

ANUTHTHARA RUPASINGHE

+1-(240)-271-2680 ◊ ar0621@princeton.edu ◊ Hillsborough, NJ ◊ U.S. Permanent Resident

[Website](#) ◊ [LinkedIn](#) ◊ [Google Scholar](#) ◊ [GitHub](#)

SUMMARY

Machine learning and computational neuroscience researcher with a Ph.D. in Electrical Engineering and postdoctoral training at the Princeton Neuroscience Institute. Experienced in developing statistical and machine learning methods for high-dimensional neural, physiological, and behavioral data, with expertise in Bayesian inference, generalized linear models, time-series analysis, predictive modeling, uncertainty quantification, and model validation. Currently exploring research scientist, applied scientist, machine learning, data science, and biomedical AI roles.

EDUCATION

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| Ph.D., Electrical and Computer Engineering | 2017 - 2022 |
| University of Maryland, College Park | Cumulative GPA: 3.97/4.00 |
| B.S. (Honors), Electrical and Electronic Engineering | 2013 - 2016 |
| University of Peradeniya, Sri Lanka | Cumulative GPA: 4.00/4.00 |

SKILLS

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| Programming: | Python (PyTorch, NumPy, Pandas, SciPy), MATLAB |
| Data: | neuronal spiking data, calcium imaging, EEG, EMG, high-dimensional time series data |
| Statistical Modeling: | Bayesian inference, Gaussian processes, generalized linear models, logistic regression |
| AI / ML: | Probabilistic modeling, predictive modeling, regression, clustering, model validation |
| Methods: | Variational inference, optimization, uncertainty quantification, variance modeling, calibration |
| Signal Processing: | Spectral analysis, Kalman filtering, frequency-domain inference, causal inference |
| Research Skills: | Data analysis, model evaluation, technical documentation, interdisciplinary collaboration |
| Tools: | Git, LaTeX, Jupyter, MS Office Package |

RESEARCH EXPERIENCE

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| Princeton Neuroscience Institute, Princeton University | 2022 - present |
| <i>Postdoctoral Research Fellow, Advisor: Dr. Jonathan Pillow</i> | |

- Developing statistical and machine learning models for neural data analysis, with emphasis on neural decoding, interpretable probabilistic modeling, uncertainty quantification, and continuous behavioral prediction.
- Developed **Continuous Multinomial Logistic Regression**, a Bayesian machine learning framework for decoding continuous behavioral variables from high-dimensional neural population activity, producing full conditional distributions rather than only point estimates. [Python]
- Implemented scalable inference methods for CMLR using Gaussian process priors, frequency-domain computation, and stochastic variational inference for high-dimensional neural decoding.
- Built analysis pipelines to train, evaluate, and validate decoding models across large-scale datasets from visual cortex, hippocampus, and motor cortex, including assessments of predictive accuracy, posterior uncertainty, calibration, and model robustness.
- Developed **Continuous Modulated Poisson** modeling, a continuous-time statistical framework for modeling over-dispersed neuronal spiking activity and separating stimulus-driven responses from latent modulatory variability. [MATLAB]
- Designed scalable frequency-domain variational inference and validation pipelines to compare model likelihoods, estimate variability structure, and interpret neural population dynamics across sensory areas.
- Authored manuscripts, technical descriptions, and analysis documentation for neuroscience and machine learning audiences, including work accepted at ICLR and eLife.
- Collaborated with interdisciplinary researchers to translate statistical modeling results into interpretable scientific conclusions.

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| University of Maryland, College Park | 2018 - 2022 |
| <i>Graduate Research Assistant, Advisor: Dr. Behtash Babadi</i> | |

- Developed Bayesian statistical models and inference algorithms for high-dimensional neural and physiological time-series data, with applications to neuronal spiking activity, calcium imaging, EEG, EMG, and human heart rate variability.
- Developed a Bayesian multitaper spectral estimation methodology for multivariate neuronal spiking time-series data, combining Kalman filtering, frequency-domain inference, generalized linear models, and state-space modeling. [MATLAB]
- Developed statistical models and algorithms for adaptive frequency-domain Granger causal inference from multivariate neuronal spiking data, combining Kalman filtering, generalized linear models, and state-space modeling.
- Mentored a graduate student on a methodological extension for Granger causal inference from spiking observations via latent variable modeling.
- Developed Bayesian and variational inference methods to directly estimate signal and noise correlations from two-photon calcium imaging data without intermediate spike deconvolution, in collaboration with the Kanold Lab at Johns Hopkins University. The model combines point-process modeling, state-space methods, Pólya-Gamma augmentation, and variational inference to relate latent spiking activity directly to observed fluorescence traces. [MATLAB]

