John H. Lagergren

Postdoctoral Research Associate
Computational and Predictive Biology
Oak Ridge National Laboratory

+1 (423) 707-5653
lagergrenjh@ornl.gov
ornl.gov/staff-profile/john-h-lagergren

Research

Scientific machine learning, data-driven modeling, and image processing to solve real-world problems in computational and predictive biology. Current research is focused on computer vision, global climate analysis, explainable artificial intelligence, and graph learning.

Education

North Carolina State University	Raleigh, NC
PhD, Applied Mathematics, GPA 4.0/4.0	December, 2020
MS, Applied Mathematics, GPA 4.0/4.0	December, 2018
East Tennessee State University	Johnson City, TN
BS, Applied Mathematics, Summa Cum Laude, GPA 3.9/4.0	December, 2015

Experience

Postdoctoral Research Associate, Oak Ridge National Laboratory — 2021 - Present
Scientific machine learning for computational systems biology.

Graduate Research Assistant, North Carolina State University — 2016 - 2020
Data-driven equation learning and biomedical image analysis.

Machine Learning Technical Intern, Applied Research Associates — 2019, 2020
Physics-guided geometric deep learning for defense applications.

SAMSI Graduate Fellow, North Carolina State University — 2018 - 2019
Deep generative models to study tumor heterogeneity in humans.

REU Researcher, East Tennessee State University — 2015
Matrix models for demographic analysis of academic enrollment.

Technical strengths

Computer languages	Python (PyTorch/Tensorflow/Keras), MATLAB, R
Markup languages	LaTeX, Microsoft Office
Tools	Windows/Mac/Linux, remote access HPCC, Git

Academic awards

ORNL Laboratory Directed Research and Development ($400,000)	2022 - 2023
NCSU Winton-Rose Award for Research Excellence ($1,000)	2020
SAMSI Graduate Fellowship ($25,000)	2018 - 2019
NCSU Graduate Student Research Symposium, 3rd Place	2017
NCSU Graduate Fellowship ($4,000)	2016 - 2017
MAA Outstanding Student Presenter Award	2016
ETSU S-STEM Scholarship ($2,750)	2015
ETSU Charles F. Wilkey Math Scholarship ($1,000)	2014

Publications

11. **J. Lagergren**, M. Cashman, V.M. Vergara, P. Eller, J.G.F.M. Gazolla, H. Chhetri, J. Streich, S. Climer, P. Thornton, W. Joubert, D. Jacobson. *Climatic clustering and longitudinal analysis with impacts on food, bioenergy, and pandemics.* Phytobiomes Journal, First Look (2022). `https://doi.org/10.1371/journal.pcbi.1008462`

10. N. Kimbrel, A. Ashley-Koch, X. Qin, J. Lindquist, M. Garrett, M. Dennis, L. Hair, J. Huffman, D. Jacobson, R. Madduri, J. Trafton, H. Coon, A. Docherty, J. Kang, N. Mullins, D. Ruderfer, VA Million Veteran Program, **MVP Suicide Exemplar Workgroup**, International Suicide Genetics Consortium, P. Harvey, B. McMahon, D. Oslin, E. Hauser, M. Hauser, J. Beckham *A genome-wide association study of suicide attempts in the million veterans program identifies evidence of pan-ancestry and ancestry-specific risk loci.* Molecular Psychiatry, vol. 27, 2022. `https://doi.org/10.1038/s41380-022-01472-3`

9. **J. Lagergren**, J. Nardini, R. Baker, M.J. Simpson, K. Flores. *Biologically-informed neural networks guide mechanistic modeling from sparse experimental data.* PLOS Computational Biology, vol. 16, no. 12 (2020). `https://doi.org/10.1371/journal.pcbi.1008462`

8. **J. Lagergren**, K. Flores, M. Gilman, S. Tsynkov. *Deep learning approach to the detection of scattering delay in radar images.* Journal of Statistical Theory and Practice, vol. 15, no. 14 (2020). `https://doi.org/10.1007/s42519-020-00149-w`

7. J. Nardini, **J. Lagergren**, A. Hawkins-Daarud, L. Curtin, B. Morris, E. Rutter, K. Swanson, K. Flores. *Learning equations from biological data with limited time samples.* Bulletin of Mathematical Biology, vol. 82, no. 119 (2020). `https://doi.org/10.1007/s11538-020-00794-z`

6. **J. Lagergren**, J. Nardini, G.M. Lavigne, E. Rutter, K. Flores. *Learning partial differential equations for biological transport models from noisy spatiotemporal data.* Proceedings of the Royal Society A, vol. 476, no. 2234 (2020). `https://doi.org/10.1098/rspa.2019.0800`

