Doris Voina

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Postdoctoral Scholar
Université de Montréal, Department of Psychology, and Mila - Quebec AI Institute, Montréal, QC Canada
June 2025 - present

EDUCATION

University of Washington, Seattle, WA
● Ph.D., Applied Mathematics; Certificate in Neural Computation and Engineering, Computational Neuroscience Program August 2022
● M.Sc., Applied Mathematics December 2015
Princeton University, Princeton, NJ June 2013
● A.B., Mathematics; Certificates in Applied and Computational Mathematics, German

PAST EMPLOYMENT

Postdoctoral Scholar
University of Washington, AI Institute in Dynamic Systems and Electrical and Computer Engineering Department, Seattle, WA September 2022 - May 2025
Research Assistant & Visiting Student
University of Washington & Allen Institute for Brain Science 2014-2015; 2019 - 2022
Software Developer Engineer Intern, TigerGraph March - June 2022
Worked on a project involving Graph Neural Network explainability methods
Freelance Data Analyst Base Capital, June 2016 - September 2016
Bayesian models on salary prediction
Data Scientist, Cognetik January 2016 - June 2016
Customer analytics solutions
Research Assistant, Princeton University September 2013 - June 2014
Working with Prof. Naomi Leonard modeling leadership in the collective behavior of a dance group

TEACHING

Instructor, University of Washington July 2019 - August 2019
Lead instructor teaching AMATH 383 *Introduction to Continuous Mathematical Modeling*
Teaching Assistant, Allen Institute's Summer Workshop for the Dynamic Brain, September 2021
Teaching Assistant, University of Washington March 2017 - June 2019
Workshop instructor, MAIN 2025 December 2025
"Computation in Neuroscience & AI: a Dynamical Systems Perspective with RNNs":
https://main-educational.github.io/neuroai-dynamical-systems/

PUBLICATIONS

- Voina D., Brunton S., Kutz J.N., *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems*
  doi: https://doi.org/10.48550/arXiv.2410.02079
  Design data-driven method to extract interpretable, parsimonious models in the form of closed-form differential equations for nonlinear, noisy, and non-stationary dynamical systems.
- Voina D., Recanatesi S., Hu B., Shea-Brown E., Mihalas S., *Single circuit in V1 capable of switching contexts during movement using inhibitory population as a switch*, Neural Computation Journal, 2021
  Designed a Bayesian model that can switch priors to model the brain's visual cortex. To infer weights between neurons and make model predictions, I solved a constrained optimization problem using the Adam optimizer from PyTorch. (*Python*)
- Voina D., Shea-Brown E., Mihalas S., A biologically inspired architecture with switching units can learn to generalize across backgrounds

Developed a new transfer learning method for image classification for objects set on different contexts/backgrounds drawing inspiration from the visual cortex model. (*Python*)

ONGOING PROJECTS

- Implement System 1/System 2 cognition (faster, automatic versus slower, more precise cognition) in AI learning by testing architectures and principles that could yield energy-efficient, heuristic reasoning alongside more systematic, deliberative reasoning (with Shahab Bakhtiari)
- Develop realistic virtual environments using generative modeling and mouse camera data to simulate an animal's visual experience through its naturalistic habitat. Use semi-supervised learning to train models using these virtual settings (with Imane Hamzaoui, Shahab Bakhtiari)
- Design data-driven method to extract interpretable, parsimonious models in the form of closed-form differential equations for nonlinear, noisy, and non-stationary dynamical systems.
- An application of deep generative networks and SINDy to reduce dimensionality in partial differential equations (with Yuma Nakamura, Dr. Thomas de Jong, and Dr. Hirofumi Notsu at Kanazawa University)
- Cell type classification based on neural activity and connectivity using Graph Neural Networks (with Allen Institute for Brain Science and Allen Institute in Neural Dynamics)

INVITED TALKS

- *Rethinking simplicity in computation: quick heuristics in the brain and in AI,* Neuro-AI Scientific retreat, Le Baluchon, Quebec, Canada, October 30, 2025
- *Dynamic SINDy: latent variable discovery in noisy and nonlinear systems,* Machine Learning and Dynamical Systems (MLDS) Seminar, Alan Turing Institute, London, UK, March 27, 2025
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* DEDS (Differential Equations for Data Science), February 2025, Kyoto, Japan
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* University of Texas at Arlington, Arlington, TX, November 15 2024
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* University of Nevada at Reno, Reno, NV, October 11 2024
- *Graph neural networks and their applications to cell type classification in the mouse brain,* Montana State University, Bozeman, MT, September 4 2024
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* Montana State University, Bozeman, MT, September 5 2024
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* WCCM (World Congress on Computational Mechanics), Vancouver BC, Canada, July 21-26 2024
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems,* SIAM Uncertainty Quantification, Trieste, Italy, March 2024
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems*, Conference on Complex Systems, Bahia, Brazil, October 2023
- *Flexible visual processing in biological and artificial neural networks*, Neural Computation and Engineering Connection, Seattle 2019, 2020
- *Network mechanisms for switching neuronal dynamics*, The Women in Network Science (WiNS) seminar, Duke University, March 2023

