MATTHEW L. WRIGHT

St. Olaf College
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EDUCATION

University of Pennsylvania (Philadelphia, Pennsylvania)   August 2011
Doctor of Philosophy in Mathematics
Thesis: *Hadwiger Integration of Definable Functions*
Advisor: Robert Ghrist

Messiah College (Grantham, Pennsylvania)   May 2006
Bachelor of Arts
Major in Mathematics and Computer Science, Minor in Spanish

EMPLOYMENT

Assistant Professor of Mathematics   August 2017 – present
St. Olaf College (Northfield, Minnesota)

Visiting Assistant Professor of Mathematics   August 2015 – August 2017
St. Olaf College (Northfield, Minnesota)

Postdoctoral Fellow   August 2013 – August 2015
Institute for Mathematics and its Applications, University of Minnesota

Assistant Professor of Mathematics   August 2011 – May 2013
Huntington University (Huntington, Indiana)

GRANTS AWARDED

PI: NSF DMS-1606967, total award $210,217   September 2015 – August 2019
Computation and Visualization of Multi-Parameter Topological Invariants of Data
Co-PI: Michael Lesnick (U. Albany)

Inclusive Teaching and Active Learning in Calculus (ITALICs); $10,920   2018 – 2019
Collaborative project with MSCS faculty, funded by the *To Include is to Excel* Mellon
Foundation grant to St. Olaf College.

Co-PI: NSF DMS-1642637, total award $34,300   January – December 2017
CBMS Regional Research Conference on Topological Data Analysis
PI: Lori Ziegelmeier (Macalaster); Co-PI: Matthew Richey (St. Olaf)

RESEARCH INTERESTS

The goal of my research is to develop mathematical tools for topological data analysis. My focus
is on the computation and visualization of multidimensional persistent homology and its use in
the analysis of complex data. I also study topological and geometric integrals and their
applications.

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PUBLICATIONS

Abdel-Rahman Madkour, Philip Nadolny, and Matthew Wright, "Finding Minimal Spanning Forests in a Graph", *Proc. of MICS 2019* (April 2019), arXiv:1705.00774.

Kristen Mazur, Mutiara Sondjaja, Matthew Wright, and Carolyn Yarnall, "Approval Voting in Product Societies," *The American Mathematical Monthly*, vol. 125, no. 1 (Jan. 2018), pp. 29 – 43, doi:10.1080/00029890.2018.1390370.

Michael Werman and Matthew Wright, "Intrinsic Volumes of Random Cubical Complexes", *Discrete and Computational Geometry*, vol. 56, no. 1 (July 2016) pp. 93 – 113, doi:10.1007/s00454-016-9789-z.

Shilad Sen, Isaac Johnson, Rebecca Harper, Huy Mai, Samuel Olsen, Benjamin Mathers, Laura Vonessen, Matthew Wright, and Brent Hecht "Towards Domain-Specific SR: A Case Study from Geography", *Proc. of IJCAI 2015*, (July 2015) pp. 2362 – 2370.

Matthew Wright, "Hadwiger Integration of Random Fields", *Topological Methods in Nonlinear Analysis*, vol. 45, no. 1 (March 2015) pp. 117 – 128, arXiv:1311.3308.

Brian Bargh, John Chase, and Matthew Wright, "Colorful Symmetries, *Math Horizons*, vol. 21, no. 4 (April 2014) pp. 14 – 17.

Robert Ghrist, Matthew Wright, and Yuliy Baryshnikov, "Hadwiger's Theorem for Definable Functions", *Advances in Mathematics*, vol. 245 (1 Oct. 2013) pp. 573 – 586, arXiv:1203.6120.

PAPERS SUBMITTED AND IN PREPARATION

Michael Lesnick and Matthew Wright, "Computing Minimal Presentations and Bigraded Betti Numbers of 2-Parameter Persistent Homology", submitted, arXix:1902.05708.

