

ANATOLY BUCHIN, PhD

Computational Biology | Neuroscience | Data Science

Senior Scientist, Cajal Neuroscience



+1 (206) 488 23 43



anat.buchin@gmail.com



LinkedIn: anatoly-buchin



Seattle, United States



www.buchin.info

EDUCATION

PhD in Computational Neuroscience, École Normale Supérieure, Paris
2012–2015

Master of Physics, Peter the Great Polytechnic University, St Petersburg
2010–2011

Master of Research, Descartes University, Paris
2009–2010

Bachelor of Physics, Peter the Great Polytechnic University, St Petersburg,
2005–2009

MACHINE LEARNING

Unsupervised

PCA, k-Means, Mixture models, Louvain method, Hierarchical clustering, t-SNE, UMAP

Supervised

kNN, SVM, Logistic regression, Naive Bayes, Random forest, Gradient boosting, XGBoost

Recommender systems

Collaborative filtering, NMF

Deep learning

Computer vision: ResNet, VGGNet, AlexNet, YOLO

NLP: LSTM, GRU, Word2Vec, GloVe, Attention networks, Transformers

Representation learning

Autoencoders, Generative models

Time series

Spectral analysis, Feature extraction

SOFTWARE SKILLS

Open source contributions

AllenSDK, [Link](#)

High performance computing

Amazon SageMaker, Cray XC40 at Berkley National Labs, Blue Gene at Blue Brain Project

Programming languages

Python, R, Matlab, Neuron, Bash

Database management

sqlalchemy, pandas, PostgreSQL

PROFILE

Research scientist with a Ph.D. in Computational Neuroscience with 10+ years of experience in computational research. Expertise in a diverse range of topics including high-dimensional, multimodal biological data analysis, machine/deep learning, statistical modeling, optimization and computational neuroscience with several high-impact peer-reviewed publications. Leader and team-player working in a collaborative environment. 10+ years of experience in software development and visualization with Python, Matlab and R. Highly proficient in data manipulation, machine learning frameworks and numerical simulations using high performance computing and cloud computations.

EXPERIENCE

INDUSTRIES: Biotechnology, Neuroscience Research

SENIOR SCIENTIST

Cajal Neuroscience | Seattle | May 2021 - Present

Analysis of high-dimensional biological data with the focus on single cell genomics (scRNA-seq, scATAC-seq). Optimization of the drug targets against neurological disorders (Alzheimer's and Parkinson diseases). Ingestion and consolidation of the external omics datasets.

- Data analysis of high-dimensional gene expression data
- Optimization of the drug targets based on GWAS, TWAS and RNA-seq
- Databases organization and consolidation of the external datasets
- Analysis and integration of mouse, human and cell culture data

SCIENTIST I

Allen Institute for Brain Science | Seattle | Apr 2017 - March 2021

Development of novel mathematical models of human neurons based on multimodal neuronal data. Analysis of high-dimensional gene expression data using RNAseq. Implementation of large-scale neural network simulations to model human epilepsy pathology.

- Data analysis pipelines for genetic, morpho- and electrophysiological data
- Model optimizations on supercomputers using genetic algorithms
- Developed human epilepsy biomarkers based on time series
- Presented results at international conferences: SfN, OCNS

POST-DOCTORAL RESEARCHER

University of Washington, | Seattle | February 2016 - April 2017

Participated in multi-laboratory collaboration studying the neural network of *Hydra vulgaris*. Developed novel neural network model to explain animal behavior. Analyzed calcium imaging data using machine learning methods.

