Anirban Nandi

Scientist, Allen Institute for Brain Science

1251 Taylor Ave N, Apt. 5
Seattle, Washington - 98109
 +1 (314) 650 4617
✉ ani.nandi989@gmail.com
🌐 anirban6908.github.io
in anirban-nandi
 anirban6908

Professional Profile

Computational Neuroscientist with Ph.D. in Electrical Engineering. Expertise in a diverse range of topics including data analysis, systems modeling, optimization, stochastic processes, and machine/deep learning. Software development and visualization skills with proficiency in Python, R, MATLAB, learning frameworks - Keras, TensorFlow, PyTorch, scikit-learn, and High Performance Computing.

Experience

Allen Inst.	Jan 2018 - present | Scientist 1 - Modeling, Simulation and Analyses of Neural Dynamics

- Developed a configurable, automated multiobjective optimization framework based on evolutionary algorithms to fit neuron models constrained by multi-modal data.
- Used unsupervized learning techniques (UMAP, t-SNE) to reveal structures in high-dimensional neural (physiology, morphology and genomic) data.
- Large scale computer simulation of biophysically realistic networks of neurons.

Education

Dec. 2017	**Ph.D. Electrical Engineering**, GPA 3.95 , Washington University in St. Louis, USA.

Thesis : Extrinsic and Intrinsic Control of Integrative Processes in Neural Systems.

Advisor : Dr. ShiNung Ching

Project #1	Inducing desired activity in neural circuits using a dynamical systems framework.

- Designed optimal control strategies to emit desired spiking activity in neural networks (Dynamical systems, Optimization, Kalman filtering, Dynamic programming).

Project #2	Control analysis and design for stochastic models of neural spiking

- Developed control solutions to generate target patterns via estimation methods, e.g., MLE (Maximum Likelihood Estimation) for point process models fitted on neural data (Stochastic modeling, MLE, Optimization).

Project #3	Investigating the existence of optimal policies in sensory detection tasks.

- Analyzed experimental data from locust olfactory circuit to infer latent decision making model and the role of optimality in detection tasks (Data analysis, Unsupervised learning, Optimal control, Generative models).

Coursework		
	Linear, Nonlinear, Hybrid Systems	Advanced Linear Statistical Models
	Optimization, Optimal Control	Stochastic Process, Bayesian Statistics
	Detection and Estimation Theory	Machine Learning, Deep Learning.AI

April 2012	**Bachelor of Electrical Engineering**, GPA 4.0 , Jadavpur University, India.
Project	A PC Sound Card Based Interface for Transducer Signals.
Internship	Summer Internships at Optimal Power Synergy India Pvt Ltd., Indian Oil Corporation Limited.

Technical Skills

</> Python, R, MATLAB and Simulink	Keras, TensorFlow, PyTorch, scikit-learn
aws EC2, S3	SQL, Spark, sqlalchemy, pandas
git, Docker, Ansible, LATEX, HTML, CSS	>_ ssh, ipyparallel, mpi4py
Matplotlib, Mayavi, Seaborn, pyQt, Qt-Designer	CentOS, Ubuntu | OSX |

Awards

Scholarship 2008-2012 Central Sector Scheme of Scholarship for College and University Students, Ministry of Human Resource Development, Government of India ⤤

Award Student travel award for presentation at IEEE Conference on Decision and Control (CDC), Los Angeles, CA, USA, December, 2014.

Talks

Team-talk "Enlightening the Chandelier" at Allen Institute Showcase, Seattle, WA, USA, November 2019. ▶

Invited Langenhop Lecture and SIU Mathematics Conference, Southern Illinois University, Carbondale, USA, May 2017. ⤤

Refereed Journal Articles

[1] **A. Nandi**, Werner Van Geit, Tom Chartrand, Anatoly Buchin, Christof Koch, and Costas A. Anastassiou. "Cellular models linking electrophysiology, morphology and transcriptomics across cortical cell types". In: *(In preparation)* (2020).

[2] Casey Schneider Mizell, **A. Nandi**, Costas A. Anastassiou, Forrest Collman, and Nuno da Costa. "A fine structural analysis of the Chandelier Cell input in a densely segmented volume of layer 2/3 of mouse primary visual cortex". In: *(In preparation)* (2020).

[3] Anatoly Buchin, Rebecca de Frates, **A. Nandi**, Peter Chong, Rusty Mann, Lindsay Ng, Jeremy Miller, Christof Koch, Jonathan Ting, and Costas A. Anastassiou. "Multi-modal characterization and simulation of human epileptic circuitry". In: *(Under Review)* (2019).

[4] Clayton P. Mosher, Yina Wei, Jan Kaminski, **A. Nandi**, Adam N. Mamelak, Costas A. Anastassiou, and Ueli Rutishauser. "Cellular classes in the human brain revealed in vivo by heartbeat-related modulation of the extracellular action potential waveform". In: *(Under Review)* (2019).

