Amin Nejatbakhsh | Curriculum Vitae

Jerome L. Greene Science Center, 5th floor, 3227 Broadway – New York, NY 10027 – US

+1 (917) 861-0912 • mn2822@columbia.edu • columbia.edu/~mn2822

Education

2017–Now — **Ph.D. Student in Theoretical Neuroscience**,
Columbia University.

2017–2019 — **M.A. & M.Phil in Theoretical Neuroscience**,
Columbia University.
- Courses: Unsupervised Learning (D. Hsu), Mathematics of Deep Learning (P. Jelenkovic), Nonparametric Theory of ML (S. Kpotufe), Optimal Transport (M. Nutz), Reinforcement Learning (S. Agrawal), Neuronal Dynamics (J. Rinzel), Representation Learning (D. Blei), Machine Learning Theory (D. Hsu), Natural Language Processing (M. Collins), Differentiable Manifolds (D. McDuff), Sparse Representations and High Dimensional Geometry (J. Wright), Deep Generative Models (J.P. Cunningham), Graphical Models (D. Blei), Advanced Machine Learning (J.P. Cunningham), Introduction to Theoretical Neuroscience (L.F. Abbott), Computational Statistics (L. Paninski), Statistics for Neuroscientists (L. Paninski), Survey of Neuroscience (F. Polleux), Advanced Theoretical Neuroscience (K.D. Miller)
- GPA: 3.77/4

2011–2016 — **B.Sc. in Computer Engineering, Minor in Pure Mathematics**,
Sharif University of Technology.
- Thesis: *"Design and Implementation of a Voice Recognition System Based on the Rat's Auditory System"*, supervised by Prof. M. Soleymani (19.8/20).
- Courses: Medical Neuroscience (L.E. White), Biomath (A. Abbasian), Neuroscience (R. Lashgari), Synapses, Neurons and Brains (I. Segev), Computational Neuroscience (R. Rao), Machine Learning (H.R. Rabiee), Modern Information Retrieval (M. Soleymani), Machine Learning (A. Ng)
- GPA: 17.07/20 (3.6/4)

Fields of Interest

Computational and Systems Neuroscience

Machine Learning and Optimization

Statistics and Dynamical Systems

Research Experience

Current — **Graduate Research Assistant**.
- Developed methods for atlas construction, registration, segmentation, tracking, and signal demixing from volumetric data of transgenic *C. elegans* using tools from optimal transport, statistical inference, matrix factorization, computer vision, and machine learning under the supervision of Prof. L. Paninski in collaboration with Prof. O. Hobert and Prof. V. Venkatachalam (work in progress).

2017–2018 — **Data Analyst**.
- Analyzed LFP and spiking data using tools from signal processing and information theory to study the effect of probabilistic cues on the attention network. Co-supervised by Prof. J. Gottlieb and Prof. R. Lashgari.

2015–2017 — **Research Assistant in Brain Engineering Research Center at IPM**.
- Designed and implemented an experimental design and data collection system (more info).
- Ran a distributed computing system on the computers in the lab for parallel computing.
- Analyzed LFP signals to cluster V1 neurons.

Honors and Awards

2021 — **Acceptance in the Doctoral Consortium**, *in WACV Conference*, (Virtual).

2020 — **Student Travel Award**, *in MICCAI Conference*, Peru (Virtual).

2015 — **Gold Medal**, *in 22nd International Mathematical Competition (IMC)*, Blagoevgrad.

2015 — **Gold Medal**, *in 39th Iranian Mathematical Society Competition (IMS)*, Yazd.

2014 **Ranked 3/7**, *in 13th International German Open Robocup*, Magdeburg.
  ○ Member of Paaydar Team in 3D Soccer Simulation League.

2014 **Ranked 2/6**, *in 3rd National Sharifcup Competition*, Tehran.
  ○ Leader of Paaydar Team in Traffic Control League.

2010 **Gold Medal**, *in 28th Iranian National Mathematical Olympiad (INMO)*, Tehran.

2009 **Silver Medal**, *in 27th Iranian National Mathematical Olympiad (INMO)*, Tehran.

Publications

1 Eviatar Yemini, Albert Lin, Amin Nejatbakhsh, Erdem Varol, Ruoxi Sun, Gonzalo E. Mena, Aravinthan D.T. Samuel, Liam Paninski, Vivek Venkatachalam, and Oliver Hobert. "NeuroPAL: A Multicolor Atlas for Whole-Brain Neuronal Identification in C. elegans". In: *Cell* (2020). URL: http://www.sciencedirect.com/science/article/pii/S0092867420316822.

