Katherine Moore

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Education

Dartmouth College, Hanover, NH
Ph.D. in Mathematics — June 2018
Patterns in Time Series and Dynamical Systems
Advisor: Sergi Elizalde
A.M. in Mathematics — June 2017

Kenyon College, Gambier, OH
B.A. in Mathematics (with Highest Honors in Mathematics) — May 2012

Academic Appointments

Amherst College, Amherst, MA
Visiting Assistant Professor — Fall 2021 - Present

Wake Forest University, Winston-Salem, NC
Teacher-Scholar Postdoctoral Fellow — Fall 2018 - Spring 2021

Research Interests

My work is in the mathematical foundations of data science. Motivated by challenges that arise in information-scarce and high dimensional settings, I identify appropriate abstractions and prove results which can give rise to more effective methods in exploratory data analysis (e.g., clustering, classification and data visualization). My graduate work was in combinatorics and incorporated classical theory in discrete dynamical systems.

Publications

($\star\star$ indicates Master's student and $\star$ indicates undergraduate student)

1. Mathematical Foundations of Data Cohesion (K. Moore) August 2023. arXiv:**2308.02546**
2. Partitioned local depths community analysis of transcriptomic data (M. Khoury, K. Berenhaut, K. Moore, E. Allen, A. Harkey, J. Muhlemann, C. Craven*, J. Xu*, S. Jain*, D. John, J. Norris, G. Muday), *in silico Plants*, **(2023)**.
3. A social perspective on perceived distances reveals deep community structure (K. Berenhaut, K. Moore and R. Melvin**) *Proceedings of the National Academy of Sciences*, 11 (4), **(2022)**.
4. Characterizations and enumerations of patterns of signed shifts (S. Elizalde and K. Moore) *Discrete Applied Mathematics*, **(2019)**.
5. Random walk null models for time series data (D. DeFord and K. Moore) *Entropy*, 19 (2017), **615**.
6. Patterns of negative shifts and beta-shifts (S. Elizalde and K. Moore) December 2015. arXiv:**1512.04479**.

Conference Papers:

1. Hotspot detection in pancreatic neuroendocrine images using local depth (M. Niazi, K. Moore, K. Berenhaut, D. Hartman, L. Pantanowitz, M. Gurcan) *Medical Imaging 2020: Digital Pathology*, (2020).

2. Patterns of signed shifts and negative shifts (K. Archer, S. Elizalde, and K. Moore) *Sem. Lothar. Combin. proc.,* 78B (2017), Article #**49**. *FPSAC Conference.*

Software:

1. pald: Partitioned Local Depth for Community Structure in Data (K. Moore, K. Berenhaut, L. D'Agostino McGowan) **R package available on CRAN**, (2022).

2. Partitioned Local Depth (PaLD) Clustering Analyses in R (L. D'Agostino McGowan, K. Moore, and K. Berenhaut), submitted to *The R Journal.*

News Articles:

1. Communities in Data (K. Berenhaut and K. Moore), SIAM News. June 2022.

Teaching

Amherst College

Math/Stat 360 - Probability	Fall 2023
Math 140 - Mathematical Modeling	Spring 2023
Math 220 - Mathematical Reasoning and Proof	Spring 2022, Fall 2022
Math 111i - Calculus 1 (intensive section)	Fall 2021
Math 272 - Linear Algebra with Applications	Fall 2021, Spring 2022, Fall 2022 Spring 2023, Fall 2023

Wake Forest University

Stat 310/610, Math 357 - Probability	Fall 2020, Spring 2021
Stat 111 - Introduction to Statistics	Fall 2020, Spring 2020(×2), Spring 2021
Math 117 - Discrete Mathematics (introduction to proofs)	Fall 2019(×2), Spring 2019(×2)
Math 111 - Calculus with Analytic Geometry	Fall 2018
Math 311 - Introductory Real Analysis	Fall 2018

Dartmouth College

Math 53 - Chaos!	Fall 2017
Math 20 - Probability	Summer 2016
Math 2 - Differential Calculus	Winter 2016

Teaching Assistant

Math 8 - Integral Calculus	Fall 2013, Winter 2015
Math 12 - Honors Multivariable Calculus for First Years	Fall 2012

Other Teaching Activities

Project NExT (Fellow) 2019 - 2020

Peer Learning Workshop on Online Learning (Statistics, Wake Forest) 2020

"Small Teaching Online" Group (Center for the Advancement of Teaching at Wake Forest) 2020

Dartmouth Mathematics Teaching Seminar 2015

An intensive 120-contact hour course including discussion, implementation and supervision.

Dartmouth Center for the Advancement of Learning 2015 - 2017

Frequent workshop participant (e.g., *Improv for Researchers Series*).

