

Curriculum Vitae

PETER BUBENIK

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Gainesville, FL 32611-8105 Date of CV: September 2021

Education/Employment

2020 – Professor, Dept of Mathematics, University of Florida
2015 – 2020 Associate Professor, Dept of Mathematics, University of Florida (Preeminence hire)
2010 – 2015 Associate Professor, Dept of Mathematics, Cleveland State University
2005 – 2010 Assistant Professor, Dept of Mathematics, Cleveland State University
2003 – 2005 Postdoctoral Fellow, Swiss Federal Institute of Technology at Lausanne (EPFL) (mentor: Kathryn Hess)
2003 Ph.D. University of Toronto, Mathematics (advisor: Paul Selick)
1997 M.Sc. University of Toronto, Mathematics (advisor: Stephen Halperin)
1996 B.Sc. University of Guelph, Guelph, ON, Canada, Mathematics and Physics (with Honors)

Appointments / Visiting positions

2014 – 2017 Founding Director, Applied Algebraic Topology Research Network, funded by the IMA
2007 Scientific Researcher, Fields Institute, Geometric Applications of Homotopy Theory
2006 General Member, MSRI, Computational Applications of Algebraic Topology

Scientific/Academic honors, grants

2019 – 2022 University of Florida Term Professorship Award
2018 – 2023 NSF/Simons Research Center: Southeast Center for Mathematics and Biology, NSF DMS - 1764406, Simons award number 594594, Research subgrant RK153-G2 (\$531,120) sole PI
2018 – 2022 ARO Research Award W911NF1810307, A topological heat map for data analysis (\$429,881) sole PI
2017 – 2018 UFII SEED Fund, Robust Hyperspectral Image Analysis via Computational Topology (\$40,000)
2013 – 2016 AFOSR Research Award FA9550-13-1-0115, Statistical Inferences from the Topology of Complex Networks (\$279,430)
2011 – 2013 CSU Faculty Scholarship Initiative Award (\$4,943)
2009 NSF Award DMS-0834140, CBMS Regional Conference in the Mathematical Sciences, Algebraic Topology in Applied Mathematics, (\$34,108)
2008 – 2011 CSU Faculty Research Development Program Award, (\$9,282)
2000 – 2001 Ontario Graduate Scholarship in Science and Technology (\$15,000)
1998 – 2000 NSERC Post-Graduate Scholarship B (\$34,800)
1996 – 1998 NSERC Post-Graduate Scholarship A (\$31,200)
1992 – 1996 Canada Scholarship (\$10,000)

Research interests

Topological data analysis and applied topology. More broadly: topology, machine learning, statistics, algebra, biology and other applications.

Editorial activities

2021 – Editor, Foundations of Computational Mathematics (FoCM)
2020 – Editorial board reviewer, Journal of Machine Learning Research (JMLR)
2019 – Editor, Homology, Homotopy and Applications (HHA)
2016 – Associate Editor, SIAM Journal on Applied Algebra and Geometry (SIAGA)

Publications (with hyperlinks in electronic version)

Submitted research articles

5. Peter Bubenik and Michael Catanzaro. *Multiparameter persistent homology via generalized Morse theory*, 18pp. arXiv:2107.08856 [math.AT]
4. Peter Bubenik and Nikola Milićević. *Homotopy, Homology and Persistent Homology Using Čech's Closure Spaces*, 46pp. arXiv:2104.10206 [math.AT]
3. Peter Bubenik and Alexander Elchesen. *Universality of persistence diagrams and the bottleneck and Wasserstein distances*, 34pp. arXiv:1912.02563 [math.AT]
2. Peter Bubenik, Jonathan Scott, and Donald Stanley. *An algebraic Wasserstein distance for generalized persistence modules*, 23pp. arXiv:1809.09654 [math.RA]
1. Peter Bubenik, Vin de Silva, and Jonathan Scott. *Categorification of Gromov-Hausdorff Distance and Interleaving of Functors*, 35pp. arXiv:1707.06288 [math.CT]

Peer-reviewed research articles

- 2021 32. Parker Edwards, Kristen Skruber, Nikola Milićević, James B. Heidings, Tracy-Ann Read, Peter Bubenik, and Eric A. Vitriol. *TDAExplore: quantitative analysis of fluorescence microscopy images through topology-based machine learning*, Patterns, accepted, 15pp + 10pp Suppl. bioRxiv:2021.06.13.448249
31. Peter Bubenik and Alexander Elchesen. *Virtual persistence diagrams, signed measures, Wasserstein distances, and Banach spaces*, Journal of Applied and Computational Topology, accepted pending minor revisions, 30pp. arXiv:2012.10514 [math.AT]
30. Ashleigh Thomas, Kathleen Bates, Alex Elchesen, Iryna Hartsock, Hang Lu, and Peter Bubenik. *Topological data analysis of *C. elegans* locomotion and behavior*, Frontiers in Artificial Intelligence, **4**:668395 (2021) 16pp. doi:10.3389/frai.2021.668395 arXiv:2102.09380 [math.AT]
29. Peter Bubenik. *Discussion of 'Event History and Topological Data Analysis'*, Biometrika, accepted, 4pp.
28. Leo Betthausen, Peter Bubenik, and Parker Edwards. *Graded persistence diagrams and persistence landscapes*, Discrete and Computational Geometry, published online, 28pp. doi:10.1007/s00454-021-00316-1 arXiv:1904.12807 [math.AT]
27. Peter Bubenik and Nikola Milićević. *Homological Algebra for Persistence Modules*, Foundations of Computational Mathematics, published online, 46pp. doi:10.1007/s10208-020-09482-9 arXiv:1905.05744 [math.AT]
- 2020 26. Peter Bubenik and Alexander Wagner. *Embeddings of Persistence Diagrams into Hilbert Spaces*, Journal of Applied and Computational Topology, **4**, 339–351 (2020). doi:10.1007/s41468-020-00056-w arXiv:1905.05604 [cs.LG]
25. Peter Bubenik. *The persistence landscape and some of its properties*, In: Baas N., Carlsson G., Quick G., Szymik M., Thaulé M. (eds) Topological Data Analysis. Abel Symposia, vol 15. Springer, 2020. pp 97–117. doi:10.1007/978-3-030-43408-3_4 arXiv:1810.04963 [math.AT]
24. Peter Bubenik, Michael Hull, Dhruv Patel, and Benjamin Whittle. *Persistent homology detects curvature*, Inverse Problems, **36** (2020) 025008 (23pp). doi:10.1088/1361-6420/ab4ac0 arXiv:1905.13196 [cs.CG]
23. Paul Bendich, Peter Bubenik, and Alexander Wagner. *Stabilizing the unstable output of persistent homology computations*, Journal of Applied and Computational Topology, **4**, 309–338 (2020). doi:10.1007/s41468-019-00044-9 arXiv:1512.01700 [cs.CG]

