Shoutik Mukherjee

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Education

University of Maryland — College Park, MD, USA
Ph.D. in Electrical Engineering — Defended Nov. 2023
Dissertation: *Statistical Models of Neural Computations and Network Interactions in High-Dimensional Neural Data*
Co-Advisors: Behtash Babadi and Shihab Shamma

University of Maryland — College Park, MD, USA
M.S. in Electrical Engineering — Dec. 2021

University of Maryland — College Park, MD, USA
B.S. in Electrical Engineering with Honors — May 2016
Minor: Mathematics

Experience

Northwestern University — Chicago, IL, USA
Postdoctoral Scholar, Department of Neurology — September 2024 – Present

- Supervised by Prof. Joshua Glaser

University of Maryland — College Park, MD, USA
Assistant Research Scientist, Institute for Systems Research — January 2024 – August 2024

- Supervised by Prof. Shihab Shamma

University of Maryland — College Park, MD, USA
Graduate Research Assistant, ECE Department — Fall 2017 – Fall 2023

- Sparsity-aware adaptive algorithms for network-level analyses of neural data, including Granger causality and higher-order spiking coordination. Applications to *in vivo* 2-photon calcium imaging and electrophysiology data.
- Computational methods for receptive field analysis in non-primary auditory areas in ferrets.
- AE-based binaural speech segregation using computational models of mammalian primary auditory cortex.

University of Maryland — College Park, MD, USA
Senior Honors Project — Fall 2015 – Spring 2016

- "*Statistical Modeling and Estimation of Network Dynamics in Ensemble Neuronal Activity*"
- Sparsity-aware model estimation algorithms applied to neuronal ensemble spiking. Tested sparsity-penalized and greedy estimation on spontaneous neuronal activity of small ensembles in mouse auditory cortex.

Publications

In Press

1. **S. Mukherjee** and B. Babadi, "Adaptive modeling and inference of higher-order coordination in neuronal assemblies: a dynamic greedy estimation approach", *PLoS Comp. Biol.*, 20(5), e1011605, 2024

2. K. M. O'Neill, E. D. Anderson*, **S. Mukherjee***, S. Gandu*, S. A. McEwan, A. Omelchenko, A. R. Rodriguez, W. Losert, D. F. Meaney, B. Babadi, and B. L. Firestein, "Time-dependent homeostatic mechanisms underlie Brain-Derived Neurotrophic Factor action on neural circuitry", *Commun. Biol.*, 6(1), 1278, 2023, (*Equal contributions)

3. L. Koçillari, M. Celotto, N. A. Francis, **S. Mukherjee**, B. Babadi, P. O. Kanold, and S. Panzeri, "Behavioural relevance of redundant and synergistic stimulus information between functionally connected neurons in mouse auditory cortex", *Brain Informatics*, 10(34), 2023

4. N. A. Francis*, **S. Mukherjee***, L. Koçillari*, S. Panzeri, B. Babadi, and P. O. Kanold, "Sequential Transmission of Task-Relevant Information in Cortical Neuronal Networks", *Cell Reports*, 39(9), 110878, 2022, (*Equal contributions)

5. S. Shamma, P. Patel, **S. Mukherjee**, G. Marion, B. Khalighinejad, C. Han, J. Herrero, S. Bickel, A. Mehta, and N. Mesgarani, "Learning Speech Production and Perception through Sensorimotor Interactions", *Cerebral cortex communications*, 2(1), tgaa091, 2021

Under Review

1. **S. Mukherjee**, B. Babadi, and S. Shamma, "Sparse High-Dimensional Decomposition of Non-Primary Auditory Cortical Receptive Fields", *Under Review as of September 2024*

In Preparation

1. **S. Mukherjee** and S. Shamma, "Attentive Speech Segregation in Binaural Mixtures using Temporally Coherent Perceptual Cues", *In Preparation as of January 2024*

Conference Papers

1. **S. Mukherjee**, P. Jendrichovsky, P. O. Kanold, and B. Babadi, "Reinforcement Learning-Guided Optogenetic Stimulation Policies for Functional Network Discovery", *ICASSP 2024, Apr. 14–17*

2. L. Koçillari, M. Celotto, N. A. Francis, **S. Mukherjee**, B. Babadi, P. O. Kanold, and S. Panzeri, "Measuring stimulus-related redundant and synergistic functional connectivity with single cell resolution in auditory cortex", *International Conference on Brain Informatics, Aug. 1-3, 2023*

3. **S. Mukherjee** and B. Babadi, "Dynamic Analysis of Higher-Order Coordination in Neuronal Assemblies via De-Sparsified Orthogonal Matching Pursuit", *Advances in Neural Information Processing Systems 34 (NeurIPS 2021), Dec. 6–14*

4. A. Rupasinghe, **S. Mukherjee** and B. Babadi, "Adaptive Frequency-domain Granger Causal Inference from Neuronal Ensemble Data", *2020* 54^{th} *Asilomar Conference on Signals, Systems, and Computers, Nov. 1–4*

5. **S. Mukherjee** and B. Babadi, "A Statistical Approach to Dynamic Synchrony Analysis of Neuronal Ensemble Spiking", *2019* 53^{rd} *Asilomar Conference on Signals, Systems, and Computers, Nov. 3–6, Pacific Grove, CA*

Posters/Abstracts

1. **S. Mukherjee**, B. Babadi, and S. Shamma. "Sparse High-Dimensional Decomposition of Non-Primary Cortical Spectrotemporal Receptive Fields", 50^{th} *Annual Neuroscience Meeting (SfN 2021), Nov. 8–11*

2. **S. Mukherjee**, K. M. O'Neill, B. L. Firestein, W. Losert, and B. Babadi, "A Statistical Approach to the Dynamic Analysis of Synchronous Spiking in Neuronal Ensembles", 49^{th} *Annual Neuroscience Meeting (SfN 2019), Oct. 19–23, Chicago, IL*

Teaching

- **Co-instructor** at University of Maryland — Fall 2021
  Statistical Pattern Recognition (ENEE633)
- **Graduate Teaching Assistant** at University of Maryland — Fall 2016 – Spring 2017
  Communications Design Lab (ENEE428)
- **Undergraduate Teaching Fellow** at University of Maryland — Fall 2014
  Electric Circuits (ENEE205)

Skills

- **Computing Languages & Software:** MATLAB, Python, Tensorflow, C

Honors, Awards, and Memberships

- Dept. of Electrical & Computer Engineering Distinguished Dissertation Fellow — 2023
- A. James Clark School of Engineering Future Faculty Fellow — 2020 Cohort
- A. James Clark School of Engineering Distinguished Graduate Fellowship — Fall 2016 – Spring 2017
- Arnold A. Korab Endowed Scholarship — Fall 2015 – Spring 2016
- Bodharamik Endowed Scholarship — Fall 2014 – Spring 2015
- Maryland State Senatorial Grant — Fall 2012 – Spring 2016
- Honors College: Entrepreneurship and Innovation Program — Fall 2012 – Spring 2014
- Eta Kappa Nu — Inducted Fall 2015
- Tau Beta Pi — Inducted Fall 2013