

Jesseba Fernando

PHD STUDENT · NETWORK SCIENCE INSTITUTE

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Education

Northeastern University

Boston, MA

PHD NETWORK SCIENCE

Aug. 2023 - present

- Advisor: Dr. Samuel V. Scarpino

University of Connecticut

Storrs, CT

BSc & MSc NEUROBIOLOGY

Aug. 2012 - May 2018

- Honors Thesis and MSc Advisor: Dr. Joseph LoTurco

Research Experience

Northeastern University, Network Science Institute

Boston, MA

ADVISOR: DR. SAMUEL V. SCARPINO

August 2023–Present

- Analyzing neural dynamics in biological systems during learning and adaptation using network science approaches. Developing mechanistic interpretability frameworks for transformer architectures using statistical mechanics and information theory.

Dana-Farber Cancer Institute

Boston, MA

SUPERVISOR: DR. WILLIAM LOTTER

January–August 2023

- Developed domain adaptation methods for medical imaging models analyzing chest X-rays. Published: “Beyond Structured Attributes: Image-Based Predictive Trends for Chest X-Ray Classification.”

Harvard Medical School, Beth Israel Deaconess Medical Center

Boston, MA

SUPERVISOR: DR. MARK L. ANDERMANN

2018–2022

- Analyzed calcium imaging data on cortical encoding in postrhinal cortex and serotonergic retino-thalamic modulation; performed stereotaxic surgeries for a study on offline reactivations in memory consolidation. Co-authored papers in *Nature*, *Neuron*, and *Current Biology*.

University of Connecticut, Department of Physiology and Neurobiology

Storrs, CT

ADVISOR: DR. JOSEPH J. LOTURCO

2013–2016

- Honors Thesis: “Time Course of Synapse Development in Interneurons of the Disinhibitory Circuits of Somatosensory Cortex.”

Publications

**equally contributing authors*

PUBLISHED

Fernando, J., Guitchounts, G. 2026. Dynamics of the Transformer Residual Stream: Coupling Spectral Geometry to Network Topology. arXiv:2605.14258v1.

Nurisso, M., **Fernando, J.**, Deshpande, R., Perotti, A., Marjeh, R., Frankland, S.M., Lewis, R.L., Webb, T.W., Campbell, D., Vaccarino, F., Cohen, J.D., Petri, G. 2026. Bound by semanticity: universal laws governing the generalization-identification tradeoff. *International Conference on Learning Representations (ICLR)*.

Fernando, J., Guitchounts, G. 2025. Transformer Dynamics: A neuroscientific approach to interpretability of large language models. arXiv:2506.14797.

Fernando, J.*, Hoebel, K.V.*, Lotter, W. 2024. Beyond Structured Attributes: Image-Based Predictive Trends for Chest X-Ray Classification. *Machine Learning for Biomedical Imaging*, PMLR 250:610–640.

Nguyen, N.D., Lutas, A., Amsalem, O., **Fernando, J.**, Young-Ahn, A., Hakim, R., Vergara, J., McMahon, J., Dimidschstein, J., Sabatini, B.L., Andermann, M.L. 2024. Cortical reactivations predict future sensory responses. *Nature* 625:110–118.

Reggiani, J.D.S., Jiang, Q., Barbini, M., Lutas, A., Liang, L., **Fernando, J.**, Deng, F., Wan, J., Li, Y., Chen, C., Andermann, M.L. 2023. Brainstem serotonin neurons selectively gate retinal information flow to thalamus. *Neuron* 111:711–726.

McGuire, K.L., Amsalem, O., Sugden, A.U., Ramesh, R.N., **Fernando, J.**, Burgess, C.R., Andermann, M.L. 2022. Visual association cortex links cues with conjunctions of reward and locomotor contexts. *Current Biology* 32:1563-1576.

Presentations

†presenting author; *equally contributing authors

INVITED TALKS

May 2026. *Before the Behavior: Sparse learning signals anticipate adaptation to rule changes in postrhinal cortex*. Invited participant: BraiNets Retreat, Carry-Le-Rouet, FR.

May 2026. *Information-theoretic encoding in postrhinal cortex*. Visiting Fellow: Analytics Group Seminar, Institut de Neurosciences de la Timone, Marseille, FR.