5. R. Everett, K. Flores, N. Henscheid, **J. Lagergren**, K. Larripa, D. Li, J. Nardini, P.T.T. Nguyen, E.B. Pitman, E. Rutter. *A tutorial review of mathematical techniques for quantifying tumor heterogeneity.* Mathematical Biosciences and Engineering, vol. 17, no. 4, pp 3660-3709 (2020). `http://dx.doi.org/10.3934/mbe.2020207`

4. T. Paniagua, **J. Lagergren**, G. Foderaro. *A simple deconvolutional mechanism for point clouds and sparse unordered data.* Proceedings of the AAAI Conference on Artificial Intelligence, vol. 34, no. 10 (2020). `https://doi.org/10.1609/aaai.v34i10.7217`

3. E. Rutter, **J. Lagergren**, K. Flores. *A convolutional neural network method for boundary optimization enables few-shot learning for biomedical image segmentation.* MICCAI 2019, Lecture Notes in Computer Science, vol. 11795, pp 190-198 (2019). `https://doi.org/10.1007/978-3-030-33391-1_22`

2. E. Rutter, **J. Lagergren**, K. Flores. *Automated object tracing for biomedical image segmentation using a deep convolutional neural network.* MICCAI 2018, Lecture Notes in Computer Science, vol. 11073, pp 686-694 (2018). `https://doi.org/10.1007/978-3-030-00937-3_78`

1. **J. Lagergren**, A. Reeder, F. Hamilton, R. Smith, K. Flores. *Forecasting and uncertainty quantification using a hybrid of mechanistic and non-mechanistic models for an age-structured population model.* Bulletin of Mathematical Biology, vol. 80, no. 6, pp 1578-1595 (2018). `https://doi.org/10.1007/s11538-018-0421-7`

Pre-prints

3. M. Pavicic, A. Walker, K. Sullivan, **J. Lagergren**, A. Cliff, J. Romero, J. Streich, M. Garvin, MVP Suicide Exemplar Workgroup, Million Veteran Program, J. Pestian, B. McMahon, D. Oslin, J. Beckham, N. Kimbrel, D. Jacobson. *Using Explainable-AI to Find Geospatial Environmental and Sociodemographic Predictors of Suicide Attempts*, 2022. `https://www.medrxiv.org/content/10.1101/2022.04.26.22274333v2.full`

2. **J. Lagergren**, E. Rutter, K. Flores. *Region growing with convolutional neural networks for biomedical image segmentation*, 2020. `https://arxiv.org/abs/2009.11717`

1. E. Rutter, **J. Lagergren**, G. Martin, E. Collins, H.T. Banks, G. LeBlanc, K. Flores. *LeDaphNet: an automated assessment of Daphnia magna populations using digital imaging and machine learning*, 2017. `http://www.lib.ncsu.edu/resolver/1840.20/35557`

Invited presentations

Explainable-AI predicts flying fox food shortages with applications to future pandemics, SIAM Conference on Life Sciences, 2022.

Few-shot learning enables fast and accurate image-based plant phenotyping, Center for Bioenergy Innovation Annual Science Meeting, 2022.

Employing rapid, accurate, high-precision phenotyping in poplar and switchgrass, Genomic Sciences Program Annual Meeting, 2022.

Data-driven network analysis detects longitudinal environmental changes with impacts on food, energy, and pandemics, SMB Annual Meeting, 2021.

Equation learning for partial differential equation models of biological transport, Joint Mathematics Meetings, 2021.

Biologically-informed neural networks guide mechanistic modeling from sparse experimental data, SMB Annual Meeting, 2020.

Data denoising and partial derivative approximation with neural networks, SIAM Conference on Mathematics of Data Science, 2020.

Neural networks: what they are and how to train them, Lanzas Lab, NCSU College of Veterinary Medicine, 2019, Raleigh, NC.

Applications of machine learning to heterogeneous population data, SAMSI Precision Medicine Transition Workshop, 2019, Raleigh, NC.

Undergraduate Workshop: Career Opporunities Panel, SAMSI program on statistical, mathematical, and computational methods for precision medicine (PMED), 2018, Raleigh, NC.

Data-driven prediction and uncertainty quantification of chaotic systems using a mechanistic and non-mechanistic hybrid model, SIAM Southeastern Atlantic Sectional Conference, 2018, Chapel Hill, NC.

Organized mini-symposia

Co-organizer: John Nardini. *Leveraging machine learning for discovery of mathematical models in biology*, SIAM Conference on Mathematics of Data Science, June 2020.