

# Shrivatsa Deshmukh

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## SKILLS

**Neuro & Computational:** EEG/fMRI Analysis, Calcium Imaging, Neural Data Analysis, Simulation-Based Inference (SNPE), Hierarchical Statistical Modeling (GLMMs), MNE-Python

**Programming & ML:** Python, NumPy, SciPy, Pandas, PyTorch, TensorFlow, Keras, Scikit-learn, MATLAB, Git, Linux/Bash

## EXPERIENCE

**Noel Lab, University of Minnesota** | *Research Associate*

September 2025 – Present

- Designed a Zero-Inflated Negative Binomial (ZINB GLMMs) pipeline to characterize ASD-associated neural signatures across three rodent models (Fmr1, Cntnap2, Shank3 KOs) and wildtype controls in International Brain Laboratory (IBL) electrophysiological data spanning 32 brain regions; initial analysis scoped to primary visual cortex.
- Quantified neural response variability, contrast response functions, and adaptation dynamics across 613 neurons, 375,000+ trials, and 37 sessions; preliminary ASD vs. wildtype differences align with existing literature, with cross-model analysis ongoing to assess generalizability across genetic models.

**Brain Networks Group, Max Planck Institute CBS** | *Guest Researcher*

May 2025 – September 2025

- Implemented amortized Bayesian inference for the Jansen-Rit neural mass model via Sequential Neural Posterior Estimation (SNPE), achieving mean  $R^2 = 0.79$ , Pearson  $r = 0.89$ , and well-calibrated posteriors across parameters.
- Grounded simulations biophysically using an MNE fsaverage lead field for cortex-to-electrode projection and 1/f noise augmentation; ablation analysis identified which EEG embedding features drive inference for each model parameter and characterized model sensitivity to 1/f noise levels, validating the domain-informed embedding design.

**Alfonso Araque Lab, University of Minnesota** | *Research Associate*

March 2025 – December 2025

- Built a Python pipeline integrating AQuA2-based event detection with automated extraction of 16 spatiotemporal features across 96 calcium imaging files; identified event frequency as the primary discriminating variable.
- Applied non-parametric testing across 4 conditions (wildtype, 5-HT<sub>2A</sub> antagonism, IP3R2 KO, CalEx) to confirm that astrocyte Ca<sup>2+</sup> activation and washout reversibility was selectively abolished across all serotonergic-IP3 perturbations, statistically confirming pathway-specific mediation of glial dynamics.

**Health Intelligence Lab, University of Minnesota** | *Research Associate*

November 2024 – May 2025

- Benchmarked six DMD extensions on EEG signals; identified Optimized DMD as most robust and non-stationarity as the core bottleneck, positioning Non-Stationary DMD (NS-DMD) as the natural next step for capturing drifting spatiotemporal dynamics in long-horizon EEG decomposition.
- Decomposed fMRI data from 100 subjects via tensor decomposition; unexpectedly weak amygdala-BDI (Beck Depression Inventory) correlations during an emotion processing task suggest BDI alone conflates depression with broader affective states, positioning anxiety as a necessary covariate for improving inter-subject variance explanation.

**Indian Institute of Technology Kanpur** | *Research Associate*

January 2023 – August 2023

- Designed a multimodal fusion pipeline integrating real-time EMG signals with YOLOv5 object detection for grasp intent decoding in prosthetic/exoskeleton hands, unifying time-domain EMG features with computer vision outputs as a single input representation.
- Benchmarked ANN, SVM, and KNN on fused EMG-CV representations; ANN achieved 11.57% accuracy improvement over prior published methods, with cross-modal compensation between modalities as the core novel contribution.
- Publication:** Deshmukh Shrivatsa, Vitthal Khatik, and Anupam Saxena. "Robust Fusion Model for Handling EMG and Computer Vision Data in Prosthetic Hand Control." *IEEE Sensors Letters* (2023). [doi:10.1109/LSSENS.2023.3301837](https://doi.org/10.1109/LSSENS.2023.3301837)

**Mercedes-Benz Research & Development India** | *Data Scientist Intern*

July 2022 – December 2022

- Developed a random forest model (77% accuracy) on finite element simulations of human body models under crash conditions to identify critical anatomical and structural factors driving biomechanical injury risk, framing vehicle safety as a human physiological response problem.

## PROJECTS

**Neural Phoneme Decoder for Speech BCI**

January 2025 – May 2025

- Implemented a Gated Recurrent Unit (GRU)- RNN to decode neural signals into phoneme sequences for Speech BCI; optimized loss function and training pipeline to adapt the architecture for phoneme-level prediction, achieving 78.77% accuracy comparable to published benchmarks.

**Spatiotemporal EEG Decoding for Motor Imagery BCI**

August 2024 – December 2024

- Reproduced and evaluated an EEGNet-based motor imagery classification pipeline (BCI Competition 2020 Track 4, 64.97% accuracy); benchmarked against prior literature to characterize the limits of spatiotemporal feature extraction under high-noise, low-data EEG conditions.

## EDUCATION

**University of Minnesota – Twin Cities**

August 2024 – May 2026 (Tentative)

*Master of Science in Robotics (Specialization: Medical Robotics)*

**GPA: 3.95 / 4.00**

**Birla Institute of Technology and Science (BITS), Pilani**

August 2018 – May 2023

*Bachelor of Engineering in Mechanical Engineering*

**GPA: 8.37 / 10.00**

*Master of Science in Physics*