Steve Oudot, Katharine Turner, Bei Wang, and Yusu Wang. "Intrinsic Interleaving Distance for Merge Trees". In: *La Matematica* (Dec. 2024). ISSN: 2730-9657. DOI: 10.1007/s44007-024-00143-9. arXiv: 1908.00063 [cs.CG].

[13] Sourabh Palande, Jeremy Arsenault, Patricia Basurto-Lozada, Andrew Bleich, Brianna N. I. Brown, Sophia F. Buysse, Noelle A. Connors, Sikta Das Adhikari, Kara C. Dobson, Francisco Xavier Guerra-Castillo, Maria F. Guerrero-Carrillo, Sophia Harlow, Héctor Herrera-Orozco, Asia T. Hightower,

Paulo Izquierdo, MacKenzie Jacobs, Nicholas A. Johnson, Wendy Leuenberger, Alessandro Lopez-Hernandez, Alicia Luckie-Duque, Camila Martínez-Avila, Eddy J. Mendoza-Galindo, David Cruz Plancarte, Jenny M. Schuster, Harry Shomer, Sidney C. Sitar, Anne K. Steensma, Joanne Elise Thomson, Damián Villaseñor-Amador, Robin Waterman, Brandon M. Webster, Madison Whyte, Sofía Zorilla-Azcué, Beronda L. Montgomery, Aman Y. Husbands, Arjun Krishnan, Sarah Percival, Elizabeth Munch, Robert VanBuren, Daniel H. Chitwood, and Alejandra Rougon-Cardoso. "Expression-based machine learning models for predicting plant tissue identity". In: *Applications in Plant Sciences* (2024). ISSN: 2168-0450. DOI: 10.1002/aps3.11621. bioRxiv: 10.1101/2023.08.20.554029.

[14] Sunia Tanweer, Firas A. Khasawneh, and Elizabeth Munch. "Robust crossings detection in noisy signals using topological signal processing". In: *Foundations of Data Science* (2024). ISSN: 2639-8001. DOI: 10.3934/fods.2024006. arXiv: 2301.07703 [cs.CG].

[15] Sunia Tanweer, Firas A. Khasawneh, Elizabeth Munch, and Joshua R. Tempelman. "A topological framework for identifying phenomenological bifurcations in stochastic dynamical systems". In: *Nonlinear Dynamics* (Feb. 2024). ISSN: 1573-269X. DOI: 10.1007/s11071-024-09289-1. arXiv: 2305.03118 [math.DS].

[16] Levent Batakci, Abigail Branson, Bryan Castillo, Candace Todd, Erin Wolf Chambers, and Elizabeth Munch. "Comparing Embedded Graphs Using Average Branching Distance". In: *Involve, a Journal of Mathematics* 16.3 (Aug. 2023), pp. 365–388. DOI: 10.2140/involve.2023.16.365. arXiv: 2210.10181 [cs.CG].

[17] Maike Buchin, Erin Chambers, Pan Fang, Brittany Terese Fasy, Ellen Gasparovic, Elizabeth Munch, and Carola Wenk. "Distances Between Immersed Graphs: Metric Properties". In: *La Mathematica* (2023). DOI: 10.1007/s44007-022-00037-8.

[18] Audun Myers, Firas A. Khasawneh, and Elizabeth Munch. "Persistence of Weighted Ordinal Partition Networks for Dynamic State Detection". In: *SIAM Journal on Applied Dynamical Systems* 22.1 (2023), pp. 65–89. DOI: 10.1137/22m1476848. arXiv: 2205.08349 [stat.ML,].

[19] Audun Myers, David Muñoz, Firas A. Khasawneh, and Elizabeth Munch. "Temporal Network Analysis Using Zigzag Persistence". In: *EPJ Data Science* 12.6 (2023). DOI: 10.1140/epjds/s13688-023-00379-5. arXiv: 2205.11338 [cs.CG].

[20] Audun D. Myers, Max M. Chumley, Firas A. Khasawneh, and Elizabeth Munch. "Persistent homology of coarse-grained state-space networks". In: *Phys. Rev. E* 107 (3 2023), p. 034303. DOI: 10.1103/PhysRevE.107.034303. arXiv: 2206.02530 [stat.ML].

[21] Sourabh Palande, Joshua A. M. Kaste, Miles D. Roberts, Kenia Segura Abá, Carly Claucherty, Jamell Dacon, Rei Doko, Thilani B. Jayakody, Hannah R. Jeffery, Nathan Kelly, Andriana Manousidaki, Hannah M. Parks, Emily M. Roggenkamp, Ally M. Schumacher, Jiaxin Yang, Sarah Percival, Jeremy Pardo, Aman Y. Husbands, Arjun Krishnan, Beronda L Montgomery, Elizabeth Munch, Addie M. Thompson, Alejandra Rougon-Cardoso, Daniel H. Chitwood, and Robert VanBuren. "Topological data analysis reveals a core gene expression backbone that defines form and function across flowering plants". In: *PLOS Biology* 21.12 (Dec. 2023). Ed. by Hajk-Georg Drost, e3002397. ISSN: 1545-7885. DOI: 10.1371/journal.pbio.3002397. bioRxiv: 10.1101/2022.09.07.506951.

[22] Erik J. Amézquita, Michelle Y. Quigley, Tim Ophelders, Danelle Seymour, Elizabeth Munch, and Daniel H. Chitwood. "The shape of aroma: Measuring and modeling citrus oil gland distribution". In: *Plants, People, Planet* (2022). DOI: 10.1002/ppp3.10333. bioRxiv: 10.1101/2022.04.14.488418.

[23] İsmail Güzel, Elizabeth Munch, and Firas A. Khasawneh. "Detecting bifurcations in dynamical systems with CROCKER plots". In: *CHAOS* 32.093111 (2022). Full version of [47]. Chosen as featured article in Chaos. DOI: 10.1063/5.0102421. arXiv: 2206.04861 [math.DS].

[24] Jose A. Perea, Elizabeth Munch, and Firas A. Khasawneh. "Approximating Continuous Functions on Persistence Diagrams Using Template Functions". In: *Foundations of Computational Mathematics* (2022). DOI: 10.1007/s10208-022-09567-7. arXiv: 1902.07190 [cs.CG, math.AT, math.ST, stat.ML, stat.TH].

[25] Erik J Amézquita, Michelle Y Quigley, Tim Ophelders, Jacob B. Landis, Daniel Koenig, Elizabeth Munch, and Daniel H Chitwood. "Measuring hidden phenotype: Quantifying the shape of bar-

ley seeds using the Euler Characteristic Transform". In: *in silico Plants* (2021). DOI: `10.1093/insilicoplants/diab033`. bioRxiv: `10.1101/2021.03.27.437348`.

[26] Adam Brown, Omer Bobrowski, Elizabeth Munch, and Bei Wang. "Probabilistic convergence and stability of random mapper graphs". In: *Journal of Applied and Computational Topology* (2021). DOI: `10.1007/s41468-020-00063-x`. arXiv: `1909.03488v1`.

[27] Erik J. Amézquita, Michelle Y. Quigley, Tim Ophelders, Elizabeth Munch, and Daniel H. Chitwood. "The shape of things to come: Topological data analysis and biology, from molecules to organisms". In: *Developmental Dynamics* (2020). Featured cover article. DOI: `10.1002/dvdy.175`.

[28] Zixuan Cang, Elizabeth Munch, and Guo-Wei Wei. "Evolutionary homology on coupled dynamical systems with applications to protein flexibility analysis". In: *Journal of Applied and Computational Topology* (2020). DOI: `10.1007/s41468-020-00057-9`. arXiv: `1802.04677`.

[29] Sarah Tymochko, Elizabeth Munch, Jason Dunion, Kristen Corbosiero, and Ryan Torn. "Using Persistent Homology to Quantify a Diurnal Cycle in Hurricane Felix". In: *Pattern Recognition Letters* 133 (2020), pp. 137–143. ISSN: 0167-8655. DOI: `10.1016/j.patrec.2020.02.022`. arXiv: `1902.06202`.

[30] Sarah Tymochko, Elizabeth Munch, and Firas A. Khasawneh. "Using Zigzag Persistent Homology to Detect Hopf Bifurcations in Dynamical Systems". In: *Algorithms* 13.11 (2020), p. 278. DOI: `10.3390/a13110278`. arXiv: `2009.08972`.