- 2019 22. Vic Patrangenaru, Peter Bubenik, Robert L. Paige, and Daniel Osborne. *Challenges in Topological Object Data Analysis*, *Sankhya A*, **81** (2019), 244–271. doi:10.1007/s13171-018-0137-7 arXiv:1804.10255 [stat.ME]
- 2018 21. Peter Bubenik and Tane Vergili. *Topological spaces of persistence modules and their properties*, *Journal of Applied and Computational Topology*, **2** (2018), 233–269. doi:10.1007/s41468-018-0022-4 arXiv:1802.08117 [math.AT]
- 2017 20. Peter Bubenik, Vin de Silva, and Vidit Nanda. *Higher interpolation and extension of persistence modules*, *SIAM Journal on Applied Algebra and Geometry* **1** (2017), 272–284. doi:10.1137/16M1100472 arXiv:1603.07406 [math.AT]
19. Peter Bubenik and Pawel Dlotko. *A persistence landscapes toolbox for topological statistics*, *Journal of Symbolic Computation* **78** (2017), 91–114. doi:10.1016/j.jsc.2016.03.009 arXiv:1501.00179 [cs.CG]
- 2016 18. Violeta Kovacev-Nikolic, Peter Bubenik, Dragan Nikolic, and Giseon Heo. *Using persistent homology and dynamical distances to analyze protein binding*, *Statistical Applications in Genetics and Molecular Biology* **15** (2016) no. 1, 19–38. doi:10.1515/sagmb-2015-0057 arXiv:1412.1394 [stat.ME]
- 2015 17. Peter Bubenik, Vin de Silva and Jonathan Scott. *Metrics for generalized persistence modules*, *Foundations of Computational Mathematics* **15** (2015), no. 6, 1501–1531. doi:10.1007/s10208-014-9229-5 arXiv:1312.3829 [math.AT]
16. Peter Bubenik. *Statistical topological data analysis using persistence landscapes*, *Journal of Machine Learning Research* **16** (2015), 77–102. jmlr.org/papers/volume16/bubenik15a arXiv:1207.6437 [math.AT]
- 2014 15. Peter Bubenik and Jonathan A. Scott. *Categorification of persistent homology*, *Discrete and Computational Geometry* **51** (2014), no. 3, 600–627. doi:10.1007/s00454-014-9573-x arXiv:1205.3669 [math.AT]
14. Yuliy Baryshnikov, Peter Bubenik, and Matthew Kahle. *Min-Type Morse Theory for Configuration Spaces of Hard Spheres*, *International Mathematical Research Notices* **2014** (2014), no. 9, 2577–2592. doi:10.1093/imrn/rnt012 arXiv:1108.3061 [math.AT]
- 2012 13. Peter Bubenik. *A comment to “A microbiology primer for pyrosequencing”*, *Quantitative BioScience* **31** (2012), no. 2, 85–86. https://qbs.kmu.ac.kr:442/!Board/down.php?wd=4&bf_code=105
12. Peter Bubenik. *Simplicial models for concurrency*, *Electronic Notes in Theoretical Computer Science* **283** (2012), 3–12. doi:10.1016/j.entcs.2012.05.002 arXiv:1011.6599 [cs.DC]
- 2011 11. Peter Bubenik and Leah H. Gold. *Graph products of spheres, associative graded algebras and Hilbert series*, *Mathematische Zeitschrift* **268** (2011), no. 3–4, 821–836. doi:10.1007/s00209-010-0697-2 arXiv:0901.4493 [math.AT]
- 2010 10. Peter Bubenik, Gunnar Carlsson, Peter T. Kim, and Zhiming Luo. *Statistical topology via Morse theory, persistence, and nonparametric estimation*, *Algebraic Methods in Statistics and Probability II*, *Contemporary Mathematics* **516** (2010), 75–92. doi:10.1090/conm/516/10167 arXiv:0908.3668 [math.ST]
- 2009 9. Moo K. Chung, Peter Bubenik, and Peter T. Kim. *Persistence diagrams of cortical surface data*, in *Information Processing in Medical Imaging 2009*, *Lecture Notes in Computer Science* **5636** (2009), 386–397. doi:10.1007/978-3-642-02498-6_32
8. Peter Bubenik. *Models and van Kampen theorems for directed homotopy theory*, *Homology, Homotopy and Applications* **11** (2009), no. 1, 185–202. euclid.hha/1251832565 arXiv:0810.4164 [math.AT]

