AmirHossein Yavari

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Education

University of Oklahoma Ph.D. Student in Biomedical Engineering *Sep 2024 - Present*
Advisor: Dr. Farnaz Zamani Esfahlani

Sharif University of Technology Bachelor of Science in Mathematics *Sep 2017 - May 2023*

Research Focus

My research investigates **mechanistic identifiability** in learning systems: when models exhibit similar behavior but rely on different internal strategies. I develop **geometric and statistical** tools for representation and sensitivity analysis to distinguish functional alignment from mechanistic alignment, and to relate these distinctions to inductive bias, robustness, and neural computation.

Manuscripts in Preparation

[1] **A. Yavari**, F. Zamani Esfahlani. "Beyond Activation Alignment: The Geometry of Neural Sensitivity." *(Draft available upon request).*

[2] **A. Yavari**, J. Faskowitz, R. Betzel, F. Zamani Esfahlani. "Dynamics of Cortico-Subcortical Interactions in Functional Brain Networks." *(In Preparation).*

Conference Presentations

[1] **A. Yavari**, J. Faskowitz, R. Betzel, F. Zamani Esfahlani. "Dynamics of Cortico-Subcortical Interactions in Functional Brain Networks." *Society for Neuroscience (SfN) Annual Meeting, San Diego, CA, November 2025.*

Research Experience

Biomedical Engineering Department, University of Oklahoma Graduate Researcher *Sep 2024 – Present*

- **Geometric Model Comparison:** Formulating metrics for analyzing the geometry of learned representations across architectures. Focused on distinguishing behavioral similarity from mechanistic similarity using differential- and information-geometric techniques. Built scalable large-model analysis workflows in **JAX** on TPU.
- **Neural Dynamics & State-Space Modeling:** Applied dynamical systems approaches to large-scale neuroimaging data (HCP).
  - Developed a **state-space clustering framework** to map high-dimensional time series into latent regimes of network integration and segregation.
  - Designed permutation-based null models to isolate the causal contribution of high-amplitude transient events to system-wide coupling.

ShenakhtPajouh Lead Researcher *Sep 2018 – Dec 2020*

- Led research on interpretable Natural Language Generation (NLG), implementing attention-based architectures to improve model transparency.

University of Essex Scientific Collaborator *Sep 2020 – Jun 2021*

- Co-developed classifiers for Potentially Idiomatic Expressions (PIE), focusing on the distributional semantics of idiomatic intent.

Skills

Frameworks & Languages: JAX, PyTorch, Python, TensorFlow, R, MATLAB, Git.
Mathematical: Differential Geometry, Stochastic Processes, Graph Theory, Linear Algebra.

Honors & Awards

- **2025** GCoE Graduate Student Travel Award.
- **2025** Third place, American Airlines Operation Research Hackathon.
- **2021** Best Poster Award, Eastern European Machine Learning (EEML) Summer School.

Relevant Coursework

Neuroscience: Behavioral Neurobiology, Neurobiology of Disease, Neural Data Science.

Mathematics & CS: Functional Analysis, Real Analysis, Topology, Network Optimization, Probability & Statistics, Theory of Computation.