[5] Sruti Mallik, Srinath Nizampatnam, **A. Nandi**, Debajit Saha, Baranidharan Raman, and ShiNung Ching. "Neural Circuit Dynamics for Sensory Tracking". In: *(Under Review)* (2019).

[6] Brian E Kalmbach, Anatoly Buchin, Brian Long, Jennie Close, **A. Nandi**, Jeremy A Miller, Trygve E Bakken, Rebecca D Hodge, Peter Chong, Rebecca de Frates, et al. "h-Channels Contribute to Divergent Intrinsic Membrane Properties of Supragranular Pyramidal Neurons in Human versus Mouse Cerebral Cortex". In: *Neuron* 100.5 (2018), pp. 1194–1208. doi: 10.1016/j.neuron.2018.10.012.

[7] **A. Nandi**, Heinz Schättler, and ShiNung Ching. "Optimal Control for Fast, Accurate Threshold-Hitting". In: *SIAM Journal on Control and Optimization* 57.4 (2019), pp. 2269–2291. doi: 10.1137/17M1161580.

[8] **A. Nandi**, Heinz Schättler, Jason T Ritt, and ShiNung Ching. "Fundamental limits of forced asynchronous spiking with integrate and fire dynamics". In: *The Journal of Mathematical Neuroscience* 7.1 (2017), p. 11. doi: 10.1186/s13408-017-0053-5.

[9] **A. Nandi**, MohammadMehdi Kafashan, and ShiNung Ching. "Control Analysis and Design for Statistical Models of Spiking Networks". In: *IEEE Transactions on Control of Network Systems* (2017). ⓓⓞⓘ: 10.1109/TCNS.2017.2687824.

[10] MohammadMehdi Kafashan, **A. Nandi**, and ShiNung Ching. "Relating observability and compressed sensing of time-varying signals in recurrent linear networks". In: *Neural Networks* 83 (2016), pp. 11–20. ⓓⓞⓘ: 10.1016/j.neunet.2016.07.007.

▬▬▬▬ Refereed Conference Articles

[1] **A. Nandi**, Heinz Schättler, and ShiNung Ching. "Selective spiking in neuronal populations". In: *American Control Conference (ACC), 2017*. IEEE. 2017, pp. 2811–2816. ⓓⓞⓘ: 10.23919/ACC.2017.7963377.

[2] **A. Nandi**, MohammadMehdi Kafashan, and ShiNung Ching. "Controlling point process generalized linear models of neural spiking". In: *American Control Conference (ACC), 2016*. IEEE. 2016, pp. 5779–5784. ⓓⓞⓘ: 10.1109/ACC.2016.7526575.

[3] Jason Ritt, **A. Nandi**, Joseph Schroeder, and ShiNung Ching. "Neurocontrol in sensory cortex". In: *APS Meeting Abstracts*. 2016.

[4] **A. Nandi**, Jason T Ritt, and ShiNung Ching. "Non-negative inputs for underactuated control of spiking in coupled integrate-and-fire neurons". In: *53rd Annual Conference on Decision and Control (CDC), 2014*. IEEE. 2014, pp. 3041–3046. ⓓⓞⓘ: 10.1109/CDC.2014.7039857.

▬▬▬▬ Posters and Abstracts

- "Generating All-Active Biophysical Models for Human and Mouse Neurons" at Society for Neuroscience (SFN), San Diego, CA, USA, November 2018.
- "Development of realistic single-neuron models of mouse V1 capturing in-vitro and in-vivo properties" at Organization of Computational Neurosciences (OCNS) Meeting, Seattle, WA, USA, July, 2018.
- "Phasic response motifs are optimal for persistent detections" at International Conference on Mathematical Neuroscience (ICMNS), Boulder, CO, USA, June, 2017.
- "Are Neural Trajectories Optimal Lines of Evidence for Unambiguous Sensory Detection?" at Workshop on Brain Dynamics and Neurocontrol Engineering, Washington University in St. Louis, MO, USA, June, 2017.

▬▬▬▬ Teaching Experience

Teaching Served as Teaching Assistant for four different graduate level courses within the Electrical and Systems Engineering Department : Nonlinear Dynamical Systems, Linear Dynamical Systems, Dynamics and Control in Neuroscience, and Brain Medicine, Optimization and Optimal Control.

Mentoring Mentored Jianmo He, MS thesis for Electrical Engineering, 2016, Washington University in St. Louis.

▬▬▬▬ Professional Memberships and Academic Services

Membership Institute for Electrical and Electronics Engineers (IEEE), IEEE Control Systems Society (CSS), Society for Neuroscience (SFN).

Reviewer American Control Conference (2016-17), Automatica (2015-16), Non-Linear Analysis and Hybrid Systems (2017), Journal of Biological Physics (2017).