7. Peter Bubenik. *Context for models of concurrency*, Electronic Notes in Theoretical Computer Science **230** (2009), 3–21. doi:10.1016/j.entcs.2009.02.014 arXiv:math/0608733 [math.AT]
- 2008 6. George A. Bubenik and Peter Bubenik. *Palmated antlers of moose may serve as a parabolic reflector of sounds*, European Journal of Wildlife Research **54** (2008), 533–535. doi:10.1007/s10344-007-0165-4
5. Peter Bubenik. *Separated Lie models and the homotopy Lie algebra*, Journal of Pure and Applied Algebra **212** (2008), no. 2, 350–369. doi:10.1016/j.jpaa.2007.05.018 arXiv:math/0406405 [math.AT]
- 2007 4. Peter Bubenik and Peter T. Kim. *A statistical approach to persistent homology*, Homology, Homotopy and Applications **9** (2007), no. 2, 337–362. euclid.hha/1201127341 arXiv:math/0607634 [math.AT]
3. Peter Bubenik and John A.R. Holbrook. *Densities for random balanced sampling*, Journal of Multivariate Analysis **98** (2007), no. 2, 350–369. doi:10.1016/j.jmva.2006.01.007 arXiv:math/0608737 [math.ST]
- 2006 2. Peter Bubenik and Krzysztof Worytkiewicz. *A model category for local po-spaces*, Homology, Homotopy and Applications **8** (2006), no. 1, 263–292. doi:10.4310/HHA.2006.v8.n1.a10 arXiv:math/0506352 [math.AT]
- 2005 1. Peter Bubenik. *Free and semi-inert cell attachments*, Transactions of the American Mathematical Society **357** (2005), no. 11, 4533–4553. doi:10.1090/S0002-9947-05-03989-9 arXiv:math/0312387 [math.AT]

PhD Dissertation

- 2003 1. Peter Bubenik. *Cell attachments and the homology of loop spaces and differential graded algebras*, Ph.D. thesis, University of Toronto (2003), v+108pp. arXiv:math/0601421 [math.AT]

Conference abstracts (peer-reviewed and/or invited)

- 2015 3. Peter Bubenik. *Persistent homology and Hilbert spaces*, in *Computational Geometric and Algebraic Topology*, abstracts from 11 October – 17 October 2015, organized by Benjamin Burton, Herbert Edelsbrunner, Jeff Erickson, and Stephan Tillmann. Oberwolfach Report No. 45 (2015), draft 41–43. preliminary_OWR.2015
- 2008 2. Peter Bubenik. *Statistical persistent homology*, in *Computational Algebraic Topology*, abstracts from June 29th – July 5th, 2008, organized by Gunnar Carlsson and Dmitry Kozlov, Oberwolfach Report No. 29 (2008), 1611–1613. 10.4171/OWR/2008/29
- 2004 1. Peter Bubenik. *Context for models of concurrency*, in *Proceedings of the Workshop on Geometry and Topology in Concurrency and Distributed Computing*, Amsterdam, The Netherlands, BRICS Notes Series (2004), no. 2 33–49. NS-04-2

Other publications

- 2003 3. Zhi-Ming Luo, Peter Bubenik, and Peter T. Kim. *Closed model categories for presheaves of simplicial groupoids and presheaves of 2-groupoids*, 17pp. arXiv:math/0301045 [math.AT]
- 1997 2. Peter Bubenik. *A quasi-isomorphism for $\tilde{C}_*(X)$* . Master's Thesis, University of Toronto (1997), 9pp.
- 1994 1. Peter Bubenik and J.J. Simpson, A. Frumkin, H. Schwarcz, and D.C. Ford) *U-series dating of speleothems by gamma spectrometry*. Manuscript # (GWP)²-NP94-03, (1994), 5pp.

Lecture series, lectures, and presentations (153 total)

Lecture series

- 2021 38th Annual Workshop in Geometric Topology, Texas Christian Univ, Forth Worth TX, (Plenary speaker): Topological Data Analysis [3 hours of lectures] (online)
- 2019 Jan. Kyoto University, Japan (Plenary speaker): Learning geometry using topology and persistence landscapes, Algebraic distances for persistent homology [2 hours of lectures]
- 2017 Jan. Ocoyoacac, Mexico, (CIMAT): Topological Data Analysis [12 hours of lectures and workshops]
- 2016 June Brookings, South Dakota (MAA Summer Seminar): Topological Data Analysis [2 hours of lectures and a 3 hour workshop]
- 2015 Dec. Queretaro, Mexico (CIMAT): Topological Data Analysis [3 hours of lectures]
- Feb. Sendai, Japan (Tohoku Univ.): Topological Data Analysis [3 hours of lectures]

Keynote talk

- 2021 Feb. University of North Carolina - Greensboro. Helen Barton Lecture: Summaries and Distances in Topological Data Analysis (online)
- 2018 Nov. U. of Manitoba, Canada. Faculty of Science Interdisciplinary speaker series: Learning the shape of data

Plenary speaker

- 2019 June Ohio State University 1st Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning. Learning the shape of data using persistence landscapes

Invited (international audience)

