Jesseba **Fernando**

PhD Student · Network Science Institute

Northeastern University, 177 Huntington Ave, Boston, MA 02115

fernando.je@northeastern.edu | jesseba.github.io | github.com/jesseba

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 Deaconness 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., Marjieh, 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. *TBD*. Invited participant: BraiNets Retreat, Institut de Neurosciences de la Timone, Marseille, 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 Deaconness 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