Seattle, WA

James Hazelden

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Website · GitHub · GeNTK software

Awards, Fellowships and Honors

- **NSF Graduate Research Fellowship (2023–2026):** $111,000 in stipends; $48,000 paid to UW for tuition and fees.
- **Breaking Barriers in Neuroscience Award (2026):** $1,000.
- **Boeing Research Awards (2024, 2026):** $300 each ($600 total).
- **CONNECT Travel Grants (two awards):** $500 each ($1,000 total).
- **Wilfred Kaplan Award in Applied Mathematics (2019)**; Evelyn O. Bychinsky Award (University of Michigan).
- **Google Gradient AI Fellow (2018)**; University of Michigan–Dearborn Honors Program stipend ($500).

Education and Research Focus

Seattle, WA **University of Washington** Fall 2021–present

PhD student, Applied Mathematics; advisors: Eli Shlizerman and Eric Shea-Brown. NSF Graduate Research Fellow.

Research: Mathematical and computational foundations of learning in finite neural networks, including global empirical NTK geometry, low-rank learning near bifurcations, and Green's-operator analyses of computation and task reuse.

Ann Arbor, MI **University of Michigan** 2018–2020

BA, Honors Mathematics and Computer Science; GPA 3.94, graduated with high distinction.

Selected Publications and Preprints

1. **Hazelden, J.**, Driscoll, L., Shlizerman, E., & Shea-Brown, E. (2026). *The Global Empirical NTK: Self-Referential Bias and Dimensionality of Gradient Descent Learning*. **Transactions on Machine Learning Research (TMLR)**, October 2026.
2. Sun, G.*, **Hazelden, J.***, Kim, R., & Forger, D. (2026). *Realistic coupling enables flexible macroscopic traveling waves in the mouse cortex*. **eLife**, 14:RP108208. **Equal contribution.*
3. Chua Cruz, M. E., **Hazelden, J.**, et al. (2026). *Biologically Interpretable Machine Learning Approaches for Analyzing Neural Data.* **Communications AI & Computing**.
4. **Hazelden, J.** & Shea-Brown, E. (2026). *Center-Manifold Reduction of Learning at Bifurcations: Interference and Rich Learning in Recurrent Neural Networks*. **NeurReps 2026** (NeurIPS workshop), accepted poster; arXiv:2605.12763.
5. **Hazelden, J.** (2026). *Disentangling Computation in Multi-Task Neural Networks with the Green's Operator*. **NeurReps 2026** (NeurIPS workshop), accepted poster; arXiv:2609.40292.
6. **Hazelden, J.**, Nagireddy, B. R., & Shea-Brown, E. (2026). *Fast Generalized Neural Tangent Kernel Statistics via Trace Estimation*. *Submitted to ICLR 2027*; arXiv:2511.10796.
7. **Hazelden, J.**, Driscoll, L., Shlizerman, E., & Shea-Brown, E. (2025). *KPFlow: An Operator Perspective on Dynamic Collapse Under Gradient Descent Training of Recurrent Networks*. arXiv preprint.
8. **Hazelden, J.**, Liu, Y. H., Shlizerman, E., & Shea-Brown, E. (2023). *Evolutionary Algorithms as an Alternative to Backpropagation for Supervised Training of Biophysical Neural Networks and Neural ODEs*. arXiv preprint.
9. **Hazelden, J.**, Ivanitskiy, M., & Forger, D. (2020). *Biophysical Neural Networks Provide Robustness and Versatility over Artificial Neural Networks.* NeurIPS Beyond Backpropagation Workshop.

Research Experience

Allen Institute — Visiting Scientist 2024–present

Collaborating with Laura Driscoll on finite-width learning geometry and dynamical computation. Develop operator-based theory and scalable, matrix-free diagnostics for RNNs and transformers; released the gentk research library.

SRI / PARC — Computation Design R&D Intern 2023

Built GPU-accelerated neural models for 3D machining fields and architectures with manufacturing constraints.

University of Michigan — HFSP Research Assistant 2019–2020

Developed CUDA simulation and training tools for large-scale biophysical neural networks with Daniel Forger.

Selected Talks and Presentations

Invited research seminars and lab visits

- ETH Zurich, Valerio Mante group (October 1, 2026).
- Computation Through Dynamics group, Paris, hosted by Srdjan Ostojic (September 8, 2026).
- New York University, Alex Williams group (October 13, 2026).
- Stanford University, Shaul Druckmann group — invited lab talk and research visit (planned).
- University of Oregon, Luca Mazzucato group — invited lab talk and research visit (planned).
- Allen Institute (February 4, 2026; Theory Meeting, October 2025); Minds and Machines seminar (2026).

Additional selected talks and conference presentations

- DeepMath 2026 — talk; International Linear Algebra Society — talk in the Numerical Linear Algebra in Machine Learning minisymposium (2026).
- PARC/SRI (February 2026); SIAM Pacific Northwest (2025).
- **NeurReps 2026 (NeurIPS workshop):** two accepted posters — center-manifold learning near bifurcations and Green's-operator analysis of multi-task computation.
- NeuroAI 2026 (Seattle) — poster; Montréal AI & Neuroscience (MAIN) 2026 — accepted poster; Dynamics Days 2026 — poster.
- Additional posters: NeuroAI 2025; Lakes Conference 2025; DeepMath 2024 and 2025; NeurIPS Beyond Backpropagation Workshop 2020.

Academic Service and Mentoring

Peer review: *Proceedings of the National Academy of Sciences* (PNAS); Cosyne 2027; NeurReps 2026 (NeurIPS workshop); Cosyne 2025.

Mentoring: Mentored Balaaji Reddy Nagireddy on matrix-free NTK statistics, resulting in a coauthored ICLR 2027 submission.

Community: Co-organized a SIAM Pacific Northwest 2025 minisymposium in learning theory and computational neuroscience; research seminar outreach and visits across neuroscience and ML groups.

Additional Research and Technical Experience

University of Washington — Research Assistant (2021): Training and optimization of biophysical networks with Eli Shlizerman.

Dyndrite — CAD Software Intern (2018): Optimized GPU/CUDA and OpenGL infrastructure for CAD geometry and NURBS evaluation.

Methods and software: PyTorch, Python, C++, CUDA, randomized numerical linear algebra, automatic differentiation, recurrent neural networks, dynamical systems, GPU programming; familiarity with Julia, Rust, OCaml, MATLAB and OpenGL.

Languages: English (native), German (proficient).