Matthew Wright and Xiaojun Zheng, "Topological Data Analysis on Simple English Wikipedia Articles," in preparation.

Michael Lesnick and Matthew Wright, "Interactive Visualization of 2-D Persistence Modules", under revision, arXiv:1512.00180.

P. Christopher Staecker and Matthew Wright, "A Hadwiger Theorem for Simplicial Maps", preprint, 2014, arXiv:1402.6391.

Matthew Wright, "Cycles of Digits" preprint, 2013, www.mlwright.org/docs/cycles.pdf.

STUDENT PAPER SUPERVISED

So Mang Han, Taylor Okonek, Nikesh Yadav, and Xiaojun Zheng, "Distributions of Matching Distances in Topological Data Analysis", submitted, 2018, arXiv:1812.11258.

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SOFTWARE AND MULTIMEDIA

Rank Invariant Visualization and Exploration Tool (RIVET): Two-parameter persistent homology software, developed with Michael Lesnick, available at http://rivet.online.

Introduction to Persistent Homology: Video, appeared in the 25th Multimedia Exposition in Computational Geometry (2016); https://youtu.be/2PSqWBIrn90.

AWARDS AND HONORS

Postdoctoral Fellowship, Institute for Mathematics and its Applications	2013 – 2015
Ben Franklin Fellowship, University of Pennsylvania	2006 – 2011
Good Teaching Award, Penn Math Department	Spring 2011, 2008
Penn Prize for Excellence in Teaching by Graduate Students	April 2008
William Lowell Putnam Mathematics Exam	
Scored 30 on the 2005 Putnam Exam (rank 256 nationally)	2005
Scored 31 on the 2004 Putnam Exam (rank 287 nationally)	2004

BOOK EDITED

Heather A. Harrington, Mohamed Omar, and Matthew Wright, eds., *Algebraic and Geometric Methods in Discrete Mathematics*, Contemporary Mathematics vol. 685, American Mathematical Society, 2017.

TEACHING EXPERIENCE

Courses taught at St. Olaf College

Math 330: Partial Differential Equations	F 2017, F 2018, F 2019
Math 282: Introduction to Computational Geometry	S 2019
Math 262: Probability Theory	F 2015, F 2016, S 2017, S 2018, F 2019
Math 242: Modern Computational Math	S 2018, S 2019
Math 230: Differential Equations	S 2016, F 2016, F 2017, F 2018
Math 126: Calculus II	F 2015, S 2017, F 2019
CSCI 121: Principles of Computer Science	S 2016, S 2017

Courses taught at Huntington University

MA 481: Seminar in Contemporary Mathematics	F 2011, F 2012
MA 431: Introduction to Real Analysis	F 2012
MA 311: Elements of Linear Algebra	S 2013
MA 171: Analytic Geometry and Calculus I	F 2011, F 2012
MA 161: Math for Managerial and Social Sciences	S 2012
MA 151: Introduction to Probability and Statistics	F 2011, S 2012
CS 355: Operating Systems	S 2013
CS 111: Introduction to Computer Science	S 2012, F 2012, S 2013

Course taught at the University of Pennsylvania

Math 103: Introduction to Calculus	Summer 2008

Teaching Assistant appointments at the University of Pennsylvania

Math 240: Calculus III	S 2009
Math 116: Honors Calculus	F 2010
Math 115: Calculus II with Probability and Matrices	S 2011
Math 114: Calculus II	F 2008
Math 104: Calculus I	S 2008
Math 103: Introduction to Calculus	F 2007

MENTORING EXPERIENCE

Summer Research Mentor (St. Olaf College)   Summer 2019
Worked with two students on improving the graphical interface and documentation for the RIVET software for topological data analysis.

Summer Research Mentor (St. Olaf College)   Summer 2018
Worked with two students on applying two-parameter persistent homology to the data and developing statistical techniques.