2 Amin Nejatbakhsh, Francesco Fumarola, Saleh Esteki, Taro Toyoizumi, Roozbeh Kiani, and Luca Mazzucato. "Predicting perturbation effects from resting state activity using functional causal flow". In: *bioRxiv* (2020). URL: https://www.biorxiv.org/content/early/2020/11/24/2020.11.23.394916.

3 Gonzalo Mena, Amin Nejatbakhsh, Erdem Varol, and Jonathan Niles-Weed. "Sinkhorn EM: An Expectation-Maximization algorithm based on entropic optimal transport". In: *arXiv* (2020). Submitted to **AISTATS**. eprint: 2006.16548.

4 Amin Nejatbakhsh, Erdem Varol, Eviatar Yemini, Vivek Venkatachalam, Albert Lin, Aravinthan D.T. Samuel, and Liam Paninski. "Extracting neural signals from semi-immobilized animals with deformable non-negative matrix factorization". In: *bioRxiv* (2020). DOI: 10.1101/2020.07.07.192120.

5 Amin Nejatbakhsh, Erdem Varol, Eviatar Yemini, Oliver Hobert, and Liam Paninski. "Probabilistic Joint Segmentation and Labeling of *C. elegans* Neurons". In: *MICCAI* (2020). Accepted.

6 Erdem Varol, Amin Nejatbakhsh, Eviatar Yemini, Ruoxi Sun, Gonzalo Mena, Oliver Hobert, and Liam Paninski. "Statistical Atlas of *C. elegans* Neurons". In: *MICCAI* (2020). Accepted.

7 Erdem Varol and Amin Nejatbakhsh. "Wasserstein Total Variation Filtering". In: *arXiv* (2020). eprint: 1910.10822.

8 Erdem Varol, Amin Nejatbakhsh, and Conor McGrory. "Temporal Wasserstein Non-negative Matrix Factorization for Non-rigid Motion Segmentation and Spatiotemporal Deconvolution". In: *arXiv* (2020). eprint: 1912.03463.

9 Amin Nejatbakhsh and Erdem Varol. "Neuron Matching in *C. elegans* with Robust Approximate Linear Regression Without Correspondence". In: *WACV* (2020). Accepted. arXiv: 1906.00273 [stat.ML].

10 Gonzalo Mena, Erdem Varol, Amin Nejatbakhsh, Eviatar Yemini, and Liam Paninski. "Sinkhorn Permutation Variational Marginal Inference". In: *AABI* (2019). URL: https://openreview.net/forum?id=HkxPtJh4YB.

11 Tessa Tekieli, Eviatar Yemini, Amin Nejatbakhsh, Erdem Varol, Robert W. Fernandez, Neda Masoudi, Liam Paninski, and Oliver Hobert. "Visualizing the organization and differentiation of the male-specific nervous system of C. elegans". In: *bioRxiv* (2021). DOI: 10.1101/2021.04.06.438718.

Presentations

1 "Nonparametric Inference of Neural Correlations from Sequential Recordings". In: **Computational and Systems Neuroscience (COSYNE)**, 2021.

2 "Predicting Perturbation Effects from Resting State Activity Using Functional Causal Flow". In: **Computational and Systems Neuroscience (COSYNE)**, 2021.

3 "Neuron matching in *C. elegans* with robust approximate linear regression without correspondence". In: **WACV**, 2021.

4 "Non-parametric Inference of Correlations Between Non-simultaneous Neural Data". In: **NAISYS**, 2020.

5 "Probabilistic Joint Segmentation and Labeling of Neurons in *C. elegans*". In: **NAISYS**, 2020.

6   "Neural Data Analysis Pipelines for Extracting Information from *C. elegans* Microscopy Data". In: **NeuroNex Workshop**, 2020.

7   "Probabilistic Joint Segmentation and Labeling of *C. elegans* Neurons". In: **MICCAI**, 2020.

8   "Extracting Neural Signals from Semi-immobilized Animals with Deformable Non-negative Matrix Factorization". In: **MICCAI**, 2020.

9   "Non-linear Matrix Factorization Methods for Extracting Calcium Traces in Moving *C. elegans* Videos". In: **Computational and Systems Neuroscience (COSYNE)**, 2020.

10   "Expected Value Correlates with Reduction in Alpha-Beta Power in Monkey Dorsolateral Prefrontal and Inferior Parietal Lobe". In: **Society for Neuroscience (SfN)**, 2017.

11   "Response Variability of V1 Neurons in Awake Primate". In: **Society for Neuroscience (SfN)**, 2017.

Fall 2020   **Invited Talk**, University of Oregon.
- Title: Predicting Perturbation Effects from Resting State Activity Using Functional Causal Flow.

Summer 2020   **Research Progress Talk**, Columbia University Center for Theoretical Neuroscience.
- Title: Neural Analysis Pipelines for Extracting Information From *C. elegans* Microscopy Data.