[31] Mitchell Eithun, Daniel H. Chitwood, James Larson, Gregory Lang, and Elizabeth Munch. "Isolating phyllotactic patterns embedded in the secondary growth of sweet cherry (Prunus avium L.) using magnetic resonance imaging". In: *Plant Methods* 15.1 (2019). DOI: `10.1186/s13007-019-0496-7`. arXiv: `1812.03321`.

[32] Audun Myers, Elizabeth Munch, and Firas A. Khasawneh. "Persistent Homology of Complex Networks for Dynamic State Detection". In: *Physical Review E* 100.2 (2019), p. 022314. DOI: `10.1103/PhysRevE.100.022314`. arXiv: `1904.07403`.

[33] Vin de Silva, Elizabeth Munch, and Anastasios Stefanou. "Theory of interleavings on categories with a flow". In: *Theory and Applications of Categories* 33.21 (2018), pp. 583–607. arXiv: `1706.04095`.

[34] Firas A. Khasawneh and Elizabeth Munch. "Topological data analysis for true step detection in periodic piecewise constant signals". In: *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Science* 474.2218 (2018), p. 20180027. DOI: `10.1098/rspa.2018.0027`. arXiv: `1805.06403`.

[35] Elizabeth Munch. "A User's Guide to Topological Data Analysis". In: *Journal of Learning Analytics* 4.2 (2017). DOI: `10.18608/jla.2017.42.6`.

[36] Paul Bendich, Sang Peter Chin, Jesse Clark, Jonathan Desena, John Harer, Elizabeth Munch, Andrew Newman, David Porter, David Rouse, Nate Strawn, and Adam Watkins. "Topological and statistical behavior classifiers for tracking applications". In: *IEEE Transactions on Aerospace and Electronic Systems* 52.6 (2016), pp. 2644–2661. DOI: `10.1109/taes.2016.160405`. arXiv: `1406.0214`.

[37] Vin de Silva, Elizabeth Munch, and Amit Patel. "Categorified Reeb Graphs". In: *Discrete & Computational Geometry* (2016), pp. 1–53. ISSN: 1432-0444. DOI: `10.1007/s00454-016-9763-9`. arXiv: `1501.04147`.

[38] Firas A. Khasawneh and Elizabeth Munch. "Chatter detection in turning using persistent homology". In: *Mechanical Systems and Signal Processing* 70-71 (2016), pp. 527–541. ISSN: 0888-3270. DOI: `10.1016/j.ymssp.2015.09.046`.

[39] Elizabeth Munch, Katharine Turner, Paul Bendich, Sayan Mukherjee, Jonathan Mattingly, and John Harer. "Probabilistic Fréchet means for time varying persistence diagrams". In: *Electron. J. Statist.* 9 (2015), pp. 1173–1204. DOI: `10.1214/15-EJS1030`. arXiv: `1307.6530`.

[40] Elizabeth Munch, Michael Shapiro, and John Harer. "Failure filtrations for fenced sensor networks". In: *The International Journal of Robotics Research* 31.9 (2012), pp. 1044–1056. DOI: `10.1177/0278364912451671`. arXiv: `1109.6535`.

[41] Elizabeth Munch and C. Douglas Haessig. "Counting prime paths in fractals built from triangles". In: *Journal for Undergraduate Research, University of Rochester* (2008).

Computer Science Conference Proceedings

My work is interdisciplinary and often crosses between mathematics and theoretical computer science. In CS, both journals and selective proceedings are highly regarded venues for publications. The proceedings have the advantage of high visibility and a shortened time to press. These venues are peer-reviewed by a general minimum of between 3 and 5 evaluators and can be highly competitive. Acceptance rates are provided when known. Most notable conferences in my work are the Symposium on Computational Geometry (SoCG)*, which is the top conference in Applied Topology and Geometry [42, 44, 45]; and IEEE Scientific Visualization (SciVis) published in the journal TVCG, which is the top conference in visualization [43].*

[42] Erin Wolf Chambers, Elizabeth Munch, and Tim Ophelders. "A Family of Metrics from the Truncated Smoothing of Reeb Graphs". In: *37th International Symposium on Computational Geometry (SoCG 2021)*. Ed. by Kevin Buchin and Éric Colin de Verdière. Vol. 189. Leibniz International Proceedings in Informatics (LIPIcs). Main session acceptance rate: 35%. Dagstuhl, Germany: Schloss Dagstuhl – Leibniz-Zentrum für Informatik, 2021, 22:1–22:17. ISBN: 978-3-95977-184-9. DOI: `10.4230/LIPIcs.SoCG.2021.22`. arXiv: `2007.07795 [cs.CG]`.

[43] Lin Yan, Yusu Wang, Elizabeth Munch, Ellen Gasparovic, and Bei Wang. "A Structural Average of Labeled Merge Trees for Uncertainty Visualization". In: *IEEE Transactions on Visualization and Computer Graphics* (2019). Main session acceptance rate: 26%, pp. 1–1. DOI: `10.1109/tvcg.2019.2934242`. arXiv: `1908.00113`.

[44] Elizabeth Munch and Bei Wang. "Convergence between Categorical Representations of Reeb Space and Mapper". In: *32nd International Symposium on Computational Geometry (SoCG 2016)*. Ed. by Sándor Fekete and Anna Lubiw. Vol. 51. Leibniz International Proceedings in Informatics (LIPIcs). Main session acceptance rate: 38%. Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik, 2016, 53:1–53:16. ISBN: 978-3-95977-009-5. DOI: `10.4230/LIPIcs.SoCG.2016.53`. arXiv: `1512.04108`.

[45] Ulrich Bauer, Elizabeth Munch, and Yusu Wang. "Strong Equivalence of the Interleaving and Functional Distortion Metrics for Reeb Graphs". In: *31st International Symposium on Computational Geometry (SoCG 2015)*. Ed. by Lars Arge and János Pach. Vol. 34. Leibniz International Proceedings in Informatics (LIPIcs). Main session acceptance rate: 38%. Dagstuhl, Germany: Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik, 2015, pp. 461–475. DOI: `10.4230/LIPIcs.SOCG.2015.461`. arXiv: `1412.6646`.

Other Conference Proceedings

This section includes conference papers either from non-computer science conferences, or from papers submitted to workshops where the paper is not part of the main session.

[46] Erin Chambers, Elizabeth Munch, and Tim Ophelders. "A quality measure for Reeb graph drawings". In: *EuroCG*. 2022.

[47] İsmail Güzel, Elizabeth Munch, and Firas Khasawneh. "A Case Study on Identifying Bifurcation and Chaos with CROCKER Plots". In: *Proceedings of TDA at SDM (SIAM Data Mining)*. Ed. by R. W. R. Darling, John A. Emanuello, Emilie Purvine, and Ahmad Ridley. Full version can be found in [23]. SIAM Data Mining. arXiv Proceedings, 2022. DOI: `10.48550/arXiv.2204.06321`. arXiv: `2204.06321 [math.DS]`.

[48] Mustafa Hajij, Elizabeth Munch, and Paul Rosen. "Fast and Scalable Complex Network Descriptor Using PageRank and Persistent Homology". In: *2020 International Conference on Intelligent Data Science Technologies and Applications (IDSTA)*. Feb. 12, 2020, pp. 110–114. DOI: `10.1109/IDSTA50958.2020.9264141`. arXiv: `2002.05158 [cs.CG]`.

[49] Audun D. Myers, Melih Yesilli, Sarah Tymochko, Firas Khasawneh, and Elizabeth Munch. "Teaspoon: A comprehensive python package for topological signal processing". In: *Topological Data Analysis and Beyond Workshop at NeurIPS 2020*. 2020.

[50] Daniel H. Chitwood, Mitchell Eithun, Elizabeth Munch, and Tim Ophelders. "Topological Mapper for 3D Volumetric Images". In: *ISMM 2019: Mathematical Morphology and Its Applications to Signal and Image Processing*. Ed. by Bernhard Burgeth, Andreas Kleefeld, Benoît Naegel, Nicolas Passat,

and Benjamin Perret. Springer International Publishing, 2019, pp. 84–95. DOI: `10.1007/978-3-030-20867-7_7`.

[51] Sarah Tymochko, Elizabeth Munch, and Firas A. Khasawneh. "Adaptive Partitioning for Template Functions on Persistence Diagrams". In: *2019 18th IEEE International Conference On Machine Learning And Applications (ICMLA)* (2019). Special session acceptance rate: 43%. DOI: `10.1109/ICMLA.2019.00202`. arXiv: `1910.08506`.

