

SARA ICHINAGA

Curriculum Vitae

Department of Applied Mathematics
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I am an applied mathematician with extensive experience with data analysis, mathematical modeling, and machine learning. I am interested in developing data-driven algorithms and software for applications across various scientific and engineering disciplines.

Education

- 2021–Present **Ph.D. Applied Mathematics**, University of Washington, Seattle, (expected June 2026).
Advisors: Prof. J. Nathan Kutz and Prof. Steven L. Brunton, GPA: 3.92/4.0.
- 2021–2022 **M.S. Applied Mathematics**, University of Washington, Seattle.
GPA: 3.87/4.0.
- 2017–2021 **B.S. Applied and Computational Mathematical Sciences**, University of Washington, Seattle.
GPA: 3.94/4.0, Magna Cum Laude.

Research Experience

- 2021–Present **University of Washington, Department of Applied Mathematics**.
As a graduate researcher, I study, implement, and extend data-driven methods for mathematically modeling time-varying snapshot data. Our methods (including DMD, SINDy, time-delay, etc.) allow for tasks like dimension reduction, future-state prediction, and control, and our implementations rely on optimization techniques and elaborate Python programming. I am interested in building robust algorithms that are capable of modeling challenging real-world data sets from various scientific and engineering disciplines.
Advisors: Prof. J. Nathan Kutz ([Kutz Lab Web-page](#)) and Prof. Steven L. Brunton ([S. Brunton Lab Web-page](#))
- Summer 2025 **National Renewable Energy Lab (NREL), AI User & Applications Program**.
As an intern at the NREL Computational Science Center, I developed PyRidge, a Python package for surrogate modeling via ridge function approximation. I also used PyRidge to analyze actual NREL data and determine under-sampled regions of parameter space. This allowed me to experiment with method variants beyond what was currently being used at NREL and better tailor PyRidge towards NREL's needs.
Advisors: Dr. Andrew Glaws and Dr. Olga Doronina
- 2019–2021 **University of Washington, Department of Biology**.
As an undergraduate researcher, I broadly studied data-driven modeling methods for systems in neuroscience. I experimented with modifications to time-delay DMD (HAVOK) for modeling chaotic time-series data, and I used data-driven network inference tools to study wide-field calcium imaging of the brain.
Advisors: Prof. Bingni W. Brunton ([B. Brunton Lab Web-page](#)), Dr. Alice Schwarze, and Dr. Seth Hirsh

Software Projects

- 2022–Present **PyDMD**, A Python Package for the Dynamic Mode Decomposition (DMD).
PyDMD is an open-source Python package for applying DMD and its variants to time-varying snapshot data. PyDMD implements optimized noise-robust DMD methods, multiresolution methods, and model visualization tools to name a few. I am currently a developer and maintainer for the package.
Code: <https://github.com/PyDMD/PyDMD>
- Summer 2025 **PyRidge**, A Python Package for Dimension Reduction and Ridge Function Approximation.
PyRidge is an NREL Python package for building surrogate models from data, where high-dimensional input data corresponds with output functions of interest. This package was built during an internship at the NREL Computational Science Center, where I was the main developer of the package.
Code: <https://github.com/NREL/PyRidge>

Publications and Preprints

- 2025 **Sara M. Ichinaga**, Steven L. Brunton, Aleksandr Y. Aravkin, and J. Nathan Kutz. Sparse-mode dynamic mode decomposition for disambiguating local and global structures, 2025. Preprint: <https://arxiv.org/abs/2507.19787>.
- 2025 Karl Lapo, **Sara M. Ichinaga**, and J. Nathan Kutz. A method for unsupervised learning of coherent spatiotemporal patterns in multiscale data. *Proceedings of the National Academy of Sciences*, volume 122, page e2415786122, 2025. Available: <https://www.pnas.org/doi/pdf/10.1073/pnas.2415786122>.
- 2024 **Sara M. Ichinaga**, Francesco Andreuzzi, Nicola Demo, Marco Tezzele, Karl Lapo, Gianluigi Rozza, Steven L. Brunton, and J. Nathan Kutz. PyDMD: A Python package for robust Dynamic Mode Decomposition. *Journal of Machine Learning Research*, volume 25, pages 1–9, 2024. Available: <http://jmlr.org/papers/v25/24-0739.html>.
- 2022 Alice C. Schwarze, **Sara M. Ichinaga**, and Bingni W. Brunton. Network inference via process motifs for lagged correlation in linear stochastic processes. *In review, Physical Review E*, 2022. Preprint: <https://arxiv.org/abs/2208.08871>.
- 2021 Seth M. Hirsh, **Sara M. Ichinaga**, Steven L. Brunton, J. Nathan Kutz, and Bingni W. Brunton. Structured time-delay models for dynamical systems with connections to Frenet–Serret frame. *Proceedings of the Royal Society A*, volume 477, page 20210097, 2021. Available: <http://doi.org/10.1098/rspa.2021.0097>.

In Preparation

Chace Wilcoxon, **Sara M. Ichinaga**, Ana Larranaga, Navid Zobeiry, and Steven L. Brunton. Dynamic Mode Decomposition with control for composite material curing. *Manuscript details available upon request*.

Sara M. Ichinaga, Alexander W. Hsu, Niharika Karnik, Steven L. Brunton, and J. Nathan Kutz. Weak Dynamic Mode Decomposition with control. *Manuscript details available upon request*.

