Jared Reiling | Curriculum Vitae

Department of Computational Mathematics, Science and Engineering
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Education

Michigan State University   **Michigan, U.S.**
Ph.D. Computational Mathematics, Science, and Engineering   *2023-Present*

Augustana College   **Illinois, U.S.**
B.A. Mathematics & Piano Performance, Summa Cum Laude   *2019-2023*

Research

Michigan State University   **Michigan, U.S.**
Graduate Student   *September 2023-Present*
Advisor: Mengsen Zhang, Ph.D.
Description: Developing a computational-experimental framework to create multiscale predictive models of naturalistic behavior and brain dynamics by integrating concepts and techniques from nonlinear dynamics, topological data analysis (TDA), and machine learning. This framework will be applied to video recordings of naturalistic social interaction in humans and animals (ferrets), and simultaneously recorded brain activity (electrophysiology). Thus, new computational frameworks are needed to model such complex neural and behavioral dynamics and to connect them across scales.

Carolina Center for Neurostimulation   **North Carolina, U.S.**
National Science Foundation Research Intern   *May 2024-July 2024*
Advisor: Flavio Frohlich, Ph.D.
Description: Assembled and validated brain activity recording (electroencephalography) and physiology recording (electrocardiogram and respiration belt) technology for clinical trial to measure brain synchronization between a therapist and patients experiencing depression and anxiety symptoms. Additionally developed algorithms for animal (ferret) motion tracking using deep neural networks to study sustained attention during a directed task.

Baylor College of Medicine   **Texas, U.S.**
Undergraduate Research Intern   *May 2022-August 2022*
Mentor: François St-Pierre, Ph.D.
Description: Implemented machine learning models to optimize protein directed evolution for genetically encoded voltage indicators that measure brain activity. Developed a pipeline that transfers laboratory's past and future experimental data into a database designed for machine learning, wrote Python programs that reduced the dataset dimensionality, and numerically encoded protein amino acid sequences. Implemented various machine learning model to predict the protein mutation sites for optimized photostability, response amplitude, and brightness. Presented project progress to laboratory and fellow undergraduates.

Augustana College   **Illinois, U.S.**
Undergraduate Student   *February 2022-May 2022*
Advisors: Jon Clauss, Ph.D. and Andrew Sward, Ph.D.
Description: Investigated introductory topology concepts and constructed example proofs with Dr. Jon Clauss. Presented definitions and examples related to metric spaces and epsilon balls to the Mathematics and Computer Science Department during a campus-wide research presentation day. Collaborated with Dr. Andrew Sward developing mathematical-themed non-fungible tokens to deploy for purchase a trade. Presented proof-of-concept tokens to the Mathematics and Computer Science Department for feedback and guidance.

Funding & Awards

NSF Fellowship: AI and Data Enabled Predictive Multiscale Modeling   *2023-2024*
Best Poster at MSU Engineering Graduate Research Symposium   *2024*
Harry Nelson Award for Excellence in Applied Mathematics, Augustana College   *2023*

Publications

Ross, G., Huang, A. W., **Reiling, J**., Zhang, M., Park, J., Radtke-Schuller, S., ... Fröhlich, F. (*In review*). Switching state to engage and sustain attention: dynamic synchronization of the frontoparietal network.

Selected Conference Presentations

Reiling, J (2024, October 22) *Topological data analysis characterizes rich behavioral dynamics in naturalistic social interaction in ferrets.* (Poster, NSF Research Traineeship Annual Meeting, Arlington, VA)

Reiling, J (2024, October 14) *Topological data analysis characterizes rich behavioral dynamics in naturalistic social interaction in ferrets.* (Poster, Michigan State University Neuroscience Program Retreat, East Lansing, MI)
Reiling, J (2024, October 11) *Topological data analysis characterizes rich behavioral dynamics in naturalistic social interaction in ferrets.* (Poster, Precision Health Symposium, Lansing, MI)

Reiling, J (2024, October 8) *Topological data analysis characterizes rich behavioral dynamics in naturalistic social interaction in ferrets.* (Poster, Society for Neuroscience Annual Conference, Chicago, IL)

Reiling, J (2024, May 2). *Improving accuracy of multi-animal motion tracking by supplementing deep learning with body model-based automatic corrections.* (Poster, Engineering Graduate Research Symposium, Michigan State University, East Lansing, MI)