[52] Melih C. Yesilli, Sarah Tymochko, Firas A. Khasawneh, and Elizabeth Munch. "Chatter Diagnosis in Milling Using Supervised Learning and Topological Features Vector". In: *2019 18th IEEE International Conference On Machine Learning And Applications (ICMLA)* (2019). Special session acceptance rate: 43%. DOI: `10.1109/ICMLA.2019.00200`. arXiv: `1910.12359`.

[53] Firas A. Khasawneh, Elizabeth Munch, and Jose A. Perea. "Chatter Classification in Turning Using Machine Learning and Topological Data Analysis". In: *14th IFAC Workshop on Time Delay Systems TDS 2018: Budapest, Hungary, 28–30 June 2018*. Ed. by Tamas Insperger. Vol. 51. 14. 2018, pp. 195–200. DOI: `10.1016/j.ifacol.2018.07.222`. arXiv: `1804.02261`.

[54] David Rouse, Adam Watkins, David Porter, John Harer, Paul Bendich, Nate Strawn, Elizabeth Munch, Jonathan DeSena, Jesse Clarke, Jeffrey Gilbert, Peter Chin, and Andrew Newman. "Feature-aided multiple hypothesis tracking using topological and statistical behavior classifiers". In: *Proc. SPIE*. Vol. 9474. 2015, pp. 94740L–94740L–12. DOI: `10.1117/12.2179555`.

[55] Firas A. Khasawneh and Elizabeth Munch. "Exploring equilibria in stochastic delay differential equations using persistent homology". In: *Proceedings of the ASME 2014 International Design Engineering Technical Conferences & Computers and Information in Engineering Conference, August 17-20, 2014, Buffalo, NY, USA*. 2014. DOI: `10.1115/DETC2014-35655`.

[56] Firas A. Khasawneh and Elizabeth Munch. "Stability Determiniation in Turning using Persistent Homology and Time Series Analysis". In: *Proceedings of the ASME 2014 International Mechanical Engineering Congress & Exposition, Montreal, Canada*. 2014. DOI: `10.1115/IMECE2014-40221`.

Book Chapters

[57] Prithwish Basu, Imdat As, and Elizabeth Munch. "Generating new architectural designs using topological AI". In: *The Routledge Companion to Artificial Intelligence in Architecture*. Taylor Francis, 2021.

[58] Elizabeth Munch and Anastasios Stefanou. "The ℓ^∞-Cophenetic Metric for Phylogenetic Trees As an Interleaving Distance". In: *Research in Data Science*. Association for Women in Mathematics Series. Springer International Publishing, 2019, pp. 109–127. DOI: `10.1007/978-3-030-11566-1_5`. arXiv: `1803.07609`.

[59] Firas A. Khasawneh and Elizabeth Munch. "Utilizing Topological Data Analysis for Studying Signals of Time-Delay Systems". In: *Time Delay Systems: Theory, Numerics, Applications, and Experiments*. Ed. by Tamás Insperger, Tulga Ersal, and Gábor Orosz. Cham: Springer International Publishing, 2017, pp. 93–106. DOI: `10.1007/978-3-319-53426-8_7`.

Packaged Python Code

[60] Firas A. Khasawneh, Elizabeth Munch, Danielle Barnes, Max M. Chumley, İsmail Güzel, Audun D. Myers, Sunia Tanweer, Sarah Tymochko, and Melih Yesilli. "Teaspoon: A Python Package for Topological Signal Processing". In: *Journal of Open Source Software* 10.107 (Mar. 2025), p. 7243. ISSN: 2475-9066. DOI: `10.21105/joss.07243`.

[61] Firas Khasawneh, Elizabeth Munch, Sarah Tymochko, Audun Myers, Danielle Barnes, Melih C. Yesilli, Max Chumley, and Sunia Tanweer. *teaspoon: A Topological Signal Processing Python Package*. teaspoonda.github.io/teaspoon/. 2024.

[62] Elizabeth Munch, Danielle Barnes, Xinyi Wang, and Ishika Ghosh. *ceREEBerus: Reeb Graph Computations in Python*. munchlab.github.io/ceREEBerus/. 2024.

[63] Elizabeth Munch, Sarah McGuire, Elena Wang, and Nathan Willey. *ect: Euler Characteristic Transform in python*. munchlab.github.io/ect/. 2024.

Published Datasets

[64]   Erik Amezquita, Michelle Quigley, Patrick Brown, Elizabeth Munch, and Daniel Chitwood. *The shape of kernels and cracks, in a nutshell.* en. 2023. DOI: `10.5061/DRYAD.NGF1VHJ09`.

[65]   Erik Amezquita, Michelle Quigley, Tim Ophelders, Danelle Seymour, Elizabeth Munch, and Daniel Chitwood. *The shape of aroma: X-ray CT scans of citrus fruits, their separate tissues, and their individual oil glands.* en. 2022. DOI: `10.5061/DRYAD.34TMPG4N6`.

[66]   Erik Amézquita, Michelle Quigley, Tim Ophelders, Jacob Landis, Daniel Koenig, Elizabeth Munch, and Daniel Chitwood. *X-Ray CT scans of barley panicles and their individual seeds from the Composite Cross II experiment.* en. 2021. DOI: `10.5061/DRYAD.RXWDBRV93`.

[67]   Daniel H. Chitwood, Mitchell Eithun, Daniel Koenig, Jacob Landis, Elizabeth Munch, and Tim Ophelders. "CT Scan of Barley (Hordeum vulgare L.)" In: (Mar. 2019). DOI: `10.6084/m9.figshare.7590833`.

[68]   Mitchell Eithun, James Larson, Daniel H. Chitwood, Gregory Lang, and Elizabeth Munch. "MRI Scan of Sweet Cherry (Prunus avium L.)" In: (Dec. 2018). DOI: `10.6084/m9.figshare.7409843.v1`.

arXiv Purgatory

This section includes papers which were submitted to arXiv, but for a variety of reasons, I am not actively trying to get published in a more standard venue.

[69]   Magnus Bakke Botnan, Justin Curry, and Elizabeth Munch. "A Relative Theory of Interleavings". In: (Apr. 29, 2020). arXiv: `2004.14286 [math.CT]`.

[70]   Kayla Makela, Tim Ophelders, Michelle Quigley, Elizabeth Munch, Daniel Chitwood, and Asia Dowtin. "Automatic Tree Ring Detection using Jacobi Sets". In: (Oct. 17, 2020). arXiv: `2010.08691 [cs.CV]`.

[71]   Jesse J. Berwald, Joel M. Gottlieb, and Elizabeth Munch. "Computing Wasserstein Distance for Persistence Diagrams on a Quantum Computer". In: (Sept. 17, 2018). arXiv: `1809.06433 [cs.CG, cs.ET, quant-ph]`.

Other Published Work

[72]   Elizabeth Munch. "Pathways to a Career Outside of the Academic Silo". In: *AMS Notices* 69.7 (2022). DOI: `10.1090/noti2519`.

[73]   Vin de Silva, Elizabeth Munch, and Anastasios Stefanou. "A Hom-Tree Lower Bound for the Reeb Graph Interleaving Distance". In: *Extended Abstract, Fall Workshop on Computational Geometry* (2015).

[74]   Elizabeth Munch and Bei Wang. "Reeb Space Approximations with Guarantees". In: *Extended Abstract, Fall Workshop on Computational Geometry* (2015).

[75]   Elizabeth Munch. "Applications of Persistent Homology to Time Varying Systems". PhD thesis. Duke University, 2013.

[76]   Elizabeth Munch, Ian Gilby, Susan Alberts, Anne Pusey, and John Harer. "Using Vineyards to Verify results of an Agent-Based Model of Primate Group Fission and Fusion". In: *YRF'12: Young Researchers Forum at CG Week.* Chapel Hill, NC, 2012.