Summer 2019   **Invited Talk**, Northeastern University.
- Title: Semi-automated Cell Identification in NeuroPAL *C. elegans* Strains.

Teaching Experience

Fall 2020   **Teaching Assistant for Foundations of Graphical Models (more info)**,
Instructor: David M. Blei.

Spring 2020   **Teaching Assistant for Theoretical Neuroscience (more info)**,
Instructors: Prof. L. Abbott, S. Fusi, K. Miller, A. Litwin-Kumar.

Spring 2020   **Instructor and TA for Math Tools for Neuroscientists (more info)**,
Instructors: D. Tyulmankov, A. Nejatbakhsh.

Fall 2019   **Instructor of Probabilistic Programming Workshop (more info)**.

Summer 2017   **Instructor of Computational Neuroscience Workshop**.

Spring 2016 &   **Teaching Assistant for Engineering Probability and Statistics**,
Fall 2015   Instructor: Prof. H. Rabiee.

Fall 2015   **Teaching Assistant for Modern Information Retrieval**,
Instructor: Prof. M. Soleymani-Baghshah.

Spring 2013   **Teaching Assistant for Linear Algebra**,
Instructor: Prof. A. Ranjbar-Motlagh.

Summer 2015   **Instructor of iOS Application Development Workshop**.

2009–Now   **Instructor of Mathematical and Informatics Olympiad**.

Working Experience

Fall 2015   **Employee of Software Development**, *Torob Company*.
- Developed an automatic feature extraction and clustering system (Python, sickit-learn)

2012–2014   **Employee of Mobile Application Development**, *Hasin Company*.
- Developed Taaghche and Gramophone iOS Applications (Objective-C)

Mentoring Experience

2018-2019   **Daiki Tagami**, *undergraduate student in statistics and biology*, Columbia University.
- Role: provided research direction and learning material for statistics, machine learning, and neural networks and co-authored a paper.

Professional Development

2019–Now   **Reviewer of NeurIPS'20, WACV'21, AISTATS'21, ICML'21, MICCAI'21**.

2017–Now   **Member of Inference in Dynamical Systems Reading Group**.
- A grad student and post-doc run reading group in which we discuss recent advances of statistical inference methods in linear/non-linear, parametric/non-parametric, latent/non-latent variable models (website).

2017–Now	**Member of Machine Learning Reading Group**.
	○ Paper discussion and presentation sessions run by Prof. Blei's group covering a variety of topics in statistics and machine learning.
Fall 2016	**Three-day Hands-on fMRI Workshop**.
	○ The common preprocessing and analysis methods on structural and functional MRI data using Freesurfer application was covered by Dr. M. Vaziri and Dr. R. Rajimehr.
Fall 2016	**Two-week International IBRO School on Brain Mapping**.
	○ Physics, theories, technologies, and analysis of brain imaging techniques such as fMRI, EEG, fNIRS, TMS, and tDCS was covered by instructors such as Prof. R. Savoy, Prof. N. Muggleton.
Spring 2016	**Three-day Stereology Course**.
	○ The three-dimensional interpretation (such as the computation of the volume or finding neurons and synapses) of two-dimensional cross sections of brain tissue was covered by Prof. J. Nyengaard.
2015–2017	**Weekly Computational Neuroscience Journal Clubs**.
	○ Weekly paper reading sessions was held at IPM by Prof. A. Abbasian in which a wide range of the theories in computational neuroscience such as predictive coding theory, graph theory, topology, point process, and dynamical systems were discussed.

Professional Skills

ML & Stats	Pyro, Pytorch, Tensorflow, CVX
Neuroscience	Fieldtrip, Freesurfer, Psychtoolbox, Brian SNN Simulator
Programming	Python, Matlab, Java, C, C++, Javascript, Prolog, Objective-C, Verilog
Web	Django, NodeJS, CSS, HTML
Typesetting	LaTeX, Microsoft Office

Languages

English (Fluent), **Persian** (Native), **Azerbaijani** (Intermediate), **Arabic** (Basic), **Turkish** (Basic)

Extracurricular Activities

Fall 2019	**7th Rank**, of Newcomer Level Ballroom Dance in Princeton Ballroom Competition.
2017–Now	Member of **GISU** Cultural Dance Group (website).
2017–Now	Player of soccer and basketball at Columbia Intramurals League
Summer 2019	**Medal**, in NYC Triathlon (Olympic Distance).
Spring 2015	**Gold Medal**, in Sharif University Basketball Championships Competition.
Fall 2014	**Technical Staff**, in Association for Computing Machinery (ACM-ICPC) Competition.
2011–2017	Member of Sharif University Mountain Climbing Group.