SHAILAJA AKELLA

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SUMMARY KEYWORDS

Neural coding, Neural dynamics, Brain rhythms, Machine learning, Computer vision, Artificial intelligence, Signal processing, Dynamical systems, Information Theory

EDUCATION

Ph.D. Electrical and Computer Engineering — Aug 2017 – Dec 2021
University of Florida, Gainesville — FL, USA
Thesis title: Neuromodulatory pattern analysis for local field potentials

M.Sc. Mathematics | BE Electrical and Electronics Engineering — Aug 2011 – July 2016
Birla Institute of Technology and Science, Pilani — Goa, India

RESEARCH EXPERIENCE

Allen Institute — Seattle, WA
Scientist 2 — June 2025 - Present
Project: Dynamic routing in the brain | PI: Dr. Shawn Olsen

- Optimized and implemented Recurrent Neural Network (RNN) models to predict neural activity and analyze neural circuit dynamics during flexible behaviors
- Characterize multi-region connectivity and interactions between task and non-task variables to extract the computational strategies underlying decision-making

Scientist 1 — Jan 2022- June 2025
Project: Deciphering neuronal variability | PI: Dr. Xiaoxuan Jia

- Designed state-based encoding models combining Generalized linear models with hidden Markov models to predict neural activity in large-scale datasets
- Quantified the effects of external environmental variables, stochastic brain-state modulations and behavior to brain-wide activity
- Applied and built a standard pipeline using computer vision techniques to track mouse posture and facial expressions, improving inference on mouse behavioral patterns; this pipeline has been adopted for use across the department
- Processed and packaged post-experiment data for open-source release

Computational NeuroEngineering Lab — Gainesville, FL
Research Assistant — Aug 2017 – Dec 2021
Project: Enhancing electrophysiological signal analysis | PI: Dr. Jose Principe

- Designed a generative unsupervised sparse-coding framework to model electrophysiological dynamics at a high temporal resolution
- Developed a robust feature extraction pipeline using hypothesis testing to identify neural features of behavior from brain field potentials, achieving 90% accuracy in predicting subject intent
- Built an information-theoretic causality measure to construct connectivity maps between brain areas from neural spiking and field potential data

Computational Sensorimotor Systems Lab College Park, MD
Research Assistant Aug 2017 – Dec 2021
Project: Dynamic auditory response estimation | PI: Dr. Jonathan Z. Simon

- Characterized the auditory response function (RF) from MEG data as a dynamic neural response for selective attention in a competing speaker environment using an L1 regularized least square estimator
- Investigated methods to exploit the sparsity of the temporal RF function using sparse regression analysis to decode the auditory neural response from the MEG signal

Analog Devices, Inc. Bengaluru, India
Research Intern Aug 2016 – Aug 2017
Project:

- Designed a predictive model using Kalman filter for offset correction of MEMS gyroscopes and successfully demonstrated 95% accuracy on a Cortex M0 Processor
- Developed a software architecture to reduce the testing time of MEMS gyroscopes by 30% and enumerated limitations in terms of the model, parameters, and design

PUBLICATIONS

1. **Akella, S.,** Ledochowitsch P.**,** … & Jia X. (2025). Deciphering neuronal variability across states reveals dynamic sensory encoding. *Nature Communications*.
2. **Akella, S.**, Mohebi, A., Principe, J. C., & Oweiss, K. (2021). Marked point process representation of oscillatory dynamics underlying working memory. *Journal of Neural Engineering*.
3. Loza, C. A., Reddy, C. G., **Akella, S.**, & Principe, J. C. (2019). Discrimination of Movement-Related Cortical Potentials Exploiting Unsupervised Learned Representations from ECoGs. *Frontiers in Neuroscience*.
4. **Akella, S.,** Keil, A., Oweiss, K., Principe, J.C. (2021). Local power estimation of neuromodulatory power using point process modeling. *10th International IEEE/EMBS Conference on Neural Engineering (NER)*.
5. **Akella, S.,** and Principe, J.C. (2019). Correntropy based robust decomposition of neuromodulations. *41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*.
6. **Akella, S.**, and Principe J.C. (2018). Quantitative Analysis of a Marked Point Process based Sleep Spindle Detector (MPP-SSD). *40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*.
7. **Akella, S.,** Bastos, A.M., Principe, J.C., et al. (2022). Directed Information for Point Process Systems. *NeurIPS 2022 Workshop on Information-Theoretic Principles in Cognitive Systems*.