GRANTS: FUNDED AND RECOMMENDED FOR FUNDING

CAREER: Reeb graph learning: Classification, Clustering, and Embedding of Graphical Signatures
- NSF CCF-2142713: $507,462
- May 2022 - May 2027
- Role: PI

Collaborative Research: AF: Medium: A Unified Framework for Geometric and Topological Signature-Based Shape Comparison
- NSF CCF-2106578: $409,945
- Jun 2021 - May 2025
- Role: Principal Investigator
- Collaborative with Erin Chambers, Computer Science, St. Louis University; Carola Wenk, Computer Science, Tulane University

Collaborative Research: RESEARCH-PGR: Predicting Phenotype from Molecular Profiles with Deep Learning: Topological Data Analysis to Address a Grand Challenge in the Plant Sciences
- NSF IOS-2310355: $639,998
- June 2023 - June 2027
- Role: co-PI
- Collaborative with

  - Dan Chitwood (PI MSU) Horticulture/CMSE, MSU
  - Robert VanBuren (coPI MSU) Horticulture, MSU
  - Aman Husbands (PI: IOS-2310356) Biology, University of Pennsylvania
  - Arjun Krishnan (PI: IOS-2310357) Biomedical Informatics, Center for Health AI, Univ. of Colorado Anschutz

Role of transport processes in formation of optimal microbial habitats and the root-microbe-soil carbon accrual continuum
- NSF DEB-1904267: $624,995
- Sept 2019 - Aug 2024
- Role: Co-PI
- Collaborative with
  - Alexandra Kravchenko (PI), Dept of Plant, Soil, and Microbial Sciences, MSU
  - Daniel Chitwood (Co-PI), Depts of Horticulture and CMSE, MSU
  - Lisa Tiemann (Co-PI), Dept of Plant, Soil, and Microbial Sciences, MSU
  - Andrey Guber (Co-PI), Dept of Plant, Soil, and Microbial Sciences, MSU

NRT-AI-HDR: Harnessing the data revolution (HDR) to enable predictive multi-scale modeling across STEM
- NSF DGE-2152014, $2,968,065
- Mar 2022 - Feb 2027
- Role: Co-PI
- Led by Keith Promislow (PI). Other co-PIs: Brian O'Shea, Mark Iwen, Huan Le. Former leadership: Daniel Appelö, Yingda Cheng, Matthew Hirn,.

GRANTS: COMPLETED PROJECTS

AF: Small: Collaborative Research: Reeb graph flows: Metrics, Drawings, and Analysis
- NSF CCF-1907591: $246,596
- Oct 2019 - Sept 2024
- Role: Principal Investigator

- Collaborative with Erin Chambers, (PI: CCF-1907612) Computer Science, St. Louis University

Zigzag Persistent Homology and Network Methods for Topological Signal Processing
- Air Force Office of Scientific Research, $375,000
- Oct 2021 - Sep 2024
- Role: Co-PI
- Collaborative with Firas Khasawneh (PI), Mechanical Engineering, MSU

Collaborative Research: A Unified Framework for the Investigation of Time Series Using Topological Data Analysis
- NSF CMMI-1562012/1800466: (UAlbany/MSU) $178,736 *
- April 2016 - Mar 2020
- Role: Principal Investigator
- Collaborative with Firas Khasawneh, (PI: CMMI-1562459/1759823) Mechanical Eng., MSU

CDS&E: Collaborative Research: Machine Learning on Dynamical Systems via Topological Features
- NSF DMS-1622320/1800446: (UAlbany/MSU) $101,672
- Sept 2016 - Aug 2019
- Role: Principal Investigator
- Collaborative with
    - Firas Khasawneh, (PI: DMS-1622293/1759824) Mechanical Eng., MSU
    - José Perea, (PI: DMS-1622301) Depts. of Math, & CMSE, MSU

Kaleidoscope: Turning System Design Inside-Out
- DARPA
- Aug 2016-July 2017
- Role: Technical POC
- Collaborative with Raytheon BBN Technologies Corp., Boston, MA

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*Double grant numbers caused by transfer of grants to MSU.

TALKS

Future planned talks.

- *Lecture Series.* EWM-EMS Summer School: Stability in Topological Data Analysis. Stockholm, Sweden. July 2025.

- *Invited Talk.* The Geometric Realization of AATRN (Applied Algebraic Topology Research Network). IMSI, Chicago, IL. August 2025.

Previous talks. *Talks with hyperlinks have recordings or supplementary material available.*

143. *Data Driven Homological Approaches for Detecting Changes in Dynamical System.* **Plenary**, SIAM Dynamical Systems, Denver, CO., May 12, 2025.

142. *Measuring Shape with the Directional Transform and Topological Descriptors.* Southeast Center for Mathematics and Biology Workshop, Atlanta, GA., April 11, 2025.

141. *Data Driven Homological Approaches for Detecting Changes in Dynamical System.* **Semi-Plenary**, 58th Spring Topology and Dynamics Conference, Christopher Newport University, Newport News, VA, March 8, 2025.

140. *Distances between Topological Representations of the Shape of Data.* Math Department Colloquium, Purdue University, West Lafayette, IN, Dec 11, 2024.

139. *Data driven homological approaches for detecting changes in dynamical systems.* Workshop on Data Driven Dynamics. Centre de Recherches Mathematiques (CRM), Montreal, Canada, Nov 11, 2024.

138. *Encoding the Shape of Data for Machine Learning Tasks.* Math Department Colloquium, University of Tennessee - Knoxville, Nov 6, 2024.

137. *Making space and studying shape in a non-traditional academic setting.* MSU ACRES REU, East Lansing, MI, May 29, 2024.

136. *The Directional Transform, or how to look at your data from every direction at once.* MSU SURIEM REU, East Lansing, MI, May 20, 2024.

135. *Comparing Embedded Shapes Using Topological Summaries.* Codes and Expansions (CodEx) Seminar, Virtual, Mar 26,2024.

134. *Bounding the Interleaving Distance for Mapper Graphs with a Loss Function.* Applied Algebraic Topology Research Network (AATRN), Online Seminar, March 20, 2024.

133. *Bounding the Interleaving Distance for Mapper Graphs with a Loss Function.* Workshop on Applied and Combinatorial Topology, Schloss Dagstuhl, Wadern, Germany, Feb 27, 2024.

132. *Topological Data Analysis for Shape Comparison.* CSCS Colloquium, University of Michigan, Ann Arbor, MI, Feb 8, 2024.

131. *Topological Data Analysis for Shape Comparison.* Tufts Colloquium, Tufts University, Boston, MA, Feb 1, 2024.

130. *Topological Data Analysis for Shape Comparison.* ACMS Colloquium, Notre Dame, South Bend, IN, Jan 11, 2024.

129. *Comparing Embedded Shapes Using Topological Summaries.* **Plenary**, SIAM Great Lakes Meeting, Michigan State University, East Lansing, MI, Oct 14, 2023.

128. *Bounding the Interleaving Distance for Geometric Graphs with a Loss Function.* Computational Persistence Workshop, Purdue, West Lafayette, IN, Sep 27, 2023.

127. *Analyzing Network Representations of Dynamical Systems Using Persistent Homology.* ICIAM, Tokyo, Japan (Virtual), Aug 25, 2023.

126. *Bounding the Interleaving Distance for Geometric Graphs with a Loss Function.* TDA Week, Kyoto University, Kyoto, Japan, Aug 1, 2023.

125. *Making space and studying shape in a non-traditional academic setting.* MSU ACRES REU, East Lansing, MI, June 7, 2023.

124. *The Directional Transform, or how to look at your data from every direction at once.* MSU Topology REU, East Lansing, MI, June 2, 2023.

123. *Combining network analysis and persistent homology for classifying behavior of time series.* IMSI Randomness in Topology and its Applications, March 22, 2023.

122. *Graph Comparison using the Interleaving Distance.* UCLA Math Department Colloquium, Feb 23, 2023.

121. *Combining network analysis and persistent homology for classifying behavior of time series.* One World MINDS Seminar, Virtual, Feb 9, 2023.

120. *The Directional Transform, or how to look at your data from every direction at once.* Workshop on Computational Topology and Quantum Computing, Kigali, Rwanda (virtual), Feb 8, 2023.

119. *The Directional Transform, or how to look at your data from every direction at once.* MSU Undergraduate Math Club, Michigan State University, Nov 29, 2022.

118. *The Directional Transform, or how to look at your data from every direction at once.* Data-oriented Mathematical & Statistical Sciences (DoMSS) Seminar, Arizona State University, Virtual, Oct 17, 2022.

117. *The Directional Transform, or how to look at your data from every direction at once.* AATRN STMS Joint Seminar Series, Virtual, Oct 14, 2022.

116. *Graph Classification Using the Interleaving Distance.* SIAM-MDS, San Diego, CA, Sep 29, 2022.

115. *Crafting Topological Features.* BIRS Deep Exploration of non-Euclidean Data with Geometric and Topological Representation Learning, Kelowna, BC, Canada, July 12, 2022.

114. *The many faces of the interleaving distance.* Plenary talk, ATMCS 10, Oxford, UK, June 23, 2022.

113. *Making space and studying shape in a non-traditional academic setting.* Keynote Address, WiDS Iowa, Virtual, Apr 21, 2022.

