Kathryn Farrell
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EDUCATION

Princeton University *Expected May 2025*
A.B. Candidate; Concentration: Neuroscience (Major), Statistics & Machine Learning (Minor)
GPA: 3.92
Relevant coursework: NEU 545: Statistics for Neuroscience, COS 485: Neural Networks: Theory and Applications, MAT 365: Topology, MAT 202: Linear Algebra with Applications, SML 310: Research Projects in Data Science, NEU 385: Neuroendocrinology, Neural Circuits, and Behavior

RESEARCH EXPERIENCE

Neural Engineering and Rehabilitation Design Lab, University of Washington Department of Bioengineering *June 2024 - Present*
Advisor: Azadeh Yazdan-Shahmorad

- Analyzed primate cortical networks receiving targeted optogenetic stimulation as linear dynamical systems; demonstrated a sustained distortion of these dynamical systems when optogenetic stimulations were applied over time
- Led investigations into Dynamical Similarity Analysis (DSA) as a tool for contextualizing experimental results; developing a first-author publication on the applications of DSA to neural data, and computational methods for interpreting neural dynamical systems
- Supported by the National Science Foundation Research Experience for Undergraduates Award

Pillow Lab, Princeton Neuroscience Institute *Nov 2023 - Present*
Advisor: Jonathan Pillow

- Examining the latent variables underlying population responses in the hippocampus; describing hippocampal cell behavior using Gaussian Process Regression models
- Developed junior independent work investigating the prevalence and behavior of hippocampal non-place cells

Graziano Lab, Princeton Neuroscience Institute *Sept 2022 - Present*
Advisor: Michael Graziano

- Designed and implemented transformer-based neural network architectures with novel attention mechanisms which approximate the Attention Schema Theory; demonstrated

enhanced recognition of other agents' attention patterns and increased multi-agent cooperation associated with Attention Schema-inspired network structure
- Assisted in MRI scans localizing centers of predictive attention modeling in the human cortex
- Studied human subjects' sensitivity to the attentional patterns represented in eye gaze sequences in behavioral experiments

PUBLICATIONS

Farrell K. T., Ziman K., Graziano M. S. A. (2024). Testing Components of the Attention Schema Theory in Artificial Neural Networks. *Under revision at PNAS.*
arXiv: arxiv.org/abs/2411.00983

Ziman K., Kimmel S. C., Christian I., **Farrell K. T.,** Graziano M. S. A. (2024). Cortical networks involved in modeling the attention of others. *Submitted at Cerebral Cortex.*

Ziman K., Kimmel S. C., **Farrell K. T.,** Graziano M. S. A. (2023). Predicting the Attention of Others. *PNAS,* 120.

POSTER PRESENTATIONS

Farrell K. T., Ziman K., Graziano M. S. A. (2024). Can we build more cooperative deep learning models from theories of human cognition? *Princeton Symposium on the Safe Deployment of Foundation Models in Robotics, Princeton, NJ.*
- Received the 2nd Place Poster Award.

Farrell K. T., Ziman K., Graziano M. S. A. (2024). The attention schema theory in machine learning: training agents to classify the attention patterns of others. *Society for Neuroscience, Chicago, IL.*

Farrell K. T., Schwock F., Yazdan-Shahmorad A. (2024). Dynamical Similarity Analysis of primate cortical networks under targeted optogenetic stimulation. *From Neuroscience to Artificially Intelligent Systems, Cold Spring Harbor, NY.*

Schwock F., Bloch J., Khateeb K., Zhou J., **Farrell K. T.,** Wang Z. C., Atlas L., Yazdan-Shahmorad A. (2024). Inferring Neural Communication Dynamics from Field Potentials Using Graph Diffusion Autoregression. *Gordon Research Conferences: Optogenetic Approaches to Understanding Neural Circuits and Behavior, Lucca (Barga), Lucca, Italy.*

Ziman K., Kimmel S. C., **Farrell K. T.,** Graziano M. S. A. (2024). Neural activity when

predicting the attention of others. *Princeton Neuroscience Institute Annual Retreat, Atlantic City, NJ.*

Ziman K., Kimmel S. C., **Farrell K. T.,** Graziano M. S. A. (2023). Predicting the Attention of Others. *Princeton Neuroscience Institute Annual Retreat, Philadelphia, PA.*

Farrell K. T., Kimmel S. C. (2023). Human Attention Judgment and the Attention Schema Theory of Consciousness. *Princeton Research Day, Princeton, NJ.*

Ziman K., Kimmel S. C., **Farrell K. T.**, Graziano M. S. A. (2023). Modelling and Predicting the Attention of Others. *Association for the Scientific Study of Consciousness, New York, NY.*