CONFERENCE ABSTRACTS

* = equal contribution

1. McBride, E.*, **Akella, S.*,** Gale, S.*, et al. (2025). Distributed context representations in the mouse brain during sensory task switching. *Society for Neuroscience*.
2. LaFehr, V., Cabasco, H., Sridhar, A., **Akella, S.**, et al. (2025). Inactivation of mouse orbitofrontal cortex impairs performance in a visual-auditory switching task. Society for Neuroscience.
3. **Akella, S.,** Principe, J.C. (2025). Measurable fields-to-spike causality and its dependence on cortical layer and area. *IEEE 13th International Winter Conference on Brain-Computer Interface*.
4. McBride, E.*, **Akella, S.*,** Gale, S.*, et al. (2024). Distributed context representations in the mouse brain during sensory task switching. *Society for Neuroscience*.
5. Pouliot, J., Ward, R., **Akella, S.,** et al. (2023). The marked point process as a method for quantifying transient brain oscillations. *Society for Psychophysiological Research*.

6. **Akella, S.,** Ledochowitsch, P., Siegle, J.H., et al. (2023). Internal states differentially modulate neuronal variability across mouse visual hierarchy. *Lake Conference – Neural Coding & Dynamics*.
7. **Akella, S.,** Ledochowitsch, P., Siegle, J.H., et al. (2023). Distinct brain states modulate visual cortical processing in mouse. *Computational and Systems Neuroscience (COSYNE)*.
8. Miao, B., **Akella, S.,** Ledochowitsch, P., et al. (2023). Visual representation of different levels of abstraction along the mouse visual hierarchy. *Computational and Systems Neuroscience (COSYNE)*.
9. **Akella, S.,** Ledochowitsch, P., Siegle, J.H., et al. (2022). State dependency of neuronal variability. *Society for Neuroscience*.
10. Jia, X., **Akella, S.,** Iyer, R., et al. (2022). Contribution of different sources of variability changes along the mouse visual hierarchy. *Society for Neuroscience*.

PREPRINTS

1. **Akella, S.,** Bastos, A., Miller, E., and Principe, J.C. (2023). Measurable fields-to-spike causality and its dependence on cortical layer and area.
2. **Akella, S.,** and Principe, J.C. (2024). Enhancing information extraction from field potentials in electrophysiology studies.

TALKS

1. Deciphering neuronal variability in the brain. *2023 International Conference on Intelligence: From Cell to Network*, Tsinghua University, Beijing, China, August 2023.
2. Laminar organization of spike-field connectivity during behavior. *Society for Neuroscience*, San Diego, CA, November 2022.
3. Laminar specific interactions in the visual cortex. *Cognitive Neuroscience Society 2022*, San Francisco, CA, April 2022.

WORKSHIPS CONDUCTED

Behavioral States Analysis January 2025
UW/Allen Collaboratory Workshop | Allen Institute Seattle, WA

Behavioral state analysis using Hidden Markov Models August 2023, 2025
Summer Workshop on the Dynamic Brain | Allen Institute Seattle, WA

Laminar organization of spike-field connectivity during behavior June 2024
Workshop for multi-area, high-density, laminar neurophysiology data | Vanderbilt University Nashville, TN

COMMUNITY INVOLVEMENT

Teaching Assistant August 2020 – Dec 2020
Neural Networks and Deep Learning | University of Florida, Gainesville

- Assisted in designing course content, projects, and assignments for a class of 50+ students
- Conducted weekly recitation sessions

Reviewer
Nature Communications | *PLOS Computational Biology* | *Cognitive Science Society* | *Computational and Systems Neuroscience (COSYNE)* | *PLOS One*