112. *The Interleaving Distance for Reeb Graphs.* Math Dept Colloquium, University of Utah, Salt Lake City, UT, Apr 7, 2022.

111. *The Shape of Data.* Keynote Address, NAPPN Annual Conference, University of Georgia, Athens, GA, Twosday, Feb 22, 2022.

110. *Combining network analysis and persistent homology for classifying behavior of time series.* Dynamics Days, Online due to COVID-19, Jan 7, 2022.

109. *The Truncated Interleaving Distance for Reeb Graphs.* Quivers Seminar, University of Iowa, Online due to COVID-19, November 15, 2021.

108. *On the inter-level-set persistence bottleneck distance for Reeb graphs.* Computational Persistence Workshop, Purdue, Online due to COVID-19, November 5, 2021.

107. *The Truncated Interleaving Distance for Reeb Graphs.* SIAM Conference on Applied Algebraic Geometry, Online due to COVID-19, August 18, 2021.

106. *The Interleaving Distance for Graphical Signatures.* Mathematical Congress of the Americas, Online due to COVID-19, July 16, 2021.

105. *Measuring the Shape of Hurricanes.* MSU SURIEM REU, Online due to COVID-19, July 7, 2021.

104. *Metrics for Graphical Signatures.* Topological Ideas in Applications, Thematic Einstein Semester on Geometric and Topological Structure of Materials, TU Berlin, Online due to COVID-19, June 24, 2021.

103. *The Directional Transform: From Theory to Practice.* Workshop on Computational Topology at SoCG, Gather town, June 10, 2021.

102. *A family of metrics from the truncated smoothing of Reeb graphs.* Symposium on Computational Geometry (SoCG) Main Session, Gather town, June 7, 2021.

101. *Quantifying the shape of time series with TDA and network-based methods.* AI and Topology Track, EPFL Applied Machine Learning Days, Online due to COVID-19, May 10, 2021.

100. *Combining network analysis and persistent homology for classifying behavior of time series.* Applied Mathematics and Complex Systems Seminar, University of Western Australia, Online due to COVID-19, May 6, 2021.

99. *The Truncated Interleaving Distance for Reeb Graphs.* Topological Data Analysis Workshop, IMSI, Online due to COVID-19, April 27, 2021.

98. *Utilizing Persistent Homology for Classifying Behavior of Time Series.* Computational Topology Class, University of Utah, Online due to COVID-19, April 22, 2021.

97. *Measuring the Shape of Hurricanes.* MSU Undergraduate Math Club, Online due to COVID-19, April 6, 2021.

96. *Combining network analysis and persistent homology for classifying behavior of time series.* Applied Math Colloquium, University of Arizona, Online due to COVID-19, March 12, 2021.

95. *Averaging Merge Trees.* EPFL Applied Topology Seminar, Online due to COVID-19, March 9, 2021.

94. *The Truncated Interleaving Distance for Reeb Graphs.* Joint Mathematics Meetings, Online due to COVID-19, Jan 9, 2021.

93. *Python Tutorial on Topological Data Analysis (TDA).* AMS Short Course on Mathematical and Computational Methods for Complex Social Systems, Joint Mathematics Meetings, Online due to COVID-19, Jan 5, 2021.

92. *Persistent homology of complex networks for dynamic state detection in time series.* Topological Data Analysis and Beyond Workshop, Neurips 2020, Online due to COVID-19, Dec 11, 2020.

91. *The Truncated Interleaving Distance for Reeb Graphs.* TGDA Seminar, Ohio State University, Online due to COVID-19, Nov 17, 2020.

90. *Combining network analysis and persistent homology for classifying behavior of time series.* CMSE Brownbag Seminar, MSU, Nov 13, 2020.

89. *Combining network analysis and persistent homology for classifying behavior of time series.* Virtual Mathematics Colloquium, Clarkson University, Online due to COVID-19, Oct 19, 2020.

88. *Combining network analysis and persistent homology for classifying behavior of time series.* Second Symposium on Machine Learning and Dynamical Systems, Fields Institute, Online due to COVID-19, Sep 29, 2020.

87. *The Truncated Interleaving Distance for Reeb Graphs.* GEOTOP-A Online Seminar, Sep 18, 2020.

86. *Convergence of Mapper Graphs.* MSU TDA Seminar, East Lansing, MI, Aug 6, 2020.

85. *Featurization of Persistence Diagrams using Template Functions for Machine Learning Tasks.* Diff CVML - CVPR Keynote, Online due to COVID-19., June 29, 2020.

84. *Topological Data Analysis for Quantifying Plant Morphology.* SIAM MDS, Online due to COVID-19., June 2, 2020.

83. *Drawing Time-Varying Reeb Graphs.* MSU AMS/AWM Grad Student Seminar, Mar 9, 2020.

82. *Applications of TDA: From Reeb Graphs to Diagrams, From Time Series to Plant Morphology.* MSU TDA Seminar, East Lansing, MI, Mar 9, 2020.

81. *Featurization of Persistence Diagrams using Template Functions for Machine Learning Tasks.* Applied Algebraic Topology Research Network (AATRN), Online Seminar, Jan 29, 2020.

80. *Featurization of Persistence Diagrams using Template Functions for Machine Learning Tasks.* Joint Math Meetings (JMM), Denver, CO, Jan 17, 2020.

79. *Featurization of Persistence Diagrams using Template Functions for Machine Learning Tasks.* Canadian Mathematical Society Winter Meeting, Toronto, Canada, Dec 7, 2019.

78. *Measuring the Shape of Data: The Shape of Hurricanes.* Big Data Colloquium, Grand Valley State University, Allendale, MI, Nov 22, 2019.

77. *Featurization of Persistence Diagrams for Classifying Attractors.* SIAM Dynamical Systems, Snowbird, Utah, May 22, 2019.

76. *Featurization of persistence diagrams using template functions for machine learning tasks.* SIAM Great Lakes Sectional Meeting, University of Michigan, Ann Arbor, MI, April 27, 2019.

75. *Utilizing persistent homology for classifying behavior of time series.* Workshop on Data Driven Dynamics: Algebraic Topology, Combinatorics and Analysis, CRM, Montreal, Canada, April 18, 2019.

74. *The Interleaving Distance for a Category with a Flow.* MSU AMS/AWM Grad Student Seminar, Feb 7, 2019.

73. *The Interleaving Distance for a Category with a Flow.* Upstate New York Topology Seminar, Albany, NY, Nov 10, 2018.

72. *Quantum Computation in a Topological Data Analysis Pipeline.* 2018 D-Wave Qubits North America, Knoxville, TN, Sep 25, 2018.

71. *Interleavings for categories with a flow and the hom-tree lower bound.* BIRS-CMO Workshop on Multiparameter Persistent Homology, Oaxaca, Mexico, Aug 9, 2018.

70. *Topological Data Analysis.* Summer Undergraduate Research Institute in Experimental Mathematics (SURIEM), MSU, East Lansing, MI, June 21, 2018.

69. *Topological Data Analysis.* iCER ACRES REU, MSU, East Lansing, MI, June 13, 2018.

68. *Topological Data Analysis for Time Series Analysis.* Abel Symposium, Geiranger, Norway, June 6, 2018.

67. *Reeb graphs, Mapper graphs, and Metrics.* IMA Special Workshop: Bridging Statistics and Sheaves, Minneapolis, MN, May 21, 2018.

66. *Approximating Continuous Functions on Persistence Diagrams for Machine Learning Tasks.* TRIPODS Seminar: Geometry and Topology of Data, ICERM, Brown University, Providence, RI, December 13, 2017.

65. *Quantifying and Comparing Shape in Data.* Colloquium, Dept of Mathematics, University of Michigan at Dearborn, Dearborn, MI, December 6, 2017.

64. *Approximating Continuous Functions on Persistence Diagrams for Machine Learning Tasks.* Geometry and Topology Seminar, Math Dept, MSU, East Lansing, MI, November 16, 2017.

63. *What is Topological Data Analysis.* CMSE Brown-bag Lecture Series, MSU, East Lansing, MI, October 17, 2017.

62. *Applications of Persistence to Time Series Analysis.* SIAM Central States Section 2017 Meeting, Colorado State University, Fort Collins, CO, September 30, 2017.

61. *Introduction to Categorical Approaches in Topological Data Analysis II.* Topology, Computation and Data Analysis, Schloss Dagstuhl, Wadern, Germany, July 17, 2017.