Sara M. Ichinaga, Steven L. Brunton, and J. Nathan Kutz. An alternative perspective on Takens Embedding Theorem. *Manuscript details available upon request*.

Selected Presentations

- 2025 **Sara M. Ichinaga**, Karl Lapo, J. Nathan Kutz, Steven L. Brunton, and Aleksandr Y. Aravkin: “Dynamic Mode Decomposition Variants and Extensions for Robust Data-Driven Modeling.” Presented at:
- SIAM Conference on Applications of Dynamical Systems (DS25) (minisymposium talk)
 - SIAM Conference on Computational Science and Engineering (CSE25) (minisymposium talk)
- 2023/24 **Sara M. Ichinaga**, Francesco Andreuzzi, Nicola Demo, Marco Tezzele, Karl Lapo, Gianluigi Rozza, Steven L. Brunton, and J. Nathan Kutz. “Extensions and Open-Source Algorithms for Data-Driven Modeling with Dynamic Mode Decomposition.” Presented at:
- SIAM Conference on Uncertainty Quantification (UQ24) (minisymposium talk and minitutorial)
 - SIAM Conference on Computational Science and Engineering (CSE23) (minisymposium talk)

Teaching Experience

- Fall, 2025: **ENGR 510: Foundations of Machine Learning for Engineering**, UW College of Engineering, Artificial Intelligence and Machine Learning (AIML) for Engineering Program ([AIML Web-page](#)). Teaching Assistant
- Winter, 2025: **ENGR 515: Data-Driven Optimization**, UW College of Engineering, Artificial Intelligence and Machine Learning (AIML) for Engineering Program. Teaching Assistant

- Fall, 2024: **ENGR 510: Foundations of Machine Learning for Engineering**, UW College of Engineering, Artificial Intelligence and Machine Learning (AIML) for Engineering Program.
Teaching Assistant
- Fall, 2021 – **MATH 124, 125, 126: Calculus with Analytic Geometry**, UW Mathematics Department.
- Spring 2022: Tutor for the Math Study Center ([MSC Web-page](#))
- Fall, 2021: **MATH 124: Calculus with Analytic Geometry I**, UW Mathematics Department.
Teaching Assistant

Awards and Honors

- 2020–2021 Weill Neurohub Undergraduate Research Fellowship
- 2017–2021 Washington State Opportunity Scholarship
- 2017–2021 Seattle Foundation Atsuhiko Tateuchi Memorial Scholarship
- 2017 Terry Scurry Scholarship of the University of Washington
- 2017 Japanese American Citizens League Scholarship
- 2017 Rotary Club of Federal Way Scholarship

Technical Skills

- Programming Languages Python (expert), MATLAB, Bash, Java, SQL, R
- Python Libraries NumPy, Matplotlib, SciPy, PyTorch, Scikit-Learn, Pandas, CVXPY, PyTest
- Technologies Git/GitHub, Jupyter, Anaconda, LaTeX, Microsoft Azure

Relevant Coursework

- Applied Mathematics
- (AMATH 505) Introduction to Fluid Dynamics
 - (AMATH 515) Optimization: Fundamentals and Applications
 - (AMATH 561) Introduction to Probability and Random Processes
 - (AMATH 563) Inferring Structure of Complex Systems
 - (AMATH 567) Applied Complex Analysis
 - (AMATH 568) Advanced Methods for Ordinary Differential Equations
 - (AMATH 569) Advanced Methods for Partial Differential Equations
 - (AMATH 575) Dynamical Systems
 - (AMATH 582) Computational Methods for Data Analysis
 - (AMATH 584) Numerical Linear Algebra
 - (AMATH 585) Numerical Analysis of Boundary Value Problems
 - (AMATH 586) Numerical Analysis of Time Dependent Problems
 - (AMATH 590) High-Dimensional Probability and Random Matrices
 - (AMATH 590) Low Rank Methods in Numerical Linear Algebra for Big Problems
- Computer Science
- (CSE 373) Data Structures and Algorithms
 - (CSE 414) Database Systems
 - (CSE 415) Artificial Intelligence
 - (CSE 417) Algorithms and Computational Complexity
 - (CSE 546) Machine Learning
 - (CSE 547) Machine Learning for Big Data

Community Outreach

- 2024–Present **SPECTRA: The Association for LGBT Mathematicians**, *UW Department of Applied Mathematics and UW Department of Mathematics*, UW SPECTRA Chapter Co-Chair and Co-Founder. I currently serve as a lead organizer for the cross-departmental UW SPECTRA community. I facilitate quarterly events aimed at fostering community among LGBTQIA+ mathematicians at UW, and I coordinate the development of materials needed to maintain chapter status.
- 2022–2024 **Inclusion, Diversity, Equity, and Accessibility (IDEA) Committee**, *UW Department of Applied Mathematics*, Committee Member. While on the committee, I planned and facilitated departmental events and initiatives aimed at building community within the department. I also gathered and presented strategies that were later implemented by the department to improve the accessibility of the undergraduate major. I am also the former lead coordinator for the department's Women in Applied Mathematics Mentorship (WAMM) program, which pairs undergraduate women with graduate mentors for a quarter of guided research exposure.

References

Prof. J. Nathan Kutz

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Dr. Andrew Glaws

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Prof. Steven L. Brunton

Professor, Department of Mechanical Engineering
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Prof. Michelle Hickner

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