Jared Reiling | Curriculum Vitae

Department of Computational Mathematics, Science and Engineering
Michigan State University
428 Shaw Lane, East Lansing, MI 48824

✉ reiling1@msu.edu

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 the brain activity recording (electrophysiology) 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 (ferrets) motion tracking using deep neural networks to study sustained attention during a directed task.

Augustana College **Illinois, U.S.**
Undergraduate Student *September 2022-May 2023*
Advisors: Andrew Sward, Ph.D. and Brooke Randazzo, Ph.D.
Description: Analyzed the mathematical algebraic structure and number theory applications of elliptic curve cryptography with Dr. Andrew Sward. Examined applications of elliptic curve cryptography within cryptocurrencies and their implementation. Studied advanced algebraic structures, including modules and representation theory with Dr. Brooke Randazzo and continued research on her doctoral dissertation. Additionally studied numerical differential equations and numerical linear algebra in preparation for graduate school studies.

Baylor College of Medicine **Texas, U.S.**
Undergraduate Research Intern *Summer 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 all the 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 each protein amino acid sequence. Implemented various machine learning model which predicted the protein mutation sites for optimized photostability, response amplitude, and brightness. Presented my project progress to my 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-Present
Best Poster at MSU Engineering Graduate Research Symposium 2024
Harry Nelson Award for Excellence in Applied Mathematics, Augustana College 2023

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)

Selected Conference Presentations

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

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

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.

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: Studying 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: Exploring 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.

Advanced Mathematics Coursework at Augustana College

Mathematics Senior Capstone Course *Spring 2023*
Description: Explored partial differential equations and linear algebra including their applications to the sciences, specifically physics applications. Presented the linear algebra of principal component analysis to the Mathematics and Computer Science Department on May 10, 2023.

Abstract Algebra II *Fall 2022*
Description: Studied advanced algebraic structures, including modules and representation theory. Presented mathematical proofs using LaTeX and researched topics involving roots of unity.

Differential Equations *Spring 2022*
Description: Learned basic theory of ordinary differential equations and used linear equations/systems in numerical, geometric, analytic, and series solutions to see their relation to the sciences. Explored the Laplace Transform as a means of solving differential equations.

Real Analysis *Fall 2021*
Description: Understood supremum/infimum, limit, continuity, derivative, and topology in the set of real numbers to prove calculus theorems. Conjectured and proved or disproved mathematical statements through constructing proofs.

Algebraic Structures *Spring 2021*
Description: Analyzed groups, rings, fields, and maps acting on these structures to understand algebraic properties on various sets. Performed calculations with mathematical objects through proof construction utilizing relevant theorems.

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 programs to construct databases and implemented machine learning models at Baylor College of Medicine and Michigan State University.
- **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.

Leadership & Membership

- Vice President of Graduate Student Organization Executive Board 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