- Data analysis pipeline for the analysis of calcium imaging data (video data)
- Applied motion tracking algorithms to the behavioral data of *Hydra vulgaris*
- Implemented simulations of biological neural networks
- Created and maintained the knowledge base in wikipedia format

SOFTWARE SKILLS

Data visualizations

Jupyter, Matplotlib, Seaborn

Machine learning frameworks

Keras, TensorFlow, PyTorch, scikit-learn, scipy, statsmodels

Parallel computations

ipyparallel, mpi4py, CUDA

Code development

Git, Github, Visual Studio, Docker, Anaconda

Operating systems

CentOS, Ubuntu, MacOS, Windows

AWARDS

2017 Assistant professor in neuroscience (France)

2016 NSF Travel grant

2016 Swartz Foundation fellowship

2014 Foundation of Medical Research grant

2011 Labex doctorate fellowship

2009 Foundation Bettencour Shueller fellowship

LANGUAGES

ENGLISH – Full professional proficiency

FRENCH – Proficient

GERMAN – Intermediate

RUSSIAN – Native speaker

MENTORSHIP

2018, Shao-An Yin
University of Washington, PhD student

2016, Dawn Liang
Boeing, Wire design engineer

2015, Marta Gajowa
UC Berkeley, Post-doctoral researcher

REFERENCES

Christof Koch

Allen Institute for Brain Science

Costas Anastassiou

Allen Institute for Brain Science

Adrienne Fairhall

University of Washington

Boris Gutkin

Ecole Normalé Supérieure

EXPERIENCE continued

DOCTORAL RESEARCHER

École Normale Supérieure, | Paris | January 2012 - November 2015

Analyzed the data from two experimental labs and developed computational models for single neurons and neural networks. Applied dynamical system theory towards explaining brain dynamics in human epilepsy and rodent motor system.

- Developed a stochastic dynamical systems describing rat neurons
- Performed numerical simulations and analyzed terabytes of data

RESEARCH COLLABORATOR

University College London | London | May 2015 , July 2014

Applied information theory towards single neuron computation in rat motor system. Discovered the novel phenomenon of inverse stochastic resonance in cerebellar neurons.

- Performed high-performance simulations for mutual information calculation
- Statistical analysis of electrophysiological data

RESEARCH ASSISTANT

loffe Institute of Physics, | St Petersburg | September 2011 - January 2012

Developed novel computational models of neural populations using statistical Physics. Applied mean-field theory to explain the properties of neurons in the visual cortex.

- Statistical physics neural population models of the visual cortex
- Presented research results on national conferences: Neuroinformatics

REFEREED JOURNAL ARTICLES

Buchin A., de Frates R., Nandi A., Mann R., Chong P., Ng L., Miller J., Hodge R., Kalmbach B., Bose S., Rutishauser U., McConoughey S., Lein E., Berg J., Sorensen S., Gwinn R., Koch Ch., Ting J., Anastassiou C. A. (2020). Multi-modal characterization and simulation of human epileptic circuitry. *Bioarxiv*. (**Paper** | **Code** | **Web product**)

Nandi A., Chartrand T., Van Geit W., **Buchin A.**, Yao Zh., Lee S. Y., Wei Y., Kalmbach B., Lee B., Lein E., Berg J., Sümbül U., Koch Ch., Tasic B., Anastassiou C. A. (2020). Single-neuron models linking electrophysiology, morphology and transcriptomics across cortical cell types. *Bioarxiv*. (**Paper** | **Code** | **Web Product**)

Berg, J., Sorensen, S. A., Ting, J. T., Miller, A. J., Chartrand, T., **Buchin, A.**, Bakken, E. T., Budzillo, A., Dee, N., Ding, S.-L. et al. (2020). Human cortical expansion involves diversification and specialization of supragranular intratelencephalic-projecting neurons. *Bioarxiv*. (**Paper** | **Code**)

Kalmbach K. E., **Buchin A.**, Miller J. A., Bakken T. E., Hodge R. D., Chong P., de Frates R., Dai K., Gwinn P. G., Cobbs C., Ko A. L., Ojemann J. G., Sibergeld D. L., Koch C., Anastassiou C. A., Lein E., Ting J. T. (2018). H-channels contribute to divergent electrophysiological properties of supragranular pyramidal neurons in human versus mouse cerebral cortex. *Neuron*, <https://doi.org/10.1016/j.neuron.2018.10.012>. (**Paper** | **Code**)

