

## SUMMARY

I'm passionate about trying to understand how things work, with a particular focus on intelligence. I'm a systems / computational neuroscientist by educational training, with work experience in applied artificial intelligence, machine learning, software development, and software engineering. I like to form interdisciplinary knowledge and test theories and create tools that help explain and create intelligent behavior. I enjoy working on solo projects, but my best work emerges in collaborations.

## EDUCATION

Ph. D. Systems & Computational Neuroscience   University College London   London, UK	Present
A.S.P. Neuroscience   Massachusetts Institute of Technology   Cambridge, MA, USA	2018
B.A. Neuroscience   Boston University   Boston, MA, USA	2015

## RESEARCH EXPERIENCE

Data Scientist, <a href="#">Sainsbury Wellcome Centre</a> University College London, London, UK	2020 Nov – 2021 Aug
Software Developer, <a href="#">CortexLab</a> & <a href="#">International Brain Lab</a> University College London, London, UK	2018 Oct – 2020 Aug
Technical Associate I/II, <a href="#">Wilson Lab</a> Massachusetts Institute of Technology, Cambridge, MA, USA	2016 Jun – 2018 Jun
Research Assistant, <a href="#">Perceptual Neuroimaging Lab</a> Boston University, Boston, MA, USA	2013 Jun – 2014 Jun
Research Assistant, <a href="#">Calakos Lab</a> Duke University, Durham, NC, USA	2012 May – 2012 Aug

## PUBLICATIONS

### *Journal Articles*

*Bhagat J. \*, Campagner D. \*, Lopes G. \*, Calcaterra L., Lo C., Almeida A., ... [Aeon: An open-source platform to study the neural basis of ethological behaviors over naturalistic timescales](#). In Prep.*

*International Brain Laboratory, Banga K., Benson J., [Bhagat J. .](#), Biderman D., Birman D., ... [Reproducibility of in-vivo electrophysiological measurements in mice](#). *Biorxiv & In Press* 2023.*

*Steinmetz N. A., Aydin C., Lebedeva A., Okun M., Pachitariu M., [Bhagat J. .](#), ... [Neuropixels 2.0: A miniaturized high-density probe for stable, long-term brain recordings](#). *Science* 2021.*

*[Bhagat J. .](#), Wells M. J. \*, Harris K. D., Carandini M., Burgess C. P. [Rigbox: An open-source toolbox for probing neurons and behavior](#). *eNeuro* 2020.*

### *Conference Abstracts*

*Campagner D. \*, [Bhagat J. .](#), Lopes G. \*, Calcaterra L. \*, Ahn J., Almeida A., ... [Aeon: An open-source platform to study the neural basis of ethological behaviors over naturalistic timescales](#). *SFN* 2024.*

*[Bhagat J. .](#), Wells, M. J. \*, Peters, A. J., Harris, K. D., Carandini, M., Burgess, C. P. [Rigbox: An open-source toolbox for probing neurons and behavior](#). *SFN* 2019.*

*[Bhagat J. .](#), Penagos, H., Wilson, M. [LSTM Neural Networks for LFP Event Detection and Classifi-](#)*

[cation in the Rodent Hippocampal-Cortical Network](#). MIT Brain and Cognitive Sciences Retreat 2018.

*Bhagat, J., Varela, C., Flores, F., Zhang, J., Wilson, M.* [Machine Learning Techniques to Improve Analyses of Neural Spike Data](#). MIT Intelligence Quest 2018. [[Press Release](#)]

## OPEN-SOURCE PROJECTS

[nanoGPT](#): A minimal (nanomal?) repository containing code for building, training, and running nanoGPT. (Sole creator, developer, and maintainer)

[Wall-E-GPT](#): Python and Arduino code for a GPT-controlled, semi-autonomous rover robot running on a Raspberry Pi. (Sole creator, developer, and maintainer)

[aeon\\_mecha](#): [Project Aeon](#)'s main library for interfacing with acquired experiment data. (Creator, developer, maintainer: active)

[aeon\\_experiments](#): [Project Aeon](#)'s main Bonsai and C# library for running behavioral neuroscience experiment workflows. (Developer, maintainer: active)

[ibllib](#): The International Brain Laboratory's core shared Python libraries for data management and neural electrophysiology acquisition  $\leftrightarrow$  analysis pipeline. (Developer, maintainer)

[MatchMentor](#): Football video analysis AI to democratise player training. (Creator, developer, and maintainer: active)

[Rigbox](#): A MATLAB and C based toolbox for running behavioral neuroscience experiments and managing data. (Developer, maintainer)

[Burgess Steering Wheel Setup](#). Hardware designs and assembly instructions for a rig used to run the [Burgess Steering Wheel Task](#). (Contributor)

[J.Clust](#). A MATLAB complete spike sorting package. (Sole creator, developer, and maintainer)

## TALKS & TUTORIALS

[Video-based Analysis of Animal Behavior](#). Sainsbury Wellcome Centre, University College London. London, UK. 2023-11-29.