Reiling, J (2024, March 9). *Improving accuracy of multi-animal motion tracking by supplementing deep learning with body model-based automatic corrections.* (Poster, Graduate Academic Conference, Michigan State University, East Lansing, MI)

Invited Talks

Reiling, J (2023). *Linear algebra in machine learning: eigenvectors and eigenvalues implemented in principal component analysis.* (Celebration of Learning, Augustana College)

Reiling, J (2022). *Machine learning: guided engineering of fluorescent voltage indicators.* (SMART Summer Research Presentation Day, Baylor College of Medicine)

Reiling, J (2022). *Metric spaces and epsilon balls: redefining distance.* (Celebration of Learning, Augustana College)

Reiling, J, Thompson. J, Olana. K, Pham. T (2021). *NFTrig: Trigonometry based non-fungible tokens (NFTs).* (Illinois Section of the Mathematical Association of America, Milikin University

Leadership & Membership

- Vice President of Graduate Student Organization Executive Board — *2024-Present*
- Society for Neuroscience, Student Membership — *2024-Present*
- CMSE Peer Mentorship Program, Mentor — *2024-Present*
- Michigan State University Concert Orchestra: Percussionist — *2023-Present*
- Secretary of Graduate Student Organization Executive Board — *2024*
- Phi Beta Kappa, National Honors Society — *2023*
- Pi Kappa Lambda, National Music Honors Society — *2023*
- Pi Mu Epsilon, National Honorary Mathematics Society — *2021*
- Eagle Scout — *2017*

Relevant Coursework at Michigan State University

Biomedical Signal Processing *Fall 2024*
Description: Deterministic and random digital signal processing theory in the context of biomedical applications with hands-on projects about the acquisition and analysis of real physiologic signals. Additional implementation of machine learning techniques for biomedical signals.

Mathematical Foundations of Data Science *Spring 2024*
Description: Studied the ability to process, extract, and utilize insightful information form large datasets which provides useful knowledge, support decision-making, uncover hidden trends, and enable deeper understanding of observed phenomena

Parallel Computing *Spring 2024*
Description: Explored the benchmark and profile performance of serial and parallel applications, developing and optimizing applications using shared-memory threading parallelism, distributed-memory message passing, and hybrid parallelism to understand the current state of high-performance parallel computing

Numerical Methods for Differential Equations *Fall 2023*
Description: Learned numerical methods of ordinary and partial differential equations, including elliptic, parabolic, and hyperbolic equations, explicit and implicit solutions, in addition to numerical error and stability analysis

Numerical Linear Algebra *Fall 2023*
Description: Studied numerical concepts and methods for efficiently solving linear equations and eigenvalue problems. Major topics include fundamental matrix factorization, solving linear systems, algorithmic analysis, and iterative solvers.

Computational Techniques

- **MATLAB:** Implemented numerical methods of ordinary and partial differential equations using Finite Element Method and Finite Difference Method. Developed scientific programming projects for research-related projects and graduate coursework.

- **Python:** Developed data manipulation methods for automatic time series correction for animal motion tracking research at Michigan State University. Additional training in python projects during undergraduate coursework.

- **MySQL:** Learned and applied MySQL database language to multiple projects and assignments. Implemented MySQL in databases which connected to website user interfaces.

- **Java:** Created optimized college registration program which produces calendar schedule from Augustana College class registration information in Software Development class. Utilized collaborative repository environments, including GitHub and Git bash. Implemented JavaFX objects to develop user-friendly client interfaces.

Mentoring Experience

- Ab Basit Rafi Syed (master's student, Data Science, MSU) *January 2025-Present*
  Naturalistic social ferret motion tracking with computer vision
- Vitika Patel (undergraduate student, Biochemistry, MSU) *November 2024-January 2025*
  Naturalistic social ferret motion tracking with computer vision
- Shreya Karikrishnan (undergraduate student, Neuroscience, UNC-CH) *May 2024-July 2024*
  Task-based ferret motion tracking with computer vision

Teaching

Augustana College **Illinois, U.S.**
Undergraduate Tutor *September 2020-May 2021*
Provided instruction and feedback for precalculus, calculus I and II, and multivariable calculus students for fundamental concepts and examples.