

Joshua Michael Roldan

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RESEARCH INTERESTS Neural Computation; Topological Neuroscience; Spiking Neural Networks; Systems Engineering; Topological/Geometric Deep Learning

EDUCATION **B.S in Mathematics (Minor in Philosophy).** University of California, San Diego. Graduated March 2018.
Related Classes: Algebra, Differential Geometry, Topology, Graph Theory, Math Logic

AWARDS Microsoft Research Fellowship Award. August 2018 - August 2022.

RESEARCH EXPERIENCE Research Assistant, March 2018 - August 2022.
Department of Bioengineering, University of California, San Diego
Mathematical Neuroscience Lab at Center for Engineered Natural Intelligence.
PI: Gabriel Silva. <http://www.silva.ucsd.edu/>.

Unsupervised Learning via Spiking Neural Networks.

- Joint collaboration with Microsoft Special Projects team.
- Lead small group and first-authored a network neuroscience paper.
- Created a latent space manifold for network dynamics.
- Queried how STDP learning rule affects manifold representation.

MEA Effective Network Analysis of Cortical Brain Organoids.

- Used graph theoretic and algebraic-topological methods to analyze organoid network dynamics.
- Applied results to determine system pathologies in autism.

Research Collaborator, May 2023 - present.

PI: Yuan Wang. <https://www.tda-brain.com/>.

Post-Surgical Outcome Prediction via Graph Neural Networks.

- Constructing a Graph Neural Network model to predict post-surgical outcome based on tractography diffusion measures.
- Data is derived from ENIGMA epilepsy dataset.

PAPERS **Roldan J.,** Pardo S., George V., Silva G. (2020) *Construction of edge-ordered multidirected graphlets for comparing dynamics of spatial temporal neural networks.* [arXiv:2006.15971](https://arxiv.org/abs/2006.15971)

POSTER Poster Title: *Topology of Dynamic Perceptrons.* Center for Engineered Natural Intelligence Symposium. La Jolla, CA. December 2018.

SKILLS **Coding Languages:** Python, Matlab
Topological Data Analysis: JavaPlex, Gudhi, Ripser, giotto-tda
Foreign Languages: English (Native), Spanish (B2), Italian (A2)