60. *Applications of Persistence to Time Series Analysis.* SIAM Conference on Dynamical Systems, Snowbird, Utah, May 23, 2017.

59. *Reeb graphs, Mapper graphs, and Metrics.* 47th Annual John H. Barrett Memorial Lectures, University of Tennessee - Knoxville, TN, Mar 2, 2017.

58. *The Convergence of Mapper.* AWM Research Symposium, UCLA, Los Angeles, CA, Apr 8, 2017.

57. *The Convergence of Mapper.* Brown University, Providence, RI, Mar 9, 2017.

56. *A Topological Approach to Data Science.* Dept. of Mathematics, Montana State University, Bozeman, MT, Feb 13, 2017.

55. *A Topological Approach to Data Science.* Dept. of Computational Mathematics, Science, and Engineering, Michigan State University, East Lansing, MI, Jan 11, 2017.

54. *The interleaving distance for posets.* Joint Mathematics Meetings, Atlanta, GA, Jan 4, 2017.

53. *The Convergence of Mapper.* New York Applied Topology Meetings, Columbia University, New York, NY, Dec 9, 2016.

52. *The interleaving distance for posets.* Union College Mathematics Conference, Schenectady, NY, Dec 3, 2016.

51. *The Reeb graph interleaving distance.* Computer Science Seminar, St. Louis University, Oct 12, 2016.

50. *Utilizing Topological Data Analysis to Detect Periodicity.* International Workshop on Topological Data Analysis in Biomedicine at ACM-BCB, Seattle, WA, Oct 2, 2016.

49. *The interleaving distance.* Geometry and Topology Seminar, Math Department, University at Buffalo, Buffalo, NY, Sep 23, 2016.

48. *Applications of Persistence to Time Series Analysis.* Topology, Geometry, and Data Analysis Conference (TGDA), Ohio State University, Columbus, OH, May 20, 2016.

47. *Topological Data Analysis.* Junior STEM Idea Exchange (JUSIE): Lightning event, Albany, NY, May 10, 2016.

46. *What Does it Mean for Data to Have Shape?.* Workshop on the Shape of Educational Data, Fairfax, VA, April 7, 2016.

45. *The Reeb Graph Interleaving Distance and its Application to Data Analysis.* Combinatorics Seminar, SUNY Binghamton, Binghamton, NY, Mar 15, 2016.

44. *Topological Data Analysis and its Application to Atmospheric Science Data.* Dept of Atmospheric and Environmental Sciences Colloquium, UAlbany, Albany, NY, Feb 15, 2016.

43. *Topological Data Analysis.* Math Department Student Seminar, Union College, Schenectady, NY, Jan 19, 2016.

42. *Applied Category Theory and the Reeb Graph Interleaving Distance.* Geometry and Topology Seminar, NCSU, Raleigh, NC, Jan 13, 2016.

41. *Complexity of the Reeb Graph Interleaving Distance.* CS Theory Seminar, NCSU, Raleigh, NC, Jan 11, 2016.

40. *Reeb Graph Approximation with Guarantees.* Joint Mathematics Meetings, Seattle, WA, Jan 9, 2016.

39. *Reeb Graph Approximation with Guarantees.* Fall Workshop on Computational Geometry (FWCG), Buffalo, NY, Oct 23, 2015.

38. *The Reeb Graph Interleaving Distance .* UAlbany - Algebra/Topology Seminar, Sep 3 (Part I) and Sep 10 (Part II), 2015.

37. *A New Metric for $\mathbb{R}$-graph Comparison.* AFRL Annual Applied Topology Workshop, Rome, NY, Aug 7, 2015.

36. *Demo: Using Perseus to Compute Persistent Homology.* UAlbany Applied Topology Reading Group, Aug 6, 2015.

35. *The Interleaving Distance.* CG Week, Symposium on Computational Geometry (SoCG), Eindhoven, Netherlands, June 25, 2015.

34. *Strong Equivalence of the Interleaving and Functional Distortion Metrics for Reeb Graphs.* Symposium on Computational Geometry (SoCG), Eindhoven, Netherlands, June 24, 2015.

33. *Using Topology to Understand Big Data.* Junior STEM Idea Exchange (JUSIE), University at Albany - SUNY, Mar 25, 2015.

32. *Strong Equivalence of Reeb Graph Metrics.* Invited Lecture, TU Munich, Munich, Germany, Mar 17, 2015.

31. *The Cosheaf-Less Reeb Graph Interleaving Distance.* Seminar on Computational Geometry, Schloss Dagstuhl, Wadern, Germany, Mar 12, 2015.

30. *The Interleaving Distance for Reeb Graphs.* Applied Algebraic Topology Research Network - Online Seminar, Feb 25, 2015.

29. *Using Topology to Understand Big Data.* Women in Science and Engineering (WISH) Lunch, University at Albany, Albany, NY, Jan 15, 2015.

28. *Towards Predicting and Preventing Machine Chatter Using Persistent Homology.* Invited lecture, Workshop on Topology : Identifying Order in Complex System, Rutgers, New Brunswick, NJ, Oct 18, 2014.

27. *Using Topology to Understand Big Data.* Invited lecture, Modern Math Workshop, Los Angeles, CA, Oct 16, 2014.

26. *Interleavings of Reeb Graphs.* Invited Lecture, AIM Workshop on Generalized Persistence and Applications, Sept 18, 2014.

25. *Interleavings of Reeb Graphs.* Invited Lecture, ATMCS 6, Vancouver, Canada, May 29, 2014.

24. *Topological Data Analysis :: Persistent Homology and Applications.* Invited Lecture, Systems Information Learning Optimization (SILO), University of Wisconsin - Madison, Madison, WI, April 23, 2014.

23. *A Distance Measure on Reeb Graphs.* Invited Lecture, Topology, Geometry and Data Seminar, Ohio State University, Columbus, OH, April 11, 2014.

22. *Using Persistence to Explore Equilibria of Delay Equations.* Invited Lecture, Spring Topology and Dynamics Conference, University of Richmond, Richmond, VA, March 14, 2014.

21. *Categorification of Reeb Graphs.* Invited Lecture, Workshop on Topological Systems : Communication, Sensing, and Actuation, IMA, Minneapolis, MN, March 6, 2014.

20. *Categorification of Reeb Graphs.* SAMSI Workshop, LDHD: Topological Data Analysis, Durham, NC, February 5, 2014.

19. *Extending Statistical Methods to Computational Topology.* SIAM Minisymposium on Applied and Computational Geometry, JMM, Baltimore, MD, January 17, 2014.

18. *A Statistical Approach for Improving Topological Data Analysis.* University of Rochester, Rochester, NY, January 10, 2014.

17. *Categorification of Reeb Graphs.* Topology Seminar, Tulane University, New Orleans, LA, November 5, 2013.

16. *Categorification of Reeb Graphs.* IMA Postdoc Seminar, University of Minnesota, Minneapolis, MN, October 22, 2013.

15. *A Continuous Mean for Finite Sets of Persistence Diagrams.* Invited Lecture, Workshop: Topological Data Analysis, IMA, University of Minnesota, Minneapolis, MN, October 10, 2013.

14. *A Continuous Mean for Distributions of Persistence Diagrams.* Invited Lecture, SIAM Conference on Applied Algebraic Geometry, Fort Collins, CO, August 2, 2013.

13. *An Introduction to Topological Data Analysis.* Invited Lecture, SUNYIT, Utica, NY, June 11, 2013.

12. *Applications of Persistent Homology to Time Varying Systems.* PhD Defense, Duke University, March 28, 2013.

11. *Using Persistent Homology to Analyze Behavior in Dynamic Point Clouds.* SIAM Student Chapter Lecture Series, Colorado State University, Fort Collins, CO, November 5, 2012.

10. *Using Persistent Homology to Analyze Dynamic Point Clouds.* Data Research Training Grant Seminar, Duke University, Durham, NC, October 22, 2012.

9. *An Intro to Persistent Homology and Some Applications.* Graduate/Faculty Seminar, Duke University, Durham, NC, September 7, 2012.

8. *Metrics on Vineyards.* Computational Geometry Week, Chapel Hill, NC, June 20, 2012.

7. *Primates and Vineyards.* Duke University Math Slam, Duke University, Durham, NC, March 23, 2012.

6. *Utilizing Ideas from Persistent Homology to Compute Probabilistic Sensor Network Coverage.* Algebra/Combinatorics Seminar, NC State University, Raleigh,NC, January 13, 2012.

5. *Applied Topology: Basic Ideas and a Mess of Applications.* Graduate/Faculty Seminar, Duke University, Durham, NC, October 14, 2011.

