Rachel A. Neville

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Academic Employment

Hanno Rund Postdoctoral Researcher 2017-present
Mathematics Department, the University of Arizona

Research Interests

Applied Algebraic Topology, Topological Data Analysis, Dynamical Systems, Pattern Formation.

Education

Colorado State University, Ph.D. Mathematics with Dr. Patrick Shipman June 2017
Thesis: *Topological Techniques for Characterization of Patterns in Differential Equations*

Colorado State University, M.S. Mathematics with Dr. Patrick Shipman May 2014
Thesis: *Persistent Homology of the Logistic Map: An Exploration of Chaos*

Colorado State University, B.S. Mathematics, Honor Scholar, Minor in Physics and French May 2011
Thesis: *Image Classification using Geometric, Linear Algebraic and Statistical Methods*

Publications

[1] M. Aminian, E. Farnell, M. Kirby, C. Peterson, J. Mirth, R. Neville, C. Shonkwiler. *A fractal dimension for measures via persistent homology.* Accepted, To Appear in Proceedings of the Abel Symposium. (2019)

[2] I. Darcy, V. Gerardi, G. Heo, R. Neville, M. Pietrsanu, M. Tsuruga.*Applications of Pseudo-Multidimensional Persistence.* Research in Computational Topology. (eds. E. Chambers, B. Fasy, L. Ziegelmeier), Springer. Association for Women in Mathematics Series, **13**. (2018) 179-202.

[3] F. Motta, R. Neville, P. Shipman, D. Pearson, R.M. Bradley. *Measures of Order in Nearly Hexagonal Lattices.* Physica D: Nonlinear Phenomena, 380-381 (2018) 17-30.

[4] R. Neville, A. Krummel, N. Levanger, P. Shipman. *ConfChem Conference on Mathematics in Undergraduate Chemistry Instruction: Applied Mathematics for Chemistry Majors*, Journal of Chemical Education. **95** (2018). 1438-1439.

[5] H. Adams, S. Chepushtanova, T. Emerson, E. Hanson, M. Kirby, F. Motta, R. Neville, C. Peterson, P. Shipman, L. Ziegelmeier. *Persistence Images: A Stable Vector Representation of Persistent Homology.* Journal of Machine Learning Research. **18** (2017) no 8, 1-35.

[6] R. Neville. *N-gram Modeling for Document Retrieval.* Internal Paper, Enterprise Operations Research, Modeling & Simulation; Department of Defense. (2015)

In Preparation:

[7] S. Fassnacht, F. Motta, J. Oprea, R. Neville, P. Shipman. *Multiscale Measures of Snow Surface Roughness.*

[8] R. Neville. *Parameter Learning in Complex Patterns with Persistent Homology.*

Research Positions

Colorado State University, Graduate Research Assistant/Thesis Research Summer 2013, 2016
NSF funding under Dr. Patrick Shipman

Department of Defense, Fort Meade, MD.
Summer Program for Operations Research Technology Graduate Intern.
Technology Directorate, Enterprise Operations Research, Modeling and Simulation Summer 2015

Teaching Experience

University of Arizona, Instructor of Record.

Math 122A Functions for Calculus	Fall 2017
Math 122B First Semester Calculus	Fall 2017
Math 196M Calculus I Supplemental Instruction Seminar	Spring 2018
Math 313 Linear Algebra	Fall 2018
Math 496T Special Topics: Introduction to Algebraic Topology	Spring 2019

Undergraduate Teaching Assistantship Program, Co-Organizer Fall 2018-present
Facilitated mentoring of teaching assistants, ran weekly professional development seminar
PACe Program at Colorado State University, Assistant Director, Spring 2012-Fall 2012
Managed program and staff for pre-calculus hybrid online courses with on-campus learning center

Colorado State University, Graduate Teaching Assistant, Instructor of Record.

Math 130 Math in the Social Sciences	Fall 2013
Math 155 Calculus for Biological Scientists I	Spring 2014, Fall 2014
Math 161 Calculus for Physical Scientists I	Fall 2011, Summer 2012
Math 261 Calculus for Physical Scientists III	Spring 2013
Math 271 & 272 Applied Math for Chemists (developmental phase; accepted)	Fall 2015-Spring 2017
Math 340 Differential Equations	Spring 2015

