

# Parker B. Edwards

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Research interests: Algebraic and computational topology and geometry, machine learning, and applications.

## Employment and Education

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### Robert and Sara Lumpkins Postdoctoral Research Associate

DEPARTMENT OF APPLIED AND COMPUTATIONAL MATHEMATICS AND STATISTICS

University of Notre Dame

June 2020 - Present

### Ph.D., Mathematics

ADVISER: PETER BUBENIK

University of Florida

Aug. 2016 - May 2020

### Master of Science, Mathematics and the Foundations of Computer Science

ADVISERS: EMILIE DUFRESNE AND HEATHER HARRINGTON

University of Oxford

Oct. 2015 - Oct. 2016

### Software Development Intern

International Business Machines Corporation

June - Dec. 2014

### Bachelor of Science, Mathematics (minor: Computer Science)

University of Florida

Aug. 2011 - May 2015

## Publications

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- 2023 **Output Mode Switching for Parallel Five-bar Manipulators Using a Graph-based Path Planner. 2023 International Conference on Robotics and Automation (ICRA). IEEE, to appear.**  
<http://arxiv.org/abs/2209.10743>. Parker B. Edwards, Aravind Baskar, Caroline Hills, Mark Plecnik, and Jonathan D. Hauenstein.
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- 2022 **Aggregating Community Maps. In Proceedings of the 30th International Conference on Advances in Geographic Information Systems (SIGSPATIAL '22). Association for Computing Machinery.**  
<https://doi.org/10.1145/3557915.3560961> With Erin Chambers, Moon Duchin, Ranthony A.C. Edmonds, JN Matthews, Anthony E. Pizzimenti, Chanel Richardson, Parker Rule, and Ari Stern.
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- 2022 **Graded Persistence Diagrams and Persistence Landscapes. Discrete Comput Geom 67, 203-230 (2022).**  
<https://doi.org/10.1007/s00454-021-00316-1>. With Leo Betthausen and Peter Bubenik.
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- 2021 **TDAExplore: quantitative image analysis of fluorescence microscopy images through topology-based machine learning. Patterns (2021).** <https://doi.org/10.1016/j.patter.2021.100367>. Parker B. Edwards, Kristen Skruber, Nikola Milićević, James B Heidings, Tracy-Anne Read, Peter Bubenik, and Eric Vitriol.
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- 2021 **Certified evaluations of Hölder continuous functions at roots of polynomials. In Maple in Mathematics Education and Research. MC 2020. Communications in Computer and Information Science, vol 1414.**  
[https://doi.org/10.1007/978-3-030-81698-8\\_13](https://doi.org/10.1007/978-3-030-81698-8_13). With Jonathan Hauenstein and Clifford Smyth.
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- 2019 **Sampling Real Algebraic Varieties for Topological Data Analysis. In 2019 18th IEEE International Conference on Machine Learning and Applications (ICMLA) (pp. 1531-1536). IEEE.**  
<https://doi.org/10.1109/ICMLA.2019.00253>. With Emilie Dufresne, Heather Harrington, and Jonathan Hauenstein.
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- 2020 **A New Palette for Persistence Landscapes**, Ph.D. dissertation, University of Florida
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- 2016 **Topological Data Analysis for Real Algebraic Varieties**, M.Sc. dissertation, University of Oxford

## Submitted Articles

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- 2022 **Computing geometric feature sizes for algebraic manifolds. Submitted, 2022. 38 pages.**  
<https://arxiv.org/abs/2209.01654>. With Sandra Di Rocco, David Eklund, Oliver Gäfvert, and Jonathan Hauenstein
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## Honors and Scholarships

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- 2018 - 20 **Informatics Institute Fellowship**, funding for professional travel, U. Florida
- 2016- 20 **Graduate School Fellowship**, tuition and stipend, U. Florida
- 2016 **Prize for Excellence: Dissertation and Course**, M.Sc. in Math. and Foundations of C.S., U. Oxford
- 2016 **Distinction**, M.Sc. in Math. and Foundations of C.S., U. Oxford
- 2015 - 16 **Frost Scholarship**, tuition and stipend, U. Oxford
- 2015 **Phi Beta Kappa**, Florida Chapter Beta
- 2015 **Magna cum laude**, B.S. in Mathematics, U. Florida
- 2015 **Pi Mu Epsilon Undergraduate Award**, U. Florida Mathematics Dept.
- 2013 **Anderson Scholar**, U. Florida College of Liberal Arts and Science