- 2021 July Mathematical Congress of the Americas, Buenos Aires, Argentina: Adjoint functors and symmetric monoidal categories for topological data analysis (online)
- July Metrics in Multiparameter Persistence, Lorentz Center, Univ Leiden, Netherlands (online)
- 2020 Dec. NeurIPS 2020, Vancouver, BC, Canada: Topological Data Analysis for Cell Biology Images (online)
- Oct. Applied Algebraic Topology Research Network: Homological Algebra for Persistence Modules (online)
- June SIAM Conference on Mathematics of Data Science (MDS20), Cincinnati, OH: Topological Data Analysis for Biological Images (online)
- 2019 Dec. Canadian Mathematical Society Winter Meeting, Toronto, ON, Canada: Distances and Angles for Topological Data Analysis
- July SIAM Conference on Applied Algebraic Geometry, Bern, Switzerland: Algebraic distances for persistent homology
- 2018 June Abel Symposium, Geiranger, Norway: Multiparameter Persistence and Generalized Morse Theory
- May TGDA@OSU TRIPODS, Columbus, OH: Topological spaces of persistence modules and their properties
- 2017 Dec. Brown U. (NSF TRIPODS workshop) Topological Data Analysis for Geometry not Topology
- Aug. Banff, Canada (BIRS): A pictorial approach to persistent homology
- July Barcelona, Spain (FoCM 2017): Stabilizing the unstable output of persistent homology computations
- May Bonn, Germany (HIM): Stabilizing the unstable output of persistent homology computations
- Jan. Atlanta, GA (AMS National Meeting): An Introduction to Topological Data Analysis
- Jan. Atlanta, GA (AMS National Meeting): Discovering Geometry using Topological Data Analysis
- 2016 Nov. Montreal, Canada (CRM): Probabilistic Persistent Homology
- Sept. Columbus, OH (MBI): Topological analysis of biological data using persistence landscapes

- July Toronto, Canada (World Congress in Probability and Statistics): An Introduction to Topological Data Analysis
- May Columbus, OH: Higher Interpolation and Extension for Persistence Modules
- Apr. Oxford, UK: Topological Data Analysis
- 2015 Oct. Oberwolfach, Germany: Persistent homology and Hilbert spaces
- Aug. Victoria, Canada: Topological Data Analysis and Machine Learning
- June Toronto, Canada (Fields): Topological Data Analysis and Representation Theory
- 2014 Nov. Copenhagen, Denmark: Statistical Topological Data Analysis
- Oct. Applied Algebraic Topology Research Network: Statistical Topological Data Analysis
- Oct. Halifax, Canada: Category theory in Topological Data Analysis
- May Vancouver, Canada: Generalized persistence modules, stability and generalized factors
- May Toronto, Canada (Fields): Statistical topological data analysis using persistence landscapes
- Feb Research Triangle Park, NC (SAMSI): Statistical topological data analysis
- 2013 July Bedlewo, Poland: Persistent homology, metrics on diagrams and metric space valued functions
- July Bremen, Germany: Metrics on diagrams and persistent homology
- 2012 Oct. Banff, Canada (BIRS): Inference using a new topological statistic, the persistence landscape
- May Columbus, OH (MBI): Toward statistical topology
- Jan. U. Pennsylvania Applied Topology Seminar: Persistence landscapes and categorification
- Jan. Boston, MA (AMS National Meeting): Persistent homology and statistical inference
- 2010 Jan. Aalborg, Denmark: Cubes, simplices, horns and necklaces: concurrency and quasi-categories
- 2009 Aug. Cleveland State U. (NSF/CBMS): Algebraic topology and statistics
- Mar. Banff, Canada (BIRS): Persistent homology and nonparametric regression
- Jan. Washington, DC (AMS National Meeting): Estimating the topology of functions on manifolds
- 2008 June Oberwolfach, Germany: Statistical persistent homology
- 2006 Sept. Berkeley, CA (MSRI): A statistical approach to persistent homology
- May London, Canada (SSC Annual Meeting): A statistical approach to persistent homology
- 2005 Mar. Montpellier, France: Using context and model categories to define directed homotopies
- Feb. Ottawa, Canada: Persistent homology and the analysis of high dimensional data (two talks given on behalf of Gunnar Carlsson)
- 2004 July London, Canada: Towards a model category for local po-spaces

Contributed (international audience)

- 2008 July Paris, France: Extremal models of concurrent systems, and directed van Kampen theorems
- 2006 Oct. Berkeley, CA (MSRI): Quillen and concurrency
- 2005 Feb. Ottawa, Canada: Persistent homology and directional statistics
- 2004 Oct. Amsterdam, Netherlands: Context for models of concurrency

Invited (domestic audience; not including seminars)

- 2021 Aug. Air Force Institute of Technology (math and stats colloquium) Topological Data Analysis (online)
- Feb. Northeastern University (math colloquium) Summaries and Distances in Topological Data Analysis (online)
- 2020 Nov. United States Military Academy West Point (math colloquium) Topological Data Analysis for Cell Biology Images (online)
- 2019 Apr. U. of Tennessee – Knoxville (math colloquium) An introduction of topological data analysis
- 2018 Sept. Northeastern U. (math colloquium) Mathematical aspects of topological data analysis
- 2017 Oct. Florida State U. (math colloquium) Topological data analysis
- Feb. U. Florida: Persistent homology
- 2014 Nov. Arlington, VA (AFOSR): Statistical topological data analysis

