

# Curriculum Vitae

## PETER BUBENIK

Office Address: University of Florida                      Office Phone: +1-352-294-2342  
Mathematics Department                      Email Address: peter.bubenik@ufl.edu  
PO Box 118105                      Homepage: http://people.clas.ufl.edu/peterbubenik  
Gainesville, FL 32611-8105                      Date of CV: January 2019

### Education/Employment

2015 – Associate Professor of Mathematics, University of Florida  
2010 – 2015 Associate Professor of Mathematics, Cleveland State University  
2005 – 2010 Assistant Professor of Mathematics, Cleveland State University  
2003 – 2005 Postdoctoral Fellow, Swiss Federal Institute of Technology at Lausanne (EPFL)  
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

2018 – 2023 NSF/Simons Research Center: Southeast Center for Mathematics and Biology, Simons award number 594594, Research subgrant RK153-G2 (\$531,120)  
2018 – 2021 ARO Research Award W911NF1810307, A topological heat map for data analysis (\$429,881)  
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, statistics, category theory, algebra, algorithms, geometry, machine learning, biology and other applications.

### Publications (with hyperlinks in electronic version)

#### Submitted journal articles

3. (with Jonathan Scott and Donald Stanley) *Wasserstein distance for generalized persistence modules and abelian categories*, 31pp. arXiv:1809.09654 [math.RA]
2. (with Vin de Silva and Jonathan Scott) *Categorification of Gromov-Hausdorff Distance and Interleaving of Functors*, 34pp. arXiv:1707.06288 [math.CT]
1. (with Paul Bendich and Alexander Wagner) *Stabilizing the unstable output of persistent homology computations*, 22pp. arXiv:1512.01700 [cs.CG]

## Peer-reviewed research articles

- 2019 23. *The persistence landscape and some of its properties*, Proceedings of the 2018 Abel Symposium, 18pp. (accepted) arXiv:1810.04963 [math.AT]
- 2018 22. (with Tane Vergili) *Topological spaces of persistence modules and their properties*, Journal of Applied and Computational Topology, (2018) 37pp. (published online) doi:10.1007/s41468-018-0022-4 arXiv:1802.08117 [math.AT]
21. (with Vic Patrangenaru, Robert L. Paige, and Daniel Osborne) *Challenges in Topological Object Data Analysis*, Sankhya A, (2018) 16pp. (published online). doi:10.1007/s13171-018-0137-7 arXiv:1804.10255 [stat.ME]
- 2017 20. (with 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. (with 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. (with Violeta Kovacev-Nikolic, 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. (with 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. *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. (with 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. (with Yuliy Baryshnikov 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. *A comment to “A microbiology primer for pyrosequencing”*, Quantitative Bio-Science **31** (2012), no. 2, 85–86.
12. *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. (with 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. (with 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. (with Moo K. Chung 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. *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. *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. (with George A. 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. *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. (with 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. (with 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. (with 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. *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. *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. *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. *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. *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. (with Zhi-Ming Luo 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. *A quasi-isomorphism for  $\tilde{C}_*(X)$* . Master’s Thesis, University of Toronto (1997), 9pp.
- 1994 1. (with J.J. Simpson, A. Frumkin, H. Schwarcz, and D.C. Ford) *U-series dating of speleothems by gamma spectrometry*. Manuscript # (GWP)<sup>2</sup>-NP94-03, (1994), 5pp.

#### Lecture series, lectures, and presentations (134 total)

##### Lecture series

- 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. Mexico City, 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

- 2018 Nov. U. of Manitoba, Canada. Faculty of Science Interdisciplinary speaker series: Learning the shape of data

## Invited (international audience)

- 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)

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

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 Hyper-spectral 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.)

- 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

### Editorial activities

2016 – Associate Editor, SIAM Journal on Applied Algebra and Geometry (SIAGA)

### Referee and review activities

Journals refereed (44 total)

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  
 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

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

#### Books refereed

Cambridge University Press  
 Springer, SpringerBriefs in Mathematics

#### Miscellaneous review activities

- 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 (25 reviews)

#### Teaching activities

##### Course development at Florida

- |      |   |
|------|---|
| 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

- |           |   |
|-----------|---|
| 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

- |      |        |  |
|------|--------|--|
| 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

- 2016–2018 Michael Catanzaro (now Assistant Professor at Iowa State Univ)

## Ph.D. students advised at Florida

- 2018– Iryna Kuz
- 2017– Alexander Elcheson
- 2017– Nikola Milicevic
- 2016– Parker Edwards
- 2016– Alexander Wagner
- 2016–2018 Leo Betthausen (now at Microsoft)

## Masters students supervised at Florida

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

## Undergraduate students supervised at Florida

- 2018– Jose Bouza: Topological Data Analysis Tools for R
- 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 (Ege University, İzmir, Turkey)

## Other graduate student independent study supervised at Florida

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

## Undergraduate Minority Mentoring (UMMP) at Florida

- 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

- 2018 – VAP (Postdoc) Search Committee (Chair)
- 2017 – 2018 Faculty Search Committee (hired six tenure-track faculty)
- 2016 – 2018 Steering (Speaker: 2017 – 2018)
- 2016 – Hiring Plan
- 2015 – 2016 Postdoc Search Committee (Chair)
- 2015 – Colloquium, Conferences, Visitors & Travel
- 2015 – PhD Topology Exam (Chair: 2018 – )
- 2015 – First-Year Topology Exam (Chair: 2017 – 2018)

## Mentoring at Florida

- 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

- Trevor Davila (in progress, Florida, Mathematics)
- Alexander Gruber (in progress, Florida, Mathematics)
- Lacey Johnson (in progress, 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