POSTERS

- *Deep generative networks as a computational approach for global non-linear control modeling in the nematode C. elegans,* with Brunton S., Kutz J.N., Society for Neuroscience, October 5-7, 2024, Chicago (virtual poster)
- Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamics for Nematode C. elegans Locomotion and for Other Systems, with Brunton S., Kutz J.N., Science Understanding through Data Science conference, August 21-23 2024, Pasadena, CA; doi: 10.22541/essoar.172736445.51490633/v1
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamics for nematode C. elegans locomotion and other systems,* with Brunton S., Kutz J.N., Fourth Symposium on Machine Learning and Dynamical Systems July 8-12, 2024, Toronto, ON Canada
- *Deep Generative Modeling for Identification of Noisy, Non-Stationary Dynamical Systems* with Brunton S., Kutz J.N., Women in Machine Learning Workshop (Neurips workshop), December 2023, New Orleans, LA

● *A biologically inspired architecture with switching units can learn to generalize across backgrounds* with Shea-Brown E., Mihalas S., Society for Neuroscience, November 2022, San Diego, CA
● *Single circuit in V1 capable of switching contexts during movement using VIP population as low-dimensional switch* with Recanatesi S., Hu Brian, Shea-Brown E., Mihalas S., Society for Neuroscience, October 2019, Chicago, IL
● *Visual activity in V1 during locomotion demystified* with Recanatesi S., Shea-Brown E., Mihalas S., Computational Neuroscience Society, July 2018, Seattle, WA; Bernstein Conference September 2018, Berlin, Germany
● *Modeling behavior in a virtual visual environment: What (if anything) do mice optimize when foraging for abstract objects?* with Groblewski P., Olsen S., Shea-Brown E., Mihalas S., Society for Neuroscience, October 2015, Chicago IL
● *Fitting Diffusion Models to Value-Based Decisions* with Shenhav A., Feng S., Cohen J.D., Cognitive Neuroscience Society, April 2014, Boston MA

RELEVANT SKILLS
Main programming language: Python 3
Programming: Python, MATLAB (proficient); R, C, C++ (familiarity)
Other technical skills: Proficient in Linux, knowledge of HPC systems, job scheduling (slurm), resource management, cloud computing (AWS), Git/Github

OTHER EXPERIENCE
Summer Internship, Princeton Neuroscience Institute June - September 2013
Mathematics tutor 2011 - 2017
Helping ~30 undergraduates to excel in Calculus I, II, Multivariable Calculus, Linear Algebra

AWARDS
Computational Neuroscience Training Grant September 2019 - September 2021
● Won one of two places in a program supporting two years of graduate stipend
Math competition awards (high school)
● National Mathematical Olympiad in Romania, gold medal 2008 (4th place), "Grigore Moisil" contest: 3 times first place in 2007, 2008, 2009; Putnam top 500 in 2010, and other awards

LEADERSHIP / SERVICE
● Mentoring Imane Hamzaoui, Ph.D. student at Université de Montréal; Yuma Nakamura, Ph.D. student in Mathematics and Physics at Kanazawa University**;** Evan Ferguson, M.Sc. student in Applied Mathematics at the University of Washington
MONIC (Montréal initiative for consciousness) November 2025 - present
Organizing conferences for the general public, securing funding for the organization
● Co-organizer for the *Data-Driven Modeling of Complex Systems* mini symposium within the World Congress on Computational Mechanics (WCCM), July 21-26, 2024, Vancouver, BC, Canada
WAMM (Women in Applied Mathematics Mentoring Program) March - June 2019, 2020, 2022
● Mentoring four female undergraduates on projects regarding image classification in deep learning
Diversity Committee Member, Applied Mathematics Department, September 2018-September 2020
● Organizing events (e.g. Black History Month) in the Applied Math department sponsoring diversity
Peer review: **D3S3 2024** (Neurips, Vancouver Canada workshop), **PNAS 2021** (with Eric Shea-Brown)

OTHER SKILLS & PERSONAL
Languages: English (fluent), Romanian (native), German (intermediate), French (intermediate)
Artistic Skills/Hobbies: mountaineering, photography, writing, dancing, yoga, meditation Vice-president of Princeton Buddhist Group, main organizer & founder of meditation Meetup group