4. *Using Persistent Homology to Compute Probabalistic Failure of a Sensor Network.* SIAM Conference on Applied Algebraic Geometry, Raleigh, NC, October 6, 2011.

3. *Computing Probabilistic Sensor Network Coverage via Algorithms Utilizing Persistent Homology.* Geometry and Topology Reading Group, Institute of Science and Technology, Klosterneuburg, Austria, June 20, 2011.

2. *Computing Probabilistic Sensor Network Coverage via Algorithms Utilizing Persistent Homology.* Computational Geometry Seminar, UNC Chapel Hill, Chapel Hill, NC, February 3, 2011.

1. *Failure Filtrations and Coverage of Fenced Sensor Networks.* Graduate/Faculty Seminar, Duke University, November 19, 2010.

TEACHING EXPERIENCE

Course	Title	Institution	Semesters
CMSE 201	Intro to Computational Modeling and Data Analysis	MSU	Spring, 2018
CMSE 381	Fundamentals of Data Science Methods	MSU	Spring, 2022 Fall, 2022 Fall, 2023 Fall, 2024
CMSE 801	Intro to Computational Modeling	MSU	Spring, 2024 Spring, 2020
CMSE 802	Methods Computational Modeling	MSU	Spring, 2021
CMSE 491/890	Topological Analysis of Large Datasets	MSU	Fall, 2017 Fall, 2021
MTH 132	Calculus I	MSU	Fall, 2020
MTH 481	Discrete Mathematics I	MSU	Fall, 2018
MTH 960	Algebraic Topology I	MSU	Fall, 2024
MTH 994	Topics: The Interleaving Distance	MSU	Spring, 2023
AMAT 840	Applied Topology	UAlbany	Spring, 2015
AMAT 587	Graph Theory	UAlbany	Fall, 2015
AMAT 540B	Topology II	UAlbany	Spring, 2017
AMAT 502	Modern Computing for Mathematicians	UAlbany	Spring, 2016
AMAT 363	Statistics	UAlbany	Fall, 2014 Fall, 2015 Spring, 2016 Spring, 2017
TIP	Mobius Strips, Klein Bottles, and Fractals: The Mathematics of Distortion	Duke TIP	July, 2012
Math 32L	Laboratory Calculus II	Duke	Spring, 2011
Math 31L	Laboratory Calculus I	Duke	Fall, 2009
Math 25L	Laboratory Calculus and Functions I	Duke	Fall, 2008

CURRENT RESEARCH GROUP MEMBERS

Graduate Students

Rachel Roca, PhD Student, MSU CMSE — Sep 2021 - Present
Jointly advised with Danny Caballero

David Muñoz, PhD Student, MSU CMSE — Jan 2022 - Present

Astrid Olave, PhD Student, MSU Math — Jan 2022 - Present

Ishika Ghosh, PhD Student, MSU CMSE — Aug 2022 - Present

Postdocs

Nkechi Nnadi, Postdoc (FTAP), MSU CMSE — Aug 2024 - Present

Yemeen Ayub, Postdoc, MSU CMSE — Oct 2024 - Present
Jointly advised with Dan Chitwood

Undergraduates

Ray Hasan, Undergraduate Student, Professorial Assistant, MSU — Sep 2023 - Present

Trenton O'Bannon, SROP REU program, MSU — Summer 2025

FORMER MEMBERS AND OTHER PERSONNEL

Graduate Students

Anastasios Stefanou, PhD student, UAlbany Math — Oct 2015 - Aug 2018
Jointly advised with Justin Curry
First job post-PhD: Postdoc, Ohio State University

Sarah Tymochko, PhD Student, MSU CMSE — Sept 2017 - May 2022
First job post-PhD: Postdoc, UCLA

Erik Amézquita, PhD Student, MSU CMSE — Sep 2018 - May 2023
Jointly advised with Dan Chitwood
First job post-PhD: Postdoc, Plant Biology, University of Missouri

Christopher Potvin, PhD Student, MSU Math — Jan 2021 - May 2023
First job post-PhD: Asst Prof, Math, Warren Wilson College

Danielle Barnes, PhD Student, MSU CMSE — June 2022 - May 2024
Job Post-PhD: Director of Data Science at RXA @ OneMagnify

Sarah McGuire, PhD Student, MSU CMSE — Sep 2019 - June 2024
Job Post-PhD: Postdoc at Pacific Northwest National Lab (PNNL)

Xinyi (Elena) Wang, PhD Student, MSU CMSE — Sep 2020 - May 2025
Job Post-PhD: Postdoc at the University of Fribourg, Switzerland

İsmail Güzel, Visiting Graduate Student from İTÜ İstanbul, Türkiye — Sep 2022 - Aug 2023

Christopher Sukhu, MS Student, MSU CMSE — May 2017 - May 2019

Mitchell Eithun, MS Student, MSU CMSE — Jan 2018 - Aug 2019
Jointly advised with Dan Chitwood

Postdocs

Sarah Percival, Postdoc, MSU CMSE/BMB — Sep 2021 - May 2024
Jointly advised with Dan Chitwood, Beronda Montgomery, Arjun Krishnan,
and Aman Husbands (OSU)

Sourabh Palande, Postdoc, MSU CMSE   Sep 2020 - May 2023
  Jointly advised with Dan Chitwood

Shelley Kandola, Postdoc, MSU Math   Sep 2019 - July 2021

Tim Ophelders, Postdoc, MSU CMSE   Sep 2018 - Aug 2020
  Jointly advised with Dan Chitwood

Michelle Quigley, Postdoc, MSU Horticulture   Sep 2018 - Sep 2020
  Jointly advised with Dan Chitwood

Undergraduate and High School Students

Denis Selyuzhitsky, Undergraduate Student, UG Research Assistant, MSU   Sep 2022 - Aug 2024

Jasmine George, Oscar Lledo, Undergraduate Students, SURIEM REU, MSU   Summer 2024

Messiah Ridgely, Undergraduate Student, ACRES REU, MSU   Summer 2024

Nathan Willey, Undergraduate Student, UG Research Assistant, MSU   Sep 2022 - May 2023

Ari Markov, Undergraduate Student, Professorial Assistant, MSU   Sep 2022 - May 2023

Yash Gautam, Undergraduate Student, Professorial Assistant, MSU   Sep 2020 - May 2022

Vee Kalkunte and Sean Bergen, Undergraduate Students, ACRES REU, MSU   Summer 2021

Levent Batakci, Abby Branson, Bryan Castillo, Candace Todd   Summer 2020
SURIEM REU, MSU

Kayla Makela, Undergraduate Student, MSU   Jan 2018 - Aug 2020

Joseph Sigler, Undergraduate Student, Professorial Assistant, MSU   Sep 2017 - May 2019

Monika Francsics, Undergraduate Student, MSU   Summer 2018

Brian Bollen, Undergraduate Student, UAlbany   May 2016 - Aug 2017

Akanksha Atrey, Undergraduate Student, UAlbany   Jan 2015 - June 2016

Bill Dong, High School Student, UAlbany   Jun 2015 - Aug 2016

COMMITTEE MEMBERSHIP

Current Committee Membership

Maryam Berijanian, PhD Student, Advisor: Dirk Colbry, MSU CMSE   Sept 2023 - Present
  MSU MechE

Alexander Harnisch, PhD Student, Advisor: Claudio Kopper,   March 2021 - Present
  MSU PA/CMSE

Ben Jones, PhD Student, Advisor: Guowei Wei, MSU Math   Sept 2023 - Present

Amey Joshi, PhD Student, Advisors: Matt Hedden and Matthew Stoffregen   Jan 2024 - Present
  MSU Math

Sunia Tanweer, PhD Student, Advisor: Firas Khasawneh,   2022 - Present
  MSU MechE

Michael Quail, PhD Student, Advisor: Kristen Bieda,   Nov 2021 - Present
  MSU Program in Mathematics Education

Ernst Röell, PhD Student, Advisor: Bastian Rieck,   Jan 2025 - Present
  Helmholtz Munich

Graduated

Emily Saunders, PhD Student, Advisor: Andrew Blumberg   Graduated April 2025
    Math, Columbia University

Max Chumley, PhD Student, Advisor: Firas Khasawneh   Graduated May 2025

Alexandre Bois, PhD Student, Advisors: Laurent Oudre and Brian Tervil   Defended Fall 2024
    Ecole Normale Superieure Paris Saclay, France

