

Mozes Jacobs

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EDUCATION

Harvard University

Ph.D. in Computer Science | Advisor: Demba Ba | Kempner Graduate Fellow

Cambridge, MA

2023 – 2028 (Expected)

University of Washington

B.S. in Computer Science | Advisor: Rajesh Rao | GPA: 3.99 / 4.00

Seattle, WA

2018 – 2022

PUBLICATIONS & PREPRINTS

- [1] Jacobs M.*, Fel T.*, Hakim R.*, Brondetta A., Ba D., Keller TA. (2025). **Block-Recurrent Dynamics in ViTs**. *Under review*.
- [2] Jacobs M., Budzinski RC., Muller L., Ba D., Keller TA. (2025). **Traveling Waves Integrate Spatial Information Through Time**. *CCN 2025*.
- [3] Jacobs M., Budzinski RC., Muller L., Ba D., Keller TA. (2025). **Traveling Waves Integrate Spatial Information Intro Spectral Representations**. *ICLR 2025 Re-Align Workshop*.
- [4] Jacobs M., Brunton BW., Brunton SL., Kutz JN., Raut RV. (2023). **HyperSINDY: Deep Generative Modeling of Nonlinear Stochastic Governing Equations**. *Preprint on arXiv*.

PROFESSIONAL EXPERIENCE

Kempner Institute (Harvard University)

Graduate Research Fellow / Advisor: Demba Ba

Cambridge, MA

2023 – Present

- **Block-Recurrent Foundation Models (Raptor):** Developed the *Block-Recurrent Hypothesis*, demonstrating that foundation models (e.g., DINOV2) can be accurately distilled using recurrent blocks. Trained surrogate models to recover **96%** of ImageNet-1k accuracy using only **2 distinct blocks** applied recurrently (vs. original depth), offering a normative solution for model compression.
- **Dynamical Interpretability:** Established a mechanistic framework characterizing ViT depth as a flow into low-dimensional attractors. Uncovered token-specific dynamics, including self-correcting trajectories and low-rank updates in late layers, bridging the gap between deep learning and dynamical systems analysis.
- **Neuro-Inspired Architectures:** Designed convolutional recurrent models that utilize traveling waves for global spatial information integration, outperforming standard U-Nets on semantic segmentation benchmarks.

Allen Institute (AI Institute in Dynamic Systems)

Shanahan Foundation Predoctoral Fellow / Advisors: Ryan Raut, J. Nathan Kutz, Steve Brunton

Seattle, WA

2022 – 2023

- **HyperSINDy:** Developed a probabilistic framework for modeling stochastic dynamics via deep generative models and amortized variational inference, enabling uncertainty quantification for sparse governing equations.

Neural Systems Lab (University of Washington)

Undergraduate Research Assistant / Advisor: Rajesh Rao

Seattle, WA

2019 – 2022

- **Predictive Coding:** Proposed *Gradient Origin Predictive Coding*, a novel video generation framework merging cortical theories of predictive coding with Bayesian deep learning for next-frame prediction.

Noble Lab (University of Washington)

Undergraduate Research Assistant / Advisor: Bill Noble

Seattle, WA

2020 – 2022

- **Genomic Algorithms:** Optimized *PASTIS*, a Poisson-based algorithm for inferring 3D chromatin structures from Hi-C maps, significantly reducing memory overhead and workflow runtime.

INVITED TALKS

- [1] **Traveling Waves Integrate Spatial Information Through Time**. Neural Computations: Dynamics Across Space, Time, and Task - *CCN*. (August 2025).
- [2] **Can Your Neurons Hear the Shape of an Object?** Frontiers in NeuroAI Symposium - Kempner Institute. (June 2025).

AWARDS & FELLOWSHIPS

Kempner Institute Graduate Fellowship | Harvard University

2023 – Present

2022

Shanahan Foundation Predoctoral Fellowship | Allen Institute

2020, 2021

Burkhardt Family Endowed Scholarship

2019

Gary A. Kildall Endowed Scholarship

2018

Boeing Scholarship

TECHNICAL SKILLS

Languages & Frameworks: Python, PyTorch

Research Areas: Computer Vision, Visual Representation Learning, Mechanistic Interpretability, Foundation Models