Buchin A., Kerr C. C., Huberfeld G., Miles R., Gutkin B. (2018). Adaptation and inhibition control pathological synchronization in a model of focal epileptic seizure. *eNeuro*, 0019-18.2018. (**Paper** | **Code**)

Buchin A., Chizhov, A., Huberfeld, G., Miles, R., & Gutkin, B. S. (2016). Reduced Efficacy of the KCC2 Cotransporter promotes epileptic oscillations in a subiculum network model. *Journal of Neuroscience*, 36(46), 11619-11633. (**Paper** | **Code**)

Buchin A., Rieubland, S., Häusser, M., Gutkin, B. S., & Roth, A. (2016). Inverse stochastic resonance in cerebellar Purkinje cells. *PLOS Computational Biology*, 12(8), e1005000. (**Paper** | **Code**)

Buchin A. Yu., Huberfeld G., Miles R., Chizhov A. V., Gutkin B. S., Petrov V. (2015). Effects of reduced efficacy of KCC2 cotransporter in single neuron model: implications for epilepsy. *St. Petersburg State Polytechnical University Journal. Humanities and Social Sciences*. 15, 13-24. (**Paper** | **Code**)

Buchin, A. Y., & Chizhov, A. V. (2010). Firing-rate model of a population of adaptive neurons. *Biophysics*, 55(4), 592-599. (**Paper**)

Buchin, A. J., & Chizhov, A. V. (2010). Modified firing-rate model reproduces synchronization of a neuronal population receiving complex input. *Optical Memory and Neural Networks*, 19(2), 166-171. (**Paper**)

CONFERENCE PROCEEDINGS

Buchin A., Chartrand T., Bakken T., Miller L., Hidge R., Gouwens N., Gratiy S., Kalmbach B., Tasic B., Lee C., Lee J., Murphy G., Zeng H., Ting J., Sorensen S., Berg J., Lein E., Anastassiou C. (2019). Conserved and divergent electrophysiological and morphological properties of mouse and human transcriptomically-defined cell types. Chicago, United States.

SCIENCE COMMUNICATION

Medium

Biomolecula journal

2019, What is so special about the human brain?

2017, Chaos in the brain.

2016, Blue brain project: connections and chaos.

2013, From living brain to artificial intelligence

Leonardo journal

2013, Biological neural networks

2013, Brain storm

Personal blog

PUBLIC OUTREACH

2020, Computational neuroscience & AI, Engineering mind podcast. [Link](#)

2019 People in science, Novatech journal

2017 Disfunction of proteins in epilepsy, Foundation of Medical Research. [Link](#)

2017, Epilepsy from neuroscience point of view, XX2 century. [Link](#)

2017 Science career in Russia, Europe and United states, Rabota.ru. [Link](#)

2016, About squids, brain modelling and practical use of neuroscience, Theory & Practice. [Link](#)

2016, Discussion about psychedelic research, Moon Ant radio podcast.

2015, Expatriates in Paris, Le Monde

2015, Public neuroscience lecture, Granum Sails, Saint Petersburg. [Link](#)

ADDITIONAL TRAINING

2020, Genomic data science, Coursera, John Hopkins

2018, Intelligent machinery course, University of Washington

2016, Dynamic brain workshop, Allen Institute for Brain Science

2013, Advanced course in computational neuroscience, FENS

2012, White nights of computational neuroscience, Bion

CONFERENCE PROCEEDINGS

Buchin A., de Frates R., Nandi A., Chong P., Mann R., Berg J., Kalmbach B., Rutishauer U., Gwinn R., Sorensen S., Ting J., Anastassiou C. (2018). Morpho-electric properties and computational simulation of human dentate gyrus granule cells from the epileptogenic hippocampus. Society for Neuroscience. San Diego, United States.