- June U. Florida (math colloquium): Topological data analysis
- 2013 Dec. Arlington, VA (AFOSR): Statistical inferences from the topology of complex networks
- Feb. Ohio State U. (math colloquium): Categorification in applied topology
- 2012 Feb. Incline Village, NV (DARPA): Categorification of applied topology
- 2010 Nov. Case Western Reserve U. (math colloquium) Topology, statistics and brain imaging
- Oct. U. Virginia (stats colloquium): Nonparametric regression for topology, and brain imaging
- 2008 Oct. Kalamazoo, MI (AMS sectional meeting): An introduction to directed homotopy theory
- Apr. U. Akron (math colloquium): Directed and concurrent computing
- 2005 Feb. Cleveland State U. (math colloquium): A mathematical model for concurrent systems
- 1995 May U. Manitoba, Winnipeg, Canada (Can Undergrad Math Conf): Random balanced samples

Seminars and other specialized topics talks

- 2020 Nov. U. Florida Topology and Dynamics: Topology and Deep Learning (online)
- 2019 Sept. U. Florida Topology and Dynamics: Algebraic distances for persistent homology
- Nov. U. Florida SIAM: An introduction to Topological Data Analysis
- May. SCMB PI talk: Learning Geometry in Biological Images using Topological Data Analysis
- 2018 Oct. U. Florida Topology and Dynamics: The persistence landscape and some of its properties
- Aug. Georgia Tech U. SCMB Kickoff: Learning the shape of data
- Feb. Michigan State U. Machine Learning: Learning the shape of data
- 2017 Sept. U. Florida Topology and Dynamics: Topological spaces of persistence modules (2 talks)
- 2016 Feb. U. Florida Topology and Dynamics: Interpolation and Extension of Persistence Modules
- 2016 Feb. U. Florida Topology and Dynamics: Interleaving, Gromov-Hausdorff, and dynamical systems
- 2015 Sept. U. Florida Comp. Inf. Sci. & Eng. Algorithms and Theory: Learning the shape of data
- Sept. U. Florida Topology and Dynamics: Persistent homology (2 talks)
- 2014 Fall Cleveland State U. Topology-Geometry-Algebra: Representations and persistence (5 talks)
- Spr. Cleveland State U. Topology-Geometry-Algebra: Random simplicial complexes (3 talks)
- 2013 Nov. Ohio State U. Topology, Geometry, Data: A central limit theorem for topology
- Nov. IAS/Penn/Rutgers Workshop on Topology: A central limit theorem for topology
- Spr. Cleveland State U. Topology-Geometry-Algebra: Polynomial differential forms (5 talks)
- 2011 Spr. Cleveland State U. Topology-Geometry-Algebra: Discrete Morse Theory (6 talks)
- 2010 Feb. Ohio State U. Geometry Topology Data: Assembling geometric data, statistics & topology
- 2009 Apr. Penn State U. Altoona Topology: Directed homotopy theory
- Apr. Wayne State U. Topology: Directed homotopy theory
- 2008 Nov. Duke U. Probability: Estimating the topology of functions on manifolds from noisy samples
- Nov. U. Oregon Topology: An introduction to directed homotopy theory
- Mar. John Carroll U. Geometry/Topology: Directed van Kampen theorems (2 talks)
- 2007 Nov. John Carroll U. Geometry/Topology: Directed topology and concurrent systems (2 talks)
- Aug. U. Guelph Mathematics and Computer Science: A mathematical model for parallel computing
- 2005 Oct. John Carroll U. Geometry/Topology: The geometry and topology of point cloud data
- May EPFL Statistics: A statistical approach to algebraic topology
- Feb. Stanford U. Applied Topology: A statistical approach to persistent homology
- 2004 Nov. U. Guelph Mathematics: A mathematical model for concurrent systems

Outreach talks, panels, and other presentations

- 2018 Mar. U. Florida Informatics Institute Annual Symposium: Topological Data Analysis and Hyperspectral Imaging
- Jan. U. Florida Data Science Institute Symposium: Learning the shape of data
- 2017 Mar. U. Florida Graduate Mathematics Association Colloquium: Geometry, Algebra, Topology and Data

- Jan. National Intelligence University, Advanced Data Analytics Curriculum Development Workshop
- 2015 Sept. U. Florida Graduate Mathematics Association Colloquium: Topological Data Analysis
- 2014 July NASA Glenn Research Center (Summer intern seminar): An introduction to computational topology and topological data analysis
- 2012 Feb. Cleveland State U. Undergraduate Student Seminar: Surfaces using paper, scissors and tape
- 2011 Mar. Cleveland State U. Undergraduate Student Seminar: Hands-on knot theory
- 2010 Sept. Cleveland State U. Undergraduate Student Seminar: Hands-on knot theory

Organizing activities (conferences, meetings, etc.)