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## Mathematical Software

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- 2022 **HomologyInferenceWithWeakFeatureSize.jl**, a Julia package for computing weak feature sizes of algebraic manifolds and using them for homology inference,  
<https://github.com/P-Edwards/HomologyInferenceWithWeakFeatureSize.jl>
- 2021 **TDAExplore**, an R library and command line tools for image analysis and exploration using topological features, <https://github.com/P-Edwards/TDAExplore-ML>
- 2021 **EvalCertification**, a Maple library to compute certified evaluations of functions at roots of polynomials, <https://github.com/P-Edwards/EvalCertification>
- 2018 **tdasampling**, a Python package to sample real algebraic varieties for topological data analysis, <https://github.com/P-Edwards/tdasampling>

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## Presentations

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Jan. 2023	<b>Joint Math Meetings: Spec. Session on Applied Enumerative Geometry</b> , Computing geometric feature sizes for algebraic manifolds	<i>Boston, MA</i>
Dec. 2022	<b>Optimization, Algebra, and Geometry Seminar (Invited)</b> , Feature Sizes and Bottlenecks for Algebraic Manifolds	<i>Carnegie Mellon/virt.</i>
Nov. 2022	<b>30th International Conference on Advances in Geographic Information Systems (SIGSPATIAL)</b> , Aggregating Community Maps	<i>Seattle, WA</i>
Oct. 2022	<b>Michigan State U., Topological Data Analysis Seminar (Invited)</b> , Exploratory Image Segmentation of Microscopy Images with Topological Data Analysis	<i>Michigan State U.</i>
Oct. 2022	<b>30th Fall Workshop on Computational Geometry</b> , Computing Geometric Feature Sizes for Algebraic Manifolds	<i>North Carolina State U.</i>
Oct. 2022	<b>NC State Symbolic Computation Seminar (Invited)</b> , Feature Sizes and Bottlenecks for Algebraic Manifolds	<i>North Carolina State U.</i>
Sept. 2022	<b>Felix Klein Seminar</b> , A computational theory for distance functions of algebraic manifolds	<i>U. Notre Dame</i>
June 2022	<b>Applied Topology: Methods, Computation, and Science 10</b> , Quantifying Topological Features in Microscopy Images	<i>U. Oxford</i>
May 2022	<b>AMS Western Sectional: Spec. Session on Computational Topology and Applications</b> , Computing geometric condition numbers for algebraic manifolds	<i>U. Denver/virt.</i>
Apr. 2022	<b>University of Oklahoma Topology and Data Science Seminar (Invited)</b> , Structure and Computations for Geometric Condition Numbers on Algebraic Manifolds	<i>U. Oklahoma/virt.</i>
Mar. 2022	<b>Workshop on Algebraic Combinatorics and Category Theory in Topological Data Analysis</b> , Graded Persistence Diagrams and Stability	<i>virt.</i>
Mar. 2022	<b>AMS Central Sectional: Spec. Session on Computational and Applied Algebraic Geometry</b> , Computing geometric condition numbers for algebraic manifolds	<i>Purdue U./virt.</i>
Nov. 2021	<b>AMS Southeast Sectional: Spec. Session on Topological data analysis and its applications in biological systems</b> , Quantifying topological features in microscopy images	<i>U. South Alabama/virt.</i>
Oct. 2021	<b>UT Knoxville Math Data Science Seminar (Invited)</b> , Exploratory Image Segmentation of Microscopy Images with Topological Data Analysis	<i>U. Tennessee, Knoxville</i>