Domain Expert (Center for Interdisciplinary Research, St. Olaf College)   F 2017 – S 2018
Worked with four students studying notions of distance between persistence modules and applications to data analysis.

Summer Research Mentor (St. Olaf College)   Summer 2017
Worked with two students on applying two-parameter persistent homology to the study of real-world data.

Summer Research Mentor (St. Olaf College)   Summer 2016
Worked with two students on mathematical and algorithmic problems necessary for the implementation of parallel computation of multiparamter persistent homology.

Research Mentor for the MAXIMA REU (IMA)   Summer 2014
Worked with a group of students investigating geographic proximity and semantic relatedness by mining data from Wikipedia and conducting a survey.

Math Mentor, Center for Teaching and Learning (Penn)   Summer 2011
Mentored graduate students teaching summer math courses at the University of Pennsylvania.

SELECTED LECTURES PRESENTED

Creighton University Mathematics Colloquium (Omaha, NE)
"Persistent Homology: Discerning the Shape of Data"   September 2019

Southeastern Undergraduate Mathematics Workshop at Georgia Tech (Atlanta, GA)
Four-lecture minicourse on Topological Data Analysis   August 2019

SIAM Applied Algebraic Geometry 2019 (Bern, Switzerland)
"Multiparameter Persistence: Brief Background and Current Challenges"   July 2019

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MSU Computational Math, Science, & Engineering Colloquium (E. Lansing, MI)
    "Visualizing Multiparameter Persistent Homology"   October 2018

Applied Algebraic Topology 2017 (Sapporo, Japan)
    "Multidimensional Persistence: Computation and Applications"   August 2017

Computational and Statistical Aspects of Topological Data Analysis (London, UK)
    "Computing Multidimensional Persistent Homology"   March 2017

SIAM Central States Section Meeting, Applied and Computational Topology Mini-Symposium
    "Computing Multidimensional Persistent Homology"   October 2016

Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland)
    "Efficiently Computing the Bigraded Betti Numbers"   August 2016

Symposium on Computational Geometry (Boston, MA)
    "Visualizing Multidimensional Persistent Homology"   June 2016

Section NExT Invited Lecture; MAA North Central Section Meeting (St. Paul, MN)
    "Introduction to Persistent Homology"   April 2016

Applied Topology and High-Dimensional Data Analysis, University of Victoria (Victoria, Canada)
    "Euler Characteristic and Data Analysis"   August 2015
    "Computing Multidimensional Persistent Homology"   August 2015

Algebraic Topology: Computation, Data Analysis, and Applications, U. Oxford (Oxford, UK)
    "Introduction to Persistent Homology"   February 2015
    "Multidimensional Persistence Computation"   February 2015

Math, Stats, and CS Seminar, Macalester College (Minneapolis, MN)
    "How many ways are there to juggle?"   February 2015

School on Topological Data Analysis and Stochastic Topology, CIMAT (Guanajuato, Mexico)
    "Computing Persistent Homology"   January 2015
    "Visualizing Multidimensional Persistent Homology"   January 2015

Computer Science and Mathematics Lecture, Bryn Mawr College (Philadelphia, PA)
    "Euler Characteristic and Data Analysis"   November 2014

Industrial and Applied Mathematics Seminar, University of Oxford (Oxford, UK)
    "Visualizing Multi-Dimensional Persistent Homology"   November 2014

Math Department Colloquium, University of Mary Washington (Fredericksburg, VA)
    "Euler Integration and Applications"   October 2014

Statistics and Topology Seminar, Technion (Haifa, Israel)
    "Intrinsic Volumes of Random Cubical Complexes"   May 2014

Postdoc Seminar, Institute for Mathematics and its Applications (Minneapolis, MN)
    "Intrinsic Volumes of Random Cubical Complexes"   April 2014
    "Hadwiger and Lefschetz: Valuations on Simplicial Maps"   December 2013

Geometry, Topology, and Data Seminar, The Ohio State University (Columbus, OH)
    "Hadwiger Integration and Applications"   November 2013