- Analyzed whole-brain light-sheet imaging, EEG, and EMG data from larval zebrafish using spectrotemporal analysis and machine learning techniques to study respiration-locomotion coordination, in collaboration with the Ahrens Lab at Janelia Research Campus, HHMI. [Python]
- Extended multitaper spectral inference methods to human physiological time-series data from ECG recordings for denoised frequency-domain heart rate variability analysis, in collaboration with Prof. Nicholas Schiff at Weill Cornell Medicine. [Python]

University of Peradeniya, Sri Lanka

2016 - 2017

Undergraduate and Postgraduate Researcher, Advisors: Dr. Janaka Wijayakulasooriya, Dr. Roshan Godaliyadda, and Dr. Parakrama Ekanayake

- Created a video database and developed a foreground estimation and trajectory tracking technique based on adaptive filtering, dynamic modeling, and affinity construction for trajectories.
- Introduced methods for learning patterns of activity using machine learning techniques including K-means and spectral clustering.
- Developed machine learning methods for motion pattern analysis in video surveillance, event detection, and anomaly identification.
- Mentored undergraduate students in applying the developed clustering and pattern analysis methods to hyperspectral imaging-based land cover mapping.

TEACHING AND COMMUNICATION EXPERIENCE

University of Maryland, College Park

2017 - 2019

Graduate Teaching Assistant, Department of Electrical & Computer Engineering

- Taught undergraduate Engineering Probability and graduate Random Processes in Communication and Control, strengthening ability to explain statistical and probabilistic concepts to technical audiences.
- Served as Teaching Assistant Training and Development Fellow, mentoring graduate teaching assistants and conducting workshops.

University of Peradeniya, Sri Lanka

2016 - 2017

Temporary Instructor, Department of Electrical & Electronic Engineering

- Conducted laboratory and tutorial sessions for multiple undergraduate courses in signal processing and electronics.

INDUSTRY EXPERIENCE

Trainee Engineer

October 2015 - January 2016

Dialog Axiata PLC - Sri Lanka

- Analyzed communication network systems and contributed to system planning and optimization tasks
- Developed technical documentation, including a disaster recovery plan

Trainee Engineer

October 2014 - January 2015

Ceylon Electricity Board - Sri Lanka

- Gained hands-on experience with power distribution systems, planning, and operations

SELECTED PUBLICATIONS AND PRESENTATIONS

- A. Rupasinghe and J. W. Pillow, "Continuous Multinomial Logistic Regression for Neural Decoding," International Conference on Learning Representations (ICLR), 2026. [Presented]
- A. Rupasinghe, A. S. Charles, and J. W. Pillow, "Continuous partitioning of neuronal variability," eLife, 2026.
- P. Jendrichovsky, S. Khosravi, A. Rupasinghe, et al., "Patchy harmonic functional connectivity of the mouse auditory cortex," Proceedings of the National Academy of Sciences (PNAS) U.S.A. 122(27): e2510012122, 2025.
- A. Rupasinghe, N. A. Francis, J. Liu, Z. Bowen, P. O. Kanold, and B. Babadi, "Direct Extraction of Signal and Noise Correlations from Two-Photon Calcium Imaging of Ensemble Neuronal Activity," eLife, 10:e68046, 2021.
- A. Rupasinghe and B. Babadi, "Multitaper Analysis of Semi-Stationary Spectra From Multivariate Neuronal Spiking Observations," IEEE Transactions on Signal Processing, Vol. 68, pp. 4328-4396, 2020.
- A. Rupasinghe, S. Mukherjee, and B. Babadi, "Adaptive Frequency-domain Granger Causal Inference from Neuronal Ensemble Data," Proceedings of the 54th Asilomar Conference on Signals, Systems, and Computers, 2020. [Presented]
- A. Rupasinghe, S. G. M. P. Senanayake, D. A. Padmasiri, M. P. B. Ekanayake, G. M. R. I. Godaliyadda, and J. V. Wijayakulasooriya, "Modes of Clustering for Motion Pattern Analysis in Video Surveillance," Proceedings of the 8th IEEE International Conference on Information and Automation for Sustainability, 2016. [Presented]

SELECTED HONORS AND SCHOLARSHIPS

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| Recipient of the Princeton Neuroscience Institute's QCN T32 Postdoctoral Fellowship Award | 2024 |
| Recipient of the SfN Trainee Professional Development Award | 2024 |
| Recipient of the Rising Stars in EECS Award | 2022 |
| Outstanding Teaching Assistant, Department of Electrical & Computer Engineering, University of Maryland | 2018 |
| Clark School of Engineering Distinguished Graduate Fellowship, University of Maryland | 2017 |
| Best Performance in Engineering, University of Peradeniya, Sri Lanka | 2016 |