SARA ICHINAGA

Curriculum Vitae

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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. *In review, SIAM Journal on Applied Dynamical Systems*, 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/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 (manuscript details available upon request)

Chace Wilcoxson, **Sara M. Ichinaga**, Ana Larranaga, Navid Zobeiry, and Steven L. Brunton. Dynamic Mode Decomposition with control for composite material curing.

Sara M. Ichinaga, Alexander W. Hsu, Niharika Karnik, Steven L. Brunton, and J. Nathan Kutz. Weak Dynamic Mode Decomposition with control.

Sara M. Ichinaga, Steven L. Brunton, and J. Nathan Kutz. An alternative perspective on Takens Embedding Theorem.

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 – Spring 2022: **MATH 124, 125, 126: Calculus with Analytic Geometry**, *UW Mathematics Department*.
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

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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Prof. Steven L. Brunton
Professor,
Department of Mechanical Engineering
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✉ sbrunton@uw.edu

Dr. Andrew Glaws
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