Plenary Talk, Applied Topology Conference (Będlewo, Poland)
"Hadwiger Integration and Applications" — July 2013

Geometry Seminar, University of Illinois at Urbana-Champaign (Urbana, IL)
"Hadwiger Integrals of Random Fields" — October 2012

SELECTED CONFERENCES AND WORKSHOPS ATTENDED

SIAM Applied Algebraic Geometry 2019 (Bern, Switzerland) — July 2019

Symposium on Computational Geometry (Portland, OR) — June 2019

Persistence, Representation, and Computation (Raitenhaslach, Germany) — February 2018

Applied Algebraic Topology 2017 (Sapporo, Japan) — August 2017

Topological Data Analysis: Developing Abstract Foundations (Banff, Canada) — July 2017

Computational and Statistical Aspects of Topological Data Analysis (London, UK) — March 2017

Applications and Statistics of Multidimensional Persistence (Lausanne, Switzerland) August 2016

Symposium on Computational Geometry (Boston, MA) — June 2016

Applied Topology and High-Dimensional Data Analysis (Victoria, Canada) — August 2015

Algebraic Topology: Computation, Data Analysis, and Applications (Oxford, UK) February 2015

Discrete, Computational, and Algebraic Topology (Copenhagen, Denmark) November 2014

Generalized Persistence and Applications (AIM, Palo Alto, CA) — September 2014

Teaching a Science of Information Course (San Diego, CA) — August 2014

Algebraic and Geometric Methods in Applied Discrete Mathematics — June 2014
AMS Mathematics Research Community (Snowbird, UT)

Algebra and Topology: Methods, Computation, & Science (Vancouver, Canada) — May 2014

IMA Thematic Year on Scientific and Engineering Applications — Sept. 2013 – June 2014
of Algebraic Topology (6 workshops, Minneapolis, MN)

Applied Topology (Będlewo, Poland) — July 2013

Algebra and Topology: Methods, Computation, & Science (Münster, Germany) — June 2010

Sensor Topology and Minimal Planning (Austin, TX) — February 2010

Geometric & Topological Methods in Computer Science (Aalborg, Denmark) — January 2010

Sensor Topology and Minimal Planning (Seattle, WA) — July 2009

INSTITUTIONAL SERVICE

Assessment Committee, St. Olaf College — September 2018 – present

Health Professions Committee, St. Olaf College — March 2019 – present

Tenure-Track Hiring Committee, St. Olaf MSCS Department — Fall 2018 – Spring 2019

Tenure-Track Hiring Committee, St. Olaf MSCS Department — Fall 2017 – Spring 2018

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PROFESSIONAL SERVICE

Organizer of minisymposium *Multiparameter Persistence: Algebra, Algorithms, and Applications* at SIAM Applied Algebraic Geometry 2019	July 2019
Co-organizer of *Tutorial on Multiparameter Persistence, Computation, and Applications*, at the IMA (with Michael Lesnick)	August 2018
Co-organizer of *Topological Data Analysis: Theory and Applications*, at Macalaster College (with Lori Ziegelmeier and Matt Richey)	June 2017
Co-organizer of *AMS Special Session on Applied and Computational Topology* at the 2016 JMM (with Nick Scoville and Paweł Dlotko)	January 2016
Co-organizer of *AMS Special Session on Algebraic and Geometric Methods in Applied Discrete Mathematics* at the 2015 JMM (with Heather Harrington and Mohamed Omar)	January 2015
Organizer of contributed paper session *Best Practices for Teaching Online Courses* at MAA MathFest 2013	August 2013

LANGUAGE AND COMPUTER SKILLS

English: complete fluency

Spanish: near fluency; studied in Quito, Ecuador for the Fall 2003 semester

Experience in Mathematica, R, Unix, Java, JavaScript, C++, Python, HTML, CSS, PHP, and MySQL