- 2020 June Organizer (with Vidit Nanda, Don Stanley, and Stephen Theriault): Workshop on Topological Data Analysis, Fields Institute, Toronto, ON, Canada (online).
- 2020 June Scientific Committee Member: Algebraic Topology: Methods, Computation, and Science, Ohio State University, Columbus, OH (postponed due to COVID-19).
- 2020 Jan. Organizer: University of Florida Topological Data Analysis conference.
- 2019 Nov. Organizer (with Natasha Jonoska): AMS Special Session on Applied Topology: Theory and Applications. U Florida.
- 2018 Aug. Organizer (with Ryan Budney and Michael Lesnick): CMO/BIRS workshop on Multi-parameter Persistent Homology at Casa Matematica Oaxaca (CMO), Mexico.
- 2018 June Scientific Committee Member (with Ulrich Bauer, Paul Bendich, Benjamin Burton, Tamal Dey, Michael Lesnick, Frank Lutz, and Amit Patel): Algebraic Topology: Methods, Computation and Science, IST Austria.
- 2018 May Scientific Committee (with Larry Wasserman): TRIPODS Center Workshop on Theory and Foundations of Topology Geometry and Data Analysis, Columbus, OH.
- 2017 Feb. Organizer (with Phil Boyland): UF/FSU Topology and Dynamics Conference, Gainesville, FL
- 2017 Jan. Organizer: Applied Algebraic Topology Research Network Seminar Series (6 speakers)
- 2016 Sept. Organizer: Applied Algebraic Topology Research Network Seminar Series (6 speakers)
- 2016 Jul. Scientific Committee Member (with Omer Bobrowski, Jacek Brodzki, Massimo Ferri, Elizabeth Munch, Giovanni Petri, Radmila Sazdanovic, Francesco Vaccarino, and Dhandapani Yogeshwaran): Conference on Applied Topology: Computation, Methods, and Science, Turin, Italy
- 2016 Jan. Organizer: Applied Algebraic Topology Research Network Seminar Series (8 speakers)
- 2015 Oct. Organizer: Applied Algebraic Topology Research Network Seminar Series (5 speakers)
- 2015 Jan. Organizer: Applied Algebraic Topology Research Network Seminar Series (12 speakers)
- 2014 Sept. Organizer: Applied Algebraic Topology Research Network Seminar Series (9 speakers)
- 2013 Aug. Organizer (with Dmitriy Morozov and Mikael Vejdemo Johansson): SIAM Mini-symposium on Applied and Computational Topology at the Conference on Applied Algebraic Geometry, Fort Collins, CO
- 2012 Oct. Lead Organizer (with Matthew Kahle): Special Session on Applied Topology at the AMS Sectional Meeting, Akron, OH
- 2009 Aug. Lead Organizer (with John Oprea): NSF/CBMS conference on Algebraic Topology in Applied Mathematics at Cleveland State University
NSF DMS-0834140: \$34,108 (lead PI)
- 2009 Mar. Lead Organizer (with Gunnar Carlsson and Peter T. Kim): BIRS Workshop on Data Analysis using Computational Topology & Geometric Statistics at Banff, Canada

Advisory boards

2017 – Applied Algebraic Topology Research Network <https://topology.ima.umn.edu/> Summary: Promotes and enables collaboration in algebraic topology applied to the sciences and engineering by connecting researchers through a virtual institute. Seed funding provided by the Institute for Mathematics and its Applications (IMA).

Referee and review activities

Journals refereed (62 total)

Advances in Mathematics
 Algebraic and Geometric Topology
 Annals of Applied Statistics
 Applicable Algebra in Engineering, Communication and Computing
 Bernoulli Journal
 Bulletin of Mathematical Biology
 Discrete and Computational Geometry
 European Journal of Applied Mathematics
 Foundations of Computational Mathematics
 Glasgow Mathematical Journal
 Homology, Homotopy and Applications
 IEEE Transactions on Network Science and Engineering
 Inverse Problems
 International Journal of Computational Geometry and Applications
 Journal of Applied and Computational Topology
 Journal of Computational Geometry
 Journal of Homotopy and Related Structures
 Journal of Machine Learning Research
 Journal of Mathematics and Music
 Journal of Multivariate Analysis
 Journal of Pure and Applied Algebra
 Journal of Topology
 Mathematical Methods in the Applied Sciences
 Physica D
 Proceedings of the American Mathematical Society
 Proceedings of the National Academy of Sciences
 SIAM Journal of Applied Algebra and Geometry
 Theoretical Computer Science
 Theory and Applications of Categories
 Topological Methods in Nonlinear Analysis
 Topology Proceedings
 Transactions on Pattern Analysis and Machine Intelligence

Conference proceedings refereed

AWM/Springer
 Abel Symposium

Conferences refereed

Algebraic Topology: Computation, Methods and Science (ATMCS)
 Symposium on Computational Geometry (SOCG)

Granting agencies review panel

National Science Foundation (NSF)

Granting agencies ad-hoc reviewer(10 total)

Air Force Office of Scientific Research (AFOSR)
 Army Research Office (ARO)
 Banff International Research Station (BIRS)
 Department of Energy (DOE)
 Israel Science Foundation (ISF)
 National Science Foundation (NSF)
 National Sciences and Engineering Research Council of Canada (NSERC)

Books refereed

Cambridge University Press
 Springer (2 reviews)
 American Mathematical Society

External reviewer for PhD defense

Ecole polytechnique, Theo Lacombe (student of Steve Oudot and Marco Cuturi), 2020
 Oxford Univ, Oliver Vipond (student of Ulrike Tillmann and Vidit Nanda), 2021

Miscellaneous review activities

- Book chapter – Springer
- Tenure and Promotion External Letter
- External M.Sc. thesis review (for Violeta Kovacev-Nikolic, student of Giseon Heo, University of Alberta, 2012)
- *AMS Mathematical Reviews* reviewer (26 reviews)