Conference & Seminar Talks

Invited

(Upcoming) Topological Techniques for Characterizing Pattern Forming Systems
Equadiff, Leiden, Netherlands. July 2019
(Upcoming) Geometric and Topological Techniques in the Study of Pattern Forming Systems
International Symposium on Computational Geometry. Portland, OR June 2019
(Upcoming) Topological Techniques for Characterizing Regularity in Social Rhythms
SIAM Applications of Dynamical Systems. Snowbird, UT May 2019
(Upcoming) Topological Techniques for Computing Fractal Dimension
University of Arizona Modeling and Computation Seminar April 2019
(Upcoming) Topological Techniques for Characterization of Pattern Forming Systems
Texas A & M Industrial and Applied Math Seminar, College Station, TX April 2019
(Upcoming) Topological Techniques for Studying Defects in Patterns
AWM Research Symposium. Houston, TX April 2019
Topological Techniques for Characterization of Pattern Forming Systems
Joint Math Meeting. Baltimore, MD January 2019
Topological Methods on Ion Bombardment Patterns
SIAM Central Section Meeting. Fort Collins, CO September 2017
Classification of Pattern Forming Systems Using Persistence
SIAM Conference on Applications of Dynamical Systems. Snowbird, UT May 2017
Topological Measure of Order on Lattice Patterns
SIAM Central Section Meeting. Little Rock, AK September 2016
Patterns in Networks of Discrete Ecological Dynamical Systems Revealed Through Persistent Homology
SIAM Conference on Applications of Dynamical Systems. Snowbird, UT May 2015

Contributed

Topological Techniques for Characterization of Nanodot Patterns
University of Arizona ADA Seminar — September 2017

Topological Measure of Order on Lattice Patterns
SIAM Annual Meeting — July 2017

Topological Measure of Order on Lattice Patterns
Joint Math Meetings. Atlanta, GA — January 2017

Persistent Images: A Stable Vector Representation of Persistent Homology (poster)
Topological and Geometric Data Analysis. Columbus, OH — May 2016

Persistent Homology of Dynamical Systems on Networks
Joint Mathematics Meetings. Seattle, WA — January 2016

N-gram Modeling
Briefing to Technical Senior Executives; Department of Defense. Fort Meade, MD — July 2015

Patterns in Persistence: Persistent Homology of Chaotic Dynamical Systems
Joint Mathematics Meetings. San Antonio, TX — January 2015

Persistence Images: A Look at Persistent Homology
Front Range Applied Mathematics Student Conference. Denver, CO — February 2015

A Pattern in Chaos: Persistent Homology of the Logistic Map
Front Range Applied Mathematics Student Conference. Denver, CO — March 2014

Greenslopes Graduate Seminar

The Parable of the Polygons - Mathematical Modeling of Segregation — January 2017
N-gram Modeling and Interning at the DoD — September 2015
Persistent Homology and Dynamics — March 2015
Persistence Images — February 2015
The Math Behind Snowflakes — December 2014
Persistent Homology of Dynamical Systems speed talk — March 2014
Persistent Homology — October 2013

Other Talks

Topological Techniques for Characterization of Patterns in Differential Equations
Doctoral Thesis Defense — June 2017

Persistent Homology of the Logistic Map: An Exploration of Chaos
Masters Thesis Defense — May 2014

Image Classification Using Linear Algebraic, Geometric and Statistical Methods
Honors Thesis Presentation — April 2011

Algorithm for Image Classification (poster)
Nebraska Conference for Women in Mathematics — February 2011

A Model for Madden-Julian Oscillations(poster)
Celebration of Undergraduate Research and Creativity Poster Fair — April 2010

Development as an Educator

AWM Workshop on the MAA's Instructional Practices Guide: Reaching All Students Through Engaged Learning — October 2018
Academy of Inquiry Based Learning Workshop, Chicago, IL — June 2018
Leader in Classroom Diversity & Inclusion Certificate, University of Arizona — Spring 2018
Teaching Certificate, The Institute of Learning and Teaching, Colorado State University, Fall 2015-2018

Math Outreach & Service

Mentoring

Honors Contract Mentor - Linear Algebra — Fall 2018

Math 485 Modeling Group Mentor — Spring 2018

Modeling Influenza-Like Pandemics, Judged Best in Session.

Second Year Graduate Student Mentor, Colorado State University. — 2015-2016

Organization

UA Modeling and Computation Seminar, Co-Organizer — Fall 2018-Spring 2019

SIAM Dynamical Systems, Mini-symposium, Topological Data Analysis and Dynamics — May 2019

ICERM Workshop: Applied Mathematical Modeling with Topological Techniques — August 2019

Greenslopes Graduate Seminar, Co-Organizer — Fall 2014

Outreach

Tucson Festival of Books, Science City Booth. — March 2018

Pi Day (with local elementary students) — March 2018

Northern Colorado Math Circles (week long program for middle school students)

Co-Organizer — 2014 & 2015

Session Facilitator: *Where did π come from? An exploratory history.* — 2016

Session Facilitator: *Knots in Nature* — 2014

Northern Colorado Math Ovals (monthly seminar for high school students)

Session Facilitator: *A Touch of Color*, interactive presentation — October 2013

Colorado State Math Day: Math Competition — 2010, 2011, 2015, 2016

Committee

SIAM National Committee on Education — January 2017-present

Professional Societies

Society of Applied and Industrial Mathematics (SIAM)

CSU Student Chapter President — Fall 2015-Spring 2016

CSU Student Chapter Webmaster — Fall 2014-Spring 2015