Srajan Agarwal

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Research Interests

Scientific Interests: Computational Neuroscience, Neural Population Dynamics, Neural Computation, Network Neuroscience, Neural Representation Learning.

Methodological Interests: Graph Representation Learning, Geometric Deep Learning, Graph Diffusion, Dynamical Systems, Multiscale Network Modelling.

Education

B.S.-M.S. in Data Science **Nov 2022 - Present**

Indian Institute of Science Education and Research (IISER TVM), Thiruvananthapuram

CGPA: 8.11 / 10 | *Major Subject GPA: 8.66 / 10* | *Expected Graduation: August 2027*

- **Relevant Coursework:** Deep Learning, Machine Learning, Cognitive Science, Systems Biology, AI in Medical Imaging, Mathematical Modeling, Probability & Statistics.

Publications & Preprints

- **Srajan Agarwal**, Megha P, Bikas C Das, Zakaria Laskar, and Saptarshi Bej. "**Extremely Fast and Compact Binary Graph Representations via Randomized Operator Sketching**." *arXiv preprint arXiv:2609.32641* (2026), **under review**. First author. **[arXiv:2609.32641]**
- Megha P, Harshit Kumar, **Srajan Agarwal**, Anirban Banerjee, Olaf Wolkenhauer, and Saptarshi Bej. "**HyperFuse: Fast Self-Supervised Node Embeddings for Attributed Hypergraphs**." *arXiv preprint arXiv:2610.03211* (2026). Co-author. **[arXiv:2610.03211]**

Research Experience

Master's Researcher (Major Thesis) **Jun 2026 - Present**

IDEA Lab, IISER TVM | Advisor: Dr. Saptarshi Bej

- **Scalable Graph Condensation for Complex Network Topologies (Ongoing):**
  - Synthesizing compact graph proxies from large networks via algebraic condensation, preserving multi-scale spectral properties and motif distributions.
  - Formulating gradient-free alignment objectives to couple discrete sketches with continuous representations, enabling memory-efficient GNN training on constrained hardware.
- **Randomized Operator Sketching for Compact Graph Representations (Preprint / Under Review):**
  - Achieved 0.46s average latency across 10 benchmarks (9x to 2900x faster than baselines), matching continuous GNN accuracy (up to 76.1%) with compact binary vectors.
  - Developed an algebraic hashing method via randomized Nyström operator sampling, producing compact binary node representations.

Remote NeuroAI Researcher **Apr 2026 - Present**

Cajal Institute, CSIC, Madrid | Advisor: Dr. Guiomar Niso ***Manuscript in Preparation***

- **Graph Modelling of Cortical Networks:** Developed a dual-stream GNN on source-localised EEG across cortical parcels, coupling Personalized PageRank diffusion over an anatomical graph with patient-specific spectral-profile cosine attention.
- **EEG-Based Dementia Classification:** Eliminated temporal epoch leakage in rs-EEG, evaluating AD versus FTD classification against non-graph baselines using participant-level splits.
- **Message Passing & Spatial Regularisation:** Found through topology ablations that graph message passing acts primarily as a spatial smoothing regularizer to stabilize optimization across cortical parcels.
- **Cortical Mapping & Model Interpretation:** Mapped 3D Grad-CAM attributions onto continuous cortical surfaces, assessing the correspondence between cortical attributions and regional θ/α slowing through sanity checks.

Research Experience (Continued)

Undergraduate Researcher **Dec 2024 - Sep 2025**

Medical Imaging Lab, IISER TVM | Advisor: Dr. Raji Susan Mathew

- **High-Field Brain MRI (QSM):** Implemented non-linear phase unwrapping and background field removal routines, enhancing magnetic susceptibility estimation in subcortical deep gray matter.
- **Tomographic Reconstruction:** Reconstructed 3D volumes from sparse-angle projections using Deep Image Prior (DIP) regularized with total variation (TV) optimization.

Machine Learning Researcher **Mar 2025 - Sep 2025**

India AI Project | Collaborative Public Sector Initiative

- **Streaming Intelligence Pipeline:** Deployed an end-to-end NLP and NER pipeline in a collaborative team, automating real-time incident filtering and event classification from regional press.
- **Contextual Predictive Modeling:** Fine-tuned language models for contextual sequence classification, forecasting emerging incident trends to support proactive decision-making.

Selected Projects

IBL Multi-Region Neural Population Decoding **2025**

International Brain Laboratory Neuropixels Data Analysis

- Decoded mouse perceptual choices from visual and motor Neuropixels recordings via PCA and GLMs, tracing low-dimensional subspace trajectories across neural populations. **[Code]**

Spike2Image: Biologically Inspired Visual Decoding **2025 - 2026**

Neural Spike Encoding to Image Reconstruction

- Engineered a 3D CNN decoder to reconstruct visual stimuli from sparse spike trains; Poisson neural coding achieved highest fidelity across 4 evaluated schemes. **[IEEE Xplore]**

Neural Oscillatory Decoding for Motor Intention **2025**

EEG Signal Processing & Representation Learning

- Achieved 92.8% accuracy across 6 motor imagery classes via an MNE-Python pipeline (CSP filtering, time-frequency features), benchmarking XGBoost against CNN-LSTMs. **[Code]**

Technical Skills

- **NeuroAI & Neural Data:** MNE-Python, Neuropixels/IBL, EEG Spectral Analysis, Cortical Surface Meshes, QSM Phase Reconstruction
- **Graph & Geometric ML:** PyTorch Geometric (PyG), Spherical GNNs, GraphSAGE, GCN, Manifold Learning, NetworkX
- **Machine Learning:** PyTorch, TensorFlow, Spiking Neural Networks (SNNs), HuggingFace Transformers, Scikit-learn
- **Scientific Computing:** NumPy, SciPy, MATLAB, R, C++ (MPI, OpenMP)
- **Tools & Environments:** Linux/Unix, Git, LaTeX

Honors, Leadership & Certificates

- **National Examination:** Qualified the **GATE** examination in Data Science & AI (DA) in 2025 and 2026.
- **Academic Leadership:** Elected **Class Representative** for Data Science (Vasanth 2025 and 2026 cohorts) at IISER Thiruvananthapuram.
- **Certificate:** Computational Neuroscience, Univ. of Washington via Coursera (neural encoding/decoding, biophysical models, synaptic plasticity).
- **Languages:** English (Professional Fluency), Hindi (Native), Japanese (Elementary).
- **Hobbies:** Acoustic Guitar, Sketching, Books.