Supervised Research Projects

Senior Honors Advisor

Allison Deegan — August 2023 - May 2024

Supported Undergraduate Research Student (URECA Fellowship)

Kevin Woytowich — Summer 2019

Price Differences in Revisiting Non-Revisiting Random Walks

Master's Degree Committee Member

Orlando Ferrer — 2018 - 2020

Price Dynamic Random Walks on General Graphs

Yichen Han — 2018 - 2020

Degree-wise Effects and the Friendship Paradox Under Configuration Models

Awards and Honors

- MRC: Data Science at the Crossroads of Analysis, Geometry, and Topology — 2022
  A week-long collaborative research retreat for early-career researchers funded by the AMS and NSF.
- Project NExT — 2019 - 2020
  A teaching-focused professional development program for early-career academics.
- Outstanding Graduate Student Teacher — 2017
  Awarded by the Dartmouth Center for Advancement of Learning.
- Dartmouth GAANN Fellowship — 2012 - 2013
- Reginald B. Allen Award for Excellence in Mathematics at Kenyon College — 2012
  Awarded to a student who has shown unusual promise in mathematics.

Research Presentations

($\star$ indicates invited talk) Note: Talks April 2020 - 2022 were virtual unless noted otherwise.

- *Cohesion: A Social Perspective on Clustering*
  Joint Math/Stat Department Colloquium, Amherst College — November 2023
  ($\star$) Department Colloquium, Colgate University, NY — October 2023

- *Cohesion: Data-Inspired Discrete Mathematics*
  ($\star$) Combinatorics Seminar, Dartmouth College, NH. — September 2023

- *The Problem of Clustering*
  ($\star$) Euler Circle for Advanced High School Mathematics Students (virtual). — May 2023

- *Similarity Comparisons as a Foundation for Clustering*
  Discrete Math Days at Smith College, MA. — May 2023

- *Cohesion and Communities: Leveraging Human Expertise and Perspective*
  ($\star$) Special Session at JMM: Applied Topology: Theory and Implementation. — January 2023

- *Partitioned Local Depths*
  ($\star$) Applied Math and Computation Seminar, UMass Amherst, MA. — April 2022
  ($\star$) SIAM Special Session at JMM: Mathematics of Complex Systems. — April 2022
  ($\star$) Metron, Inc. — December 2021
  Data Science, Statistics and Visualization, SAMSI Conference, NC. — July 2020
  Interdisciplinary Applied Math Seminar, Dartmouth College, NH. — March 2020
  Interdisciplinary Network Science Seminar, Wake Forest University, NC. — March 2020

- *Communities in Data* (Department Colloquia)
  ($\star$) Smith College, MA. (in person) — October 2021
  ($\star$) Lenoir-Rhyne University, NC. — April 2021
  ($\star$) University of Montana, MT. — March 2021
  ($\star$) Amherst College, MA. — March 2021

(⋆) Kenyon College, OH. February 2021
Wake Forest University, NC. April 2020
(⋆) High Point University, NC. October 2019
Wake Forest University, NC. February 2019
(⋆) Davidson College, NC. February 2019

- *A New Perspective on Clustering: Partitioned Local Depth*
  CanaDAM, Canada Mathematical Society. May 2021
  (⋆) 34th Clemson Mini-Conference on Discrete Math and Algorithms, Clemson, SC. October 2019
  CanaDAM, Vancouver, BC. May 2019

- *Permutation-based Techniques for Estimating Entropy of Time Series*
  Applied and Computational Mathematics Seminar, Dartmouth College, NH. September 2017

- *Permutations in Time Series and Dynamical Systems*
  (⋆) AMS Special Session at JMM: Dynamical Algebraic Combinatorics. January 2018
  (⋆) Combinatorics Seminar, Brandeis University, MA. September 2017
  (⋆) New York Combinatorics Seminar, Brooklyn College, NY. September 2017

- *Patterns and Cyclic Permutations in Dynamical Systems*
  Summer Combo in Vermont, Saint Michael's College, VT. July 2017
  Permutation Patterns, Reykjavik University, Iceland. June 2017
  (⋆) Combinatorics Seminar, Brandeis University, MA. January 2017

- *Patterns Realized by Negative Shifts and Beta-Shifts*
  Summer Combo in Vermont, Saint Michael's College, VT. July 2016
  Graduate Student Combinatorics Conference, Clemson University, SC. April 2016

- *Patterns in Chaos* (Department Colloquium)
  (⋆) Kenyon College, OH. September 2015

Posters

19th Annual Graduate Student & Postdoc Research Day, Wake Forest University, NC. March 2019
Formal Power Series and Algebraic Combinatorics (FPSAC), Queen Mary, London, UK. July 2017
Discrete Math Days of the Northeast, Dartmouth College, NH. May 2017
Graduate Poster Session, Dartmouth College, NH. April 2017
Women's Intellectual Network Research Symposium, Brown, RI. March 2017

Community

AWM Mentor Program at Wake Forest (Mentor) 2019 - 2021
Sonia Kovalevesky Day 2012 - 2018
An annual math day for middle and high school girls; contributed five years.
Developed and lead workshop sections; organized the event in May 2016.
Dartmouth Center for the Advancement of Learning 2015 - 2017
Led sessions for graduate teaching assistants on diversity and inclusivity in the classroom.
Exploring Mathematics at Dartmouth 2015
Collaboratively developed and ran two week-long workshops for high school students.

Service

Speaker at Orientation for New Faculty (Amherst Provost Office) 8/2022, 11/2023
Graduate Admissions Committee (Mathematics and Statistics, Wake Forest) 2019 - 2020
Curriculum Committee Member (Mathematics, Wake Forest) 2018 - 2019
Advisory Board Member (Dartmouth Center for the Advancement of Learning) 2017 - 2018