Rubchinsky, L. L., Ahn, S., ..., **Buchin A.** ... Vassena, E. (2017, August). 26th Annual Computational Neuroscience Meeting (CNS 2017): Part 2. BMC Neuroscience (Vol. 18, No. 1, p. 59). BioMed Central.

Buchin A., Chizhov, A., Huberfeld G., Miles R., Gutkin, B., S. (2016). Reduced Efficacy of the KCC2 cotransporter promotes epileptic oscillations in a subiculum network model. Society for Neuroscience. San Diego, United States.

Buchin, A., Rieubland, S., Hausser, M., Gutkin, B., Roth, A. (2015). Inverse stochastic resonance in cerebellar Purkinje cells. Society for Neuroscience, Chicago, United States.

Buchin, A. Y., Huberfeld, G., Miles, R., Chizhov A. V., Gutkin B. (2015). Effects of a reduced efficacy of the KCC2 co-transporter in Temporal Lobe Epilepsy: single neuron and network study. Organization for Computational Neurosciences, Prague, Czech Republic.

Buchin, A. Y., Huberfeld, G., Miles, R., Chizhov A. V., Gutkin B. (2014). Effects of a reduced efficacy of the KCC2 co-transporter in a single neuron model: relevance for epilepsy. Federation of European Neuroscience Societies, Milan, Italy.

Buchin, A. Y., Huberfeld, G., Miles, R., Gutkin, B. (2014). Effects of a reduced efficacy of the KCC2 co-transporter in a single neuron model: relevance for epilepsy. Society for Neuroscience, Washington DC, United States.

Buchin, A., Chizhov, A. V. (2011). Description of pathologic neuron synchronization using firing-rate model framework, Physics Spb, St Petersburg, Russia, 36 – 37.

Buchin, A., Rieubland, S., Roth, A., Hausser, M., Gutkin, B. (2011). Model of bistability and inhibition by noise of Purkinje cells, Neuroinformatics, Moscow, Russia, 2, 196 – 205.

Buchin, A., Rieubland, S., Roth, A., Hausser, M., Gutkin, B. (2010). Model of bistability and inverse stochastic resonance of Purkinje cell, Multiscale analysis of neural systems: taking the challenge seriously, Gif-sur-Yvette, France, 14.

Buchin, A., Chizhov, A. V. (2009). Synchronization in the firing-rate model, Hippocampus and memory: norm and pathology, Pushchino, Russia, 80–81.

Buchin, A., Chizhov, A. V. (2009). Synchronization of a neuron population by complex shape signal, Neuroinformatics, Moscow, Russia, 1, 264–273.

INVITED TALKS

Multi-modal characterization and simulation of human epileptic circuitry, Skoltech, Moscow, 2019, [Link](#)

Computational modeling of human epilepsy: from single neurons to pathology, 2018, Microsoft Research, Redmond, United States. [Link](#)

What is so special about human cortex? or H-channels contribute to divergent electrophysiological properties of supragranular pyramidal neurons in human versus mouse cerebral cortex, 2018, Higher School of Economics, Center for Cognition & Decision Making, Moscow.

Mathematical models of the brain, 2015, JetBrains, St Petersburg, Russia. [Link](#)

TEACHING

Neuromatch Academy, Mentor, 2020

Dynamic Brain Workshop, Teaching Assistant, Allen Institute for Brain Science, 2019

Modeling in Neuroscience, Teaching Assistant, École Normale Supérieure, 2013 – 2015

CERTIFICATIONS

Convolutional Neural Networks
Sequence Models
Neural Networks and Deep Learning
Structuring Machine Learning Projects
Improving Deep Neural Networks
Deeplearning.ai | 2019

Machine learning
Stanford | 2019

Machine Learning Foundations:
Case study approach
University of Washington | 2016

SERVICE AND MEMBERSHIPS

Journal reviewer
Neurocomputing
Journal of Computational Neuroscience
PLOS ONE
PLOS Computational Biology

Member
Society for Neurosciences
Organization for Computational
Neurosciences