Chris St. Clair, PhD Student, Advisor: Matt Hedden, MSU Math   Graduated Aug 2024

Nkechi Nnadi, PhD Student, Advisor: Daniel Isaksen   Graduated July 2024
    Math, Wayne State University

Nathan Brugnone, PhD Student, Advisor: Robert Richardson,   Graduated July 2023
    MSU CSUS/CMSE

Brian Bollen, PhD Student, Advisor: Josh Levine   Graduated May 2022
    Arizona State University Program in Applied Mathematics

Rachel Domagalski, PhD Student, Advisor: Bruce Sagan, MSU Math   Graduated Aug 2021

Nick Young, PhD Student, Advisor: Danny Caballero   Graduated Aug 2021
    MSU Physics/CMSE

Zixuan Cang, PhD Student, Advisor: Guowei Wei, MSU Math   Graduated July 2018

Hitesh Gakhar, PhD Student, Advisor: José Perea, MSU Math   Graduated May 2020

Luis Polanco, PhD Student, Advisor: José Perea, MSU CMSE/Math   Graduated May 2022

Audun Myers, PhD Student, Advisor: Firas Khasawneh, MSU ME   Graduated May 2022

Melih Yesili, PhD Student, Advisor: Firas Khasawneh, MSU ME   Graduated May 2022

SERVICE

Departmental and University Service

MSU TDA Seminar, Creator and Co-Organizer	Mar 2020 - Present
CMSE Advisory Committee (AdCom), MSU	
Elected Member	Sept 2020 - Aug 2026
Secretary	Sept 2017 - Aug 2018
CMSE Graduate Curriculum Committee, MSU	
Chair	Sept 2023 - Present
College of Engineering Graduate Studies Commitee, MSU	
CMSE Representative	Sept 2023 - Aug 2024
CMSE Representative	Sept 2018 - Aug 2020
Hiring Committees, MSU	
CMSE/Math Joint Search	June 2023 - May 2025
CMSE 1855 Data Science	Mar 2022 - May 2023
CMSE TT Data Science	Sept 2021- Feb 2022
Math Undergraduate Committee, MSU	Sept 2021- Feb 2022
CMSE Graduate Studies Committee, MSU	
Chair	Aug 2018 - Aug 2020
Member	Aug 2020 - Aug 2021
MSU College of Natural Science Panel Discussion:	Mar 14, 2023
Winning Strategies for NSF CAREER Proposals	
Member of CMSE Awards Committee, MSU	Sept 2019 - Aug 2020
CNS Strategic Plan Integration Committee, MSU	Jan 2020 - Dec 2020
Panel on Academic Careers for Engineering Graduate Students, MSU	Nov 26, 2019
Member, Executive Committee for PlantBio NSF-NRT Grant, MSU	Sept 2018 - Aug 2019
Math Dept. Graduate Committee, UAlbany	Sept 2016 - Aug 2017
Math Dept Representative, UAlbany Undergraduate Research Information Session and Forum	Mar 2016
Faculty Speaker, UAlbany Math Department Graduation Ceremony	May 2015
Organizer, UAlbany Reading Group on Applied Topology	Summer 2015
UAlbany Math Dept Colloquium Committee	Sept 2014-Aug 2017
Organizer for the IMA Postdoc Seminar	Sept 2013-Aug 2014
President, Noetherian Ring of Duke University	Sept 2012-May 2013
Mathbio Seminar Organizer, Duke Math Dept	Spring 2012
Project Mentor: Duke Workshop on Applications of Math to Physiology and Medicine	May 16-20, 2011
Tea Organizer for Duke Mathematics Dept	Sept 2010 - May 2011
Graduate Student Representative for Duke Math Department	Jan 2009 - Dec 2009

Professional Service

Minitutorial, *Topological Signal Processing for Dynamical Systems*, SIAM-DS	May 2023
Organized with Firas Khasawneh and Max Chumley	
Special Session, *Topological Data Analysis with Mapper*	SIAM-MDS 2022
Organized with Sarah Percival.	
Organizer, Workshop on Topological Signal Processing at SIAM DS 21	May 2021
Workshop Committee Member, Symposium on Computational Geomtry (SoCG)	2020
Program Committee Member, Women+ Data Science Monthly Meetup, MSU	Fall 2020
Mentor, National Alliance for Doctoral Studies in the Mathematical Sciences	Fall 2020 - present
Steering Committee Member, ATMCS	Mar 2017 - present
Steering Committee Member, Women in Computational Topology	Sep 2016 - Dec 2024
Organizer, IMA Workshop: Bridging Statistics and Sheaves	May 2018

Organizer for Special Session on Sheaves in TDA at the Joint Math Meetings	Jan 2017
Organizer, The 4th Annual Minisymposium on Computational Topology,	Jun 2015
CG Week at the Symposium on Computational Geometry	
Session Organizer, AWM Research Symposium	Apr 2015
Organizer for Special Session at the Joint Math Meetings	Jan 2013

Community Outreach

Interviewed for *Meet a Mathematician*, Museum of Math (Virtual)	Feb 3, 2025
Panelist on Careers in Academia, Women in Science Conference, Notre Dame	Oct 2018
Interview for The Girls' Angle Bulletin, ISSN 2151-5700	Oct/Nov 2015
NYS Master Teacher Program Application Review Committee	Sept 2014
Volunteer for FEMMES Capstone Events	April 2011, April 2012

Editorial Boards & Conference Program Committees

Inaugural Editorial Board Member, Computing in Geometry and Topology (CGT)	2021-Present
Associate Editor, EPJ Data Science	2024-Present
Associate Editor, Journal of Applied and Computational Topology (APCT)	2024 - Present
Guest Editor, La Mathematica	2023-2024
Advances in Applied and Computational Topology, WinCompTop Special Issue	
Scientific Committee Member, The 4th Workshop on Computational Persistence (CompPer)	2024
Program Committee Member, Symposium on Computational Geometry (SoCG)	2023
Program Committee Member, "Applications of Topological Data Analysis	2021
to Big Data" Workshop, IEEE Big Data Conference	
Program Committee Member, Symposium on Computational Geometry (SoCG)	2018
Program Committee Member, Fall Workshop on Computational Geometry	2014, 2016
Scientific Committee, ATMCS7, Torino, Italy	Jul 2016
Applied Topology: Methods, Computation, and Science	

Review and Referee

Journals

AMS Notices	2022
AMS Proceedings	2022
Algebraic and Geometric Topology	2024
Bulletin of Mathematical Biology	2023
Chaos	2021
Climate Dynamics	2021
Computational Geometry: Theory and Applications	2016
Discrete and Computational Geometry	2015, 2019, 2024, 2025
Image and Vision Computing	2020
Medical Image Analysis	2020
Journal of Applied and Computational Topology (APCT)	2018-2024
Journal of Computational Geometry (JoCG)	2018, 2019, 2021
Journal of Machine Learning Research (JMLR)	2017
Journal of Computational and Graphical Statistics	2023, 2024
Patterns	2021
PLOS ONE	2015, 2016
PNAS	2022
Science Advances	2021
Scientific Reports	2023
SIAM Journal on Applied Algebra and Geometry (SIAGA)	2017
SIAM Journal on Mathematics of Data Science (SIMODS)	2022
SIAM Review	2021

IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)	2019, 2020, 2023
Transactions of Mathematics and Its Applications	2023
WIRES Computational Statistics	2019

Conferences

International Symposium on Algorithms and Computation (ISAAC)	2017
Symposium on Computational Geometry (SoCG)	2014, 2016, 2018-2025
Outstanding Reviewer Award, 2025	
Symposium on Discrete Algorithms (SoDA)	2017, 2020
International Conference on Robotics and Automation (ICRA)	2019
IEEE Scientific Visualization (SciVis)	2019

Funding agencies

NSF: CISE	2016, 2018, 2019, 2021, 2022, 2024
NSF: DMS	2018, 2019
NSF: Other	2025
AFOSR	2022
Swiss National Science Foundation	2024

Other

MathSciNet	2018-Present
zbMath	2021-Present

PROFESSIONAL AFFILIATIONS

American Mathematical Society (AMS)
Society for Industrial and Applied Mathematics (SIAM)
Association for Women in Mathematics (AWM)
Association for Computing Machinery (ACM)
Math Alliance Mentor
National Association of Mathematicians (NAM)
American Harp Society (AHS)

TECHNICAL STRENGTHS

Software and Coding	Python, MATLAB, R, LaTeX, Inkscape, HTML, CSS
Operating Systems	Linux, Windows, Android