Teaching activities

Course development at Florida

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| 2017 | Special Topics in Mathematics: Topological Data Analysis (MAT 4930) I developed a new course to introduce our undergraduate students to topology and how it can be used in applications, and also to introduce some of the most important tools in modern data science. |
| 2017 | Advanced Topics in Topology 2 (MAT 6932) I have developed a course to introduce our graduate students to some powerful mathematical tools for organizing mathematical structures and computations: category theory, homological algebra and spectral sequences. |
| 2016 | Advanced Topics in Topology (MTG 7396) I have developed a course to introduce our graduate students to new areas of current research in topology and their connections with other areas of mathematics and the sciences. |

Course development at Cleveland State

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|-----------|---|
| 2015 | Special Topics in Mathematics – Topology (MTH 493/593) I developed a new course in Topological Data Analysis, accessible to students without prior knowledge of topology, in which they spent half of their class time in a computer lab learning to use Matlab to analyze data with topological tools. |
| 2008–2013 | Real Analysis (MTH 381 and MTH 415/515) This course had not been taught in many years. I redeveloped it and led the creation of a new cross-listed course accessible to undergraduate and graduate students to help ensure its viability. |

Courses taught at Florida

- 2021 Spring Elements of/Introduction to Topology 2 (MTG 4303/5317)
- 2020 Fall Special Topics – Topological Data Analysis and Machine Learning (MAT 4930)
- 2020 Spring Advanced Topics in Topology 2 (MTG 7347)
- 2019 Fall Advanced Topics in Topology 1 (MTG 7346)
- 2019 Spring Topology 2 (MTG 6347)
- 2018 Fall Topology 1 (MTG 6346)
- 2018 Spring Elements of/Introduction to Topology 2 (MTG 4303/5317)
- 2017 Fall Elements of/Introduction to Topology 1 (MTG 4302/5316)
- 2017 Fall Special Topics – Topological Data Analysis (MAT 4930)
- 2017 Spring Advanced Topics in Topology 2 (MAT 6932)
- 2016 Fall Advanced Topics in Topology (MTG 7396)
- 2016 Spring Topology 2 (MTG 6347)
- 2015 Fall Topology 1 (MTG 6346)

Courses taught at Cleveland State

- 2015 Spring Special Topics in Mathematics – Topology (MTH 493/593)
- 2014 Spring Calculus 2 (MTH 182)
- 2013 Fall Real Analysis (MTH 415/515)
- 2013 Spring Junior Seminar (MTH 396)
- 2013 Spring Calculus 1 (MTH 181)
- 2012 Fall Linear Algebra/Functions of Several Variables (MTH 514)
- 2012 Fall Calculus 1 (MTH 181)
- 2011 Summer Calculus 1 (MTH 181)
- 2011 Summer Precalculus 1 (MTH 167)
- 2011 Spring Calculus 1 (MTH 181)
- 2011 Spring Precalculus 2 (MTH 168)
- 2010 Fall Special Topics - Topology (MTH 493/593)
- 2010 Fall Statistical Methods (MTH 323)
- 2010 Spring Junior Seminar (MTH 396)
- 2010 Spring Precalculus 2 (MTH 168)
- 2009 Fall Geometry (MTH 333)
- 2009 Fall Multivariable Calculus (MTH 281)
- 2009 Spring Differential Geometry (MTH 434/534)
- 2009 Spring Junior Seminar (MTH 396)
- 2009 Spring Precalculus 1 (MTH 167)
- 2008 Fall Honors Calculus 2 (MTH 182H)
- 2008 Spring Analysis (MTH 381)
- 2008 Spring Honors Calculus 2 (MTH 182H)
- 2007 Fall Geometry (MTH 333)
- 2007 Fall Honors Calculus 2 (MTH 182H)
- 2007 Spring Geometry (MTH 333)
- 2007 Spring Honors Calculus 2 (MTH 182H)
- 2006 Spring Honors Calculus 2 (MTH 182H)
- 2006 Spring Calculus 2 (MTH 182)
- 2005 Fall Calculus 1 (MTH 181)

Courses taught at Toronto

- 2001 Fall Calculus 1 (MAT 186)

Seminars organized at Florida

2016 Spring Student Applied Topology Seminar: I started this new weekly seminar in which eight students gave talks.

Mentoring activities

Postdocs mentored at Florida

2021– Johnathan Bush
 2019– Matthew Wheeler
 2019–2021 Ashleigh Thomas
 2018–2019 Michael Hull (now Assistant Professor at UNC-Greensboro)
 2016–2018 Michael Catanzaro (now Assistant Professor at Iowa State Univ)

Ph.D. students advised at Florida

2018– Iryna Hartsock
 2017– Alexander Elcheson
 2017–2021 Nikola Milicevic, graduated May 2021 (now a 2-year postdoc at Penn State Univ)
 2016–2020 Parker Edwards, graduated May 2020 (now a 3-year postdoc at Univ of Notre Dame)
 2016–2020 Alexander Wagner, graduated May 2020 (now a Phillip Griffiths Assistant Research Professor at Duke Univ)
 2016–2018 Leo Betthausen, graduated Dec 2018 (now at Microsoft Research)

Masters students supervised at Florida

2017–2018 Dhruv Patel (now PhD student in Statistics at UNC-Chapel Hill)

