Rachel A. Neville

303-495-0679
raneville@math.arizona.edu
https://raneville.weebly.com/

Academic Employment

Hanno Rund Postdoctoral Research Associate — 2017-present
Mathematics Department, the University of Arizona

Research Interests

Applied Algebraic Topology, Topological Data Analysis, Dynamical Systems, Pattern Formation, Partial Differential Equations, Modeling.

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. 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

Conference & Seminar Talks

Invited

(Upcoming) Topological Techniques for Parameter Learning of Ion Bombarded Systems
SIAM Conference on the Math of Data Science. Cincinnati, OH — May 2020

(Upcoming) Studying Ion Bombarded Systems with Topological Techniques
Applied Algebraic Topology Research Network, Virtual Seminar. — November 2019

Studying Ion Bombarded Systems with Topological Techniques
SIAM LA-TX Sectional Meeting, Dallas, TX — October 2019

Topological Techniques for Characterizing Pattern Forming Systems
Equadiff, Leiden, Netherlands. — July 2019

Geometric and Topological Techniques in the Study of Pattern Forming Systems
International Symposium on Computational Geometry. Portland, OR — June 2019

Topological Techniques for Characterizing Regularity in Social Rhythms
SIAM Applications of Dynamical Systems. Snowbird, UT — May 2019

Topological Techniques for Computing Fractal Dimension
University of Arizona Modeling and Computation Seminar — April 2019

Topological Techniques for Characterization of Pattern Forming Systems
Texas A & M Industrial and Applied Math Seminar, College Station, TX — April 2019

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
SIAM Conference on Applications of Dynamical Systems. Snowbird, UT — May 2015

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

Contributed

(Upcoming) Topological Methods for Characterizing Snow Surface Roughness
Joint Mathematics Meeting. Denver, CO — January 2020

Fractal Dimension for Measures via Persistent Homology
University of Arizona Analysis, Dynamics, and Applications Seminar — May 2019

Topological Techniques for Characterization of Nanodot Patterns
University of Arizona Analysis, Dynamics, and Applications Seminar — September 2017

Topological Measure of Order on Lattice Patterns
SIAM Annual Meeting. Pittsburgh, PA — 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

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

Graduate Seminar

The Parable of the Polygons - Mathematical Modeling of Segregation — January 2017
N-gram Modeling and Interning at the Department of Defense — 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

Workshops

Applied Mathematical Modeling with Topological Techniques. ICERM. — August 2019
Tutorial on Multiparameter Persistence, Computation, and Applications. IMA. — August 2018
Women in Computational Topology Workshop. IMA. — August 2016
IMA Industrial Careers Conference. IMA. — April 2015
Summer School in Dynamical Systems. Houston, TX. — May 2013

Teaching

University of Arizona, Instructor of Record.

Math 129 Calculus II — Fall 2019
Math 496T Special Topics: Introduction to Algebraic Topology — Spring 2019
Math 313 Linear Algebra — Fall 2018
Math 196M Calculus I Supplemental Instruction Seminar — Spring 2018
Math 122B First Semester Calculus — Fall 2017
Math 122A Functions for Calculus — Fall 2017

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 Applied Math for Chemists I (developmental phase; accepted) — Fall 2015, 2016
Math 272 Applied Math for Chemists II (developmental phase; accepted) — Spring 2016, 2017
Math 340 Differential Equations — Spring 2015

Undergraduate Teaching Assistantship Program, Co-Organizer — Fall 2018-present
Facilitated mentoring of teaching assistants, run 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 & on-campus learning center

Development as an Educator

AWM Workshop on the MAA's Instructional Practices Guide Workshop — 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

Honors and Awards

University of Arizona Mathematics Department Teaching and Service Award — May 2019
University of Arizona Outstanding Postdoctoral Scholar Award, nominated — Fall 2019

Outreach & Service

Mentoring

Undergraduate Teaching Assistant Mentor - Calculus 2 - Lane Lewis — Fall 2019
Math 485 Modeling Group Mentor (teams of 4 undergraduates) — Spring 2018, 2019
Modeling Influenza-Like Pandemics, Judged Best in Session 2018.
Competing Species, Judged Best in Session 2019.

Honors Contract Mentor - Linear Algebra — Fall 2018
Second Year Graduate Student Peer Mentor, Colorado State University. — 2015-2016

Departmental Service

Mathematics Undergraduate Teaching Assistantship (UTA) Program, Co-Director. — Fall 2018-present
Coordinate mentorship of UTA's, run weekly professional development seminar
⋆Women in STEM Mentorship Project, Founding Co-Director. — Fall 2019-present
Weekly peer mentorship program (100+ undergraduate participants) with monthly seminar
UA Modeling and Computation Seminar, Co-Organizer. — Fall 2018-Spring 2019
Greenslopes Graduate Seminar, Co-Organizer. — Fall 2014
Society of Applied and Industrial Mathematics (SIAM)
CSU Student Chapter President — Fall 2015-Spring 2016
CSU Student Chapter Webmaster — Fall 2014-Spring 2015

Service to the Discipline

SIAM Dynamical Systems, Mini-symposium Organizer — May 2019
Topological Data Analysis and Dynamics
⋆ICERM Workshop Organizer. — August 2019
Applied Mathematical Modeling with Topological Techniques
SIAM National Committee on Education — January 2017-present
Reviewer for Journal of Applied and Computational Topology — Fall 2018-present
Reviewer for Journal of Discrete and Computational Geometry — Summer 2019-present

Outreach

Tucson Festival of Books, Science City Booth. — March 2018, 2019
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