July 2021	<b>Southeast Center for Mathematics and Biology Summer Seminar (Invited)</b> , Using Topological Data Analysis to Extract Spatial Information from Microscopy Datasets	Georgia Tech./virt.
Mar. 2021	<b>Notre Dame Applied Math Seminar</b> , Some Vignettes in Applied Topology	U. Notre Dame
Jan. 2020	<b>Workshop and Winter School on Geometric and Topological Data Analysis (Invited)</b> , Graded Persistence Diagrams and Persistence Landscapes	CIMAT, Guanajuato, Mexico
Oct. 2019	<b>UF Topology and Dynamics Seminar</b> , Stability for Graded Persistence Diagrams	U. Florida
Oct. 2019	<b>UF Applied Topology Seminar</b> , Feature Sizes for Real Semialgebraic Sets	U. Florida
July 2019	<b>SIAM Applied Algebraic Geometry 2019</b> , Sampling Real Algebraic Varieties for Topological Data Analysis	U. Bern, Switzerland
May 2019	<b>Midwest Student Conference on Geometric Data Analysis</b> , Sampling Real Algebraic Varieties for Topological Data Analysis	Ohio State U.
Apr. 2019	<b>UF SIAM Seminar</b> , Topological Data Analysis of Actin Networks	U. Florida
Mar. 2019	<b>UF Topology and Dynamics Seminar</b> , Graded Persistence Diagrams and Persistence Landscapes	U. Florida
June 2018	<b>Applied Topology: Methods, Computation, and Science 8</b> , Persistence Landscapes are Graded Persistence Diagrams	IST Austria
Mar. 2018	<b>UF Student Data Analysis Seminar</b> , The Topology of Cyclo-octane's Configuration Space	U. Florida Informatics Institute
Aug. 2017	<b>SIAM Applied Algebraic Geometry 2017</b> , Topological Data Analysis for Real Algebraic Varieties	Atlanta, Georgia
Oct. 2017	<b>UF Graduate Student Topology Seminar</b> , Algebraic Stability of Persistence Diagrams	U. Florida
Aug. 2017	<b>UF Student Data Analysis Seminar</b> , Finding Good Data Samples from Polynomial Systems	U. Florida Informatics Institute
Feb. 2017	<b>UF Graduate Student Topology Seminar</b> , Finding Matchings Between Persistence Diagrams	U. Florida
Feb. 2017	<b>Joint Florida State University/University of Florida Topology and Dynamics Meeting</b> , Extracting Topological Information from Systems of Polynomials	U. Florida
Feb. 2017	<b>Joint Math Meetings Mini-Symposium</b> , Topological Data Analysis for Real Algebraic Varieties	Atlanta, Georgia
Mar. 2015	<b>UF Graduate Student Topology Seminar</b> , Stability for Persistence Diagrams	U. Florida

## Teaching and Supervision

Fall 2021 - Present	<b>Advisor</b> , Marie Grasse, undergraduate student	U. Notre Dame
Fall 2021 - Present	<b>Advisor</b> , Hoai Trinh, undergraduate student	U. Notre Dame
Fall 2022	<b>Lecturer</b> , Applied Linear Algebra (ACMS 20620)	U. Notre Dame
Spring 2022	<b>Lecturer</b> , Applied Linear Algebra (ACMS 20620)	U. Notre Dame
Fall 2021	<b>Lecturer</b> , Special Topics in Applied Mathematics - Applied Topology (ACMS 80770)	U. Notre Dame
Spring 2021	<b>Lecturer</b> , Applied Linear Algebra (ACMS 20620)	U. Notre Dame
Fall 2020	<b>Lecturer</b> , Applied Linear Algebra (ACMS 20620)	U. Notre Dame
Spring 2019	<b>Lecturer</b> , Trigonometry (MAC 1114)	U. Florida
Fall and Spring 2018	<b>Discussion sections</b> , Calculus I (MAC 2311)	U. Florida
Fall 2017	<b>Discussion sections</b> , Precalculus Algebra with Trigonometry (MAC 1147)	U. Florida

## Service and Experience

2022	<b>Organizer: Special Session on Comp. and Applied Algebraic Geom., AMS Spring Central Sectional 2022</b>
2021	<b>Contributor: OPEN-Maps Redistricting and Communities of Interest Faculty Working Group.</b> <a href="https://megg.org/cois">https://megg.org/cois</a>
2021	<b>Outreach: Judge for Northern Indiana Regional Science and Engineering Fair</b>
2020-	<b>Referee: Journal of Applied and Computational Topology</b>
2020	<b>Referee: Foundations of Data Science</b>

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2018	<b>Member: U. Florida Mathematics Department Graduate Committee</b>
2018	<b>President: U. Florida Graduate Mathematics Association</b>
2017-19	<b>Organizer: UF Student Data Analysis Seminar</b>
2016	<b>Member: U. Oxford, Exeter College IT Committee</b>
2016-	<b>Member: American Mathematical Society</b>
2016-	<b>Member: Society of Industrial and Applied Mathematics</b>

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