Undergraduate students supervised at Florida

2020–2021 Vishweshwar Ramanakumar: Topological data analysis and deep neural networks
 2020–2021 Max Zhang: Topological data analysis and deep neural networks (transferred to Cornell Univ)
 2020– Genesis Escobar: Topological data analysis and computer vision
 2019–2020 Gianfranco Cortes: Multiparameter persistent homology
 2019–2020 David Freeman: Topological data analysis of biological images (now a PhD student in Atmosphere Ocean Science and Mathematics at the Courant Institute)
 2019 Ana Pilar Ysasi Cillero: Persistent homology of random walks (now a graduate student at the Univ of Chicago)
 2018–2020 Jose Bouza: Topological Data Analysis Tools for R (now a graduate student in Computer Science at Univ of Florida)
 2016–2018 Samuel Rizzo: Topological Data Analysis of fMRI data (now a graduate student in Mathematics at Vanderbilt)
 2016–2017 Dhruv Patel: Persistent Homology and Curvature (now a PhD student in Statistics at UNC-CH)
 2015–2018 Benjamin Whittle: Persistent Homology and Curvature

Visiting researchers at Florida

2016–2017 Tane Vergili (now at Karadeniz Technical University, Trabzon, Turkey)

Other graduate student independent study supervised at Florida

- 2016 Nicolas Sizemore: Representation Theory of Quivers
 2015 Alexander Gruber: Persistence Landscapes

Undergraduate Minority/Multicultural Mentoring (UMMP) at Florida

- 2019–2020 Xinyi Zhang
 2018–2019 Emma Viola
 2016–2017 Dylan Santalo

Masters students advised at Cleveland State

- 2013–2014 Luo Yixi: Persistent homology of random polynomials
 2011–2012 Brian Feister: Topology, geometry and brain imaging

Visiting Masters students mentored

- 2013–2014 Coralie Spahn (EPFL, Switzerland; at Cleveland State)

Undergraduate students supervised at Cleveland State

- 2014 Zachary McCarthy: Color theory and matrix groups
 2014 Kelton Anderson: Knot theory
 2013–2014 Matthew McDonald: Moiré patterns
 2010–2011 Arlist Hunter: Complex analysis
 2010–2011 Eden Kovacic: Knot theory
 2010–2011 Daniel Limeer: Probability theory and graphs

University service

University committees at Cleveland State

- 2012 – 2014 College Budget and Planning
 2011 – 2014 University Research Council
 2010 – 2014 Graduate Council

Departmental service

Departmental committees at Florida

- 2020 – 2021 Tenure and Promotion Committee
 2019 – 2020 Tenure-track Faculty Search Committee (Chair, hired two tenure-track faculty)
 2019 – 2021 Chair's Advisory Committee
 2018 – 2021 VAP (Postdoc) Search Committee (Chair)
 2017 – 2018 Faculty Search Committee (hired six tenure-track faculty)
 2016 – 2018 Steering Committee (Speaker: 2017 – 2018)
 2016 – 2021 Hiring Plan Committee
 2015 – 2016 Postdoc Search Committee (Chair)
 2015 – 2021 Colloquium, Conferences, Visitors & Travel
 2015 – 2021 PhD Topology Exam Committee (Chair: 2018 – 2019)
 2015 – 2021 First-Year Topology Exam Committee (Chair: 2017 – 2018)

Mentoring at Florida

- 2021 – Hubert Wagner
 2021 – Johnathan Bush

2019 – 2020 Ashleigh Thomas
 2019 – 2020 Matthew Wheeler
 2018 – Luca Di Cerbo

Departmental committees at Cleveland State

2013 – 2014 Appointments (chair)
 2013 – 2014 Graduate Program
 2010 – 2011 Appointments (chair)
 2010 – 2011 Graduate Program
 2009 – 2010 Graduate Program (chair)
 2009 – 2010 Colloquium (chair)
 2007 – 2011 Appointments
 2007 – 2010 Undergraduate Advising
 2007 – 2010 Library
 2007 – 2008 Computer Needs and Math Lab
 2005 – 2006 Graduate Program

Departmental committees at Toronto

2000 – 2001 Graduate
 1998 – 1999 Graduate

Dissertation committees

Mahdi Kouretchian (in progress, Florida, Mathematics)
 Deep Kundu (in progress, Florida, Mathematics)
 Jamie Scott (in progress, Florida, Mathematics)
 Trevor Davila (2020, Florida, Mathematics)
 Alexander Gruber (2019, Florida, Mathematics)
 Lacey Johnson (2019, Florida, Mathematics)
 Joshua Hiller (2017, Florida, Mathematics)
 Ryan Madden (2016, Cleveland State, Mechanical Engineering)

Publicity

Publicity at Florida

2018 May NSF: Announcement of NSF/Simons \$10M Center
 2018 May Simons Foundation: Announcement of NSF/Simons \$10M Center
 2018 May GATech: Announcement of NSF/Simons \$10M Center
 2018 June Florida CLAS: Article on NSF/Simons \$10M Center
 2016 Feb. Article in the Feb/Mar 2016 issue of the MAA Focus magazine advertising the MAA Summer School for which I was the keynote speaker.

Publicity at Cleveland State

2014 Mar. Article in Engaged, CSU eDigest, on my persistence landscape.
 2014 Apr. CSU Office of Research: Featured Researcher video
 2013 Apr. Cleveland Stater: Front page article on AFOSR grant
 2013 Mar. Engaged, CSU blog: Article on geometry of complex data
 2008 Mar. Plain Dealer (Cleveland daily): Front page article on antlers and sound
 2008 Mar. NPR/CBC As it happens: National broadcast on antlers and sound
 2008 Mar. Ottawa Citizen (daily newspaper): Article on antlers and sound
 2008 Mar. National Post (Canadian daily): Article on antlers and sound
 2008 Mar. The Guardian: Article on antlers and sound
 2008 Mar. The Independent: Article on antlers and sound
 2008 Mar. BBC: Article on antlers and sound