May 2025. *From Neurons to Networks: Unraveling Adaptive Learning Mechanisms in Mice and Machines*. Invited Participant: Foundations of Adaptive Networks Working Group, Santa Fe Institute, Santa Fe, NM.

CONFERENCE TALKS

September 2025. *From Neurons to Networks: Unraveling Adaptive Learning Mechanisms in Mice and Machines*. Contributory Talk: Conference on Complex Systems, Siena, Italy.

May 2025. *Transformer Dynamics: A neuroscientific approach to interpretability of large language models*. Spotlight Talk: Sixth International Conference on Mathematics of Neuroscience and AI, Split, Croatia.

January 2025. *From Neurons to Networks: Unraveling Adaptive Learning Mechanisms in Mice and Machines*. Contributory Talk: NetSciX, Indore, India.

POSTERS

Fernando, J.[†], G. Petri, S.V. Scarpino. March 2025. *Unraveling Adaptive Learning Mechanisms in Mice and Machines*. Poster: NetSI Student Research Symposium, Boston, MA.

Fernando, J.[†], G. Petri, S.V. Scarpino. September 2024. *Multi-scale Analysis of Learning Dynamics in Biological and Artificial Neural Systems*. Poster: IPAM Naturalistic Approaches to Intelligence Workshop, Los Angeles, CA.

Fernando, J.^{*†}, K.V. Hoebel*, W. Lotter. July 2024. *Beyond Structured Attributes: Image-Based Predictive Trends for Chest X-Ray Classification*. Poster: Medical Imaging with Deep Learning, Paris, France.

Awards, Fellowships, & Grants

May 2026	AccelNet-MultiNet Fellowship , AccelNet-MultiNet program	\$8,350
Mar 2026	NetSI Spring Travel Award , Network Science Institute	\$1,000
May 2025	NetSI Spring Travel Award , Network Science Institute	\$1,000
Feb 2024	Workshop Travel Award , UCLA Institute of Pure and Applied Mathematics	\$1,725
Feb 2024	NetSI Spring Travel Award , Network Science Institute	\$1,000

Outreach & Professional Development

CONFERENCE & WORKSHOP ORGANIZATION

June 2026	Mathematics for Neuroscience & AI 2026 , Neural Theory Session Chair	Rome, IT
June 2026	NetSci 2026 Workshop: TopoNets: Analysis, Inference and Prediction , Organizer	Boston, MA
March 2026	CoSyNe 2026 Workshop: Renormalization Principles in Neural Systems , Chair	Lisbon, PT
Sept 2025	CCS 2025 Satellite: Complexity in the Brain , Chair	Siena, IT
March 2025	Network Science Student Research Symposium , Chair	Boston, MA

DEPARTMENTAL SERVICE

- 2024–present **Theoretical Neuroscience Reading Group**, Organizer *Remote*
- 2024–2025 **Students, Networks, And Collaborations (SNACs) Seminar**, Organizer *Boston, MA*
- 2024–2025 **Network Science Institute Graduate Student Association**, Events Coordinator *Boston, MA*

PEER REVIEW Cerebral Cortex

PROFESSIONAL DEVELOPMENT

- Santa Fe Institute Working Group:** Foundations of Adaptive Networks, *invited speaker*
- UCLA IPAM Workshop:** Naturalistic Approaches to Intelligence, *poster presenter*
- MIT CBMM Summer School:** Brains, Minds, Machines, *participant*
- Neuromatch Computational Neuroscience**, *participant*
- UCLA IPAM Workshop:** Mathematical Approaches for Connectome Analysis, *participant*

Teaching & Mentoring

Teaching

- 2016-2018 **PNB 2275: Physiology and Neurobiology I & II**, Teaching Assistant *UConn*
- 2017 **Integrative Neurobiological Imaging**, Teaching Assistant *UConn*

Mentoring Supervised 7 undergraduate students and 1 research technician in laboratory research at Harvard Medical School and Beth Israel Deaconess Medical Center (2018–2021).

Professional Experience

- 2023 **Research Assistant**, Dana Farber Cancer Institute - Data Science Department
- 2022-2023 **Consultant**, E11 Bio
- 2018-2023 **Senior Research Associate**, Harvard Medical School
- 2016-2018 **Graduate Teaching Assistant**, Physiology and Neurobiology, University of Connecticut
- 2013-2016 **Undergraduate Research Assistant**, Physiology and Neurobiology, University of Connecticut