[Collaborative Coding and Software Development Best Practices](#). Sainsbury Wellcome Centre, University College London. London, UK. 2023-10-25.

[Introduction to Software Development in Python](#). Sainsbury Wellcome Centre, University College London. London, UK. 2023-09-21.

[Neuroverse Podcast: Challenges with Collaborative Neuroscience & the Impact of Generative AI](#). London, UK. 2023-06-29.

[Introduction to High-performance Computing with Linux](#). Sainsbury Wellcome Centre, University College London. London, UK. 2023-04-25.

International Brain Laboratory Data Organization and Architecture. Jerome L. Green Science Center, Columbia University. New York, NY. 2019-09-02.

Optimizing Tetrode Spike Sorting and Using LSTMs for LFP Event Detection. Cruciform Building, UCL. London, UK. 2018-04-06.

Git and Github for Code Versioning and Collaboration in Neuroscience. Picower Institute for Learning and Memory, MIT. Cambridge, MA. 2018-03-28.

[An Introduction to Spike Sorting](#). Center for Brains, Minds and Machines, MIT. Cambridge, MA. 2017-

03-22.

## TEACHING

[Neuronauts Summer Camp – 2023](#). Instructor. Sainsbury Wellcome Centre, University College London. London, UK. 2023-07-31 – 2023-08-04.

[Neuronauts School Club – 2022-2023](#). Instructor. Sainsbury Wellcome Centre, University College London. London, UK. 2022 - 2023.

[SWC Bonsai Workshop – 2022](#). Teaching Assistant. Sainsbury Wellcome Centre, University College London. London, UK. 2022-11-08 – 2022-11-11.

[SWC Ph. D. Bootcamp – 2022](#). Teaching Assistant. Sainsbury Wellcome Centre, University College London. London, UK. 2022-09-13 – 2022-09-30.

[Neuronauts Summer Camp - 2022](#). Head Instructor. Sainsbury Wellcome Centre, University College London. London, UK. 2022-07-25 – 2022-08-05.

[International Brain Lab Code Camp – 2019](#). Workshop Organizer and Instructor. Jerome L. Green Science Center, Columbia University. New York, NY. 2019-09-02 – 2019-09-06.

[Neuropixels Course at UCL – 2019](#). Workshop Teaching Assistant. Sainsbury Wellcome Centre, UCL. London, UK. 2019-04-29 – 2019-05-01.

[Neuroinformatics – Spring 2019](#). Course Teaching Assistant. Sainsbury Wellcome Centre, UCL. London, UK. 2019.

[9.123: Neurotechnology in Action – Spring 2018](#). Guest Lecturer. Department of Brain and Cognitive Sciences, MIT. Cambridge, MA. 2018.

[9.17: Systems Neuroscience – Fall 2017](#). Guest Lecturer. Department of Brain and Cognitive Sciences, MIT. Cambridge, MA. 2017.

## AWARDS

[Fondation JFMLCT Education Outreach Fund 2023](#): £5000

[UCL AWPO Bespoke Project Fund 2022](#): £15000

[SWC Public Engagement Fund 2022](#): £1000

[SWC Ph. D. Scholarship 2021](#): £150000

## PROFESSIONAL GROUPS & ACTIVITIES

[UCL NeuroAI](#). Organizing committee member. 2023-Present.

[Neuronauts](#). Founder, President. 2021-Present.

[Project Aeon](#). Head of Data Architecture. 2021-Present.

[International Brain Lab](#). Member. 2019-Present.

[Society for Neuroscience](#). Member. 2019-Present.

[Cognitive Rhythms Collaborative](#). Member. 2017-2018.

[MIT Ephys Analysis and Spike Sorting Discussion Group](#). Founder, President. 2016-2018.

[The Nerve Magazine](#). Writer and Editor. 2013-2014.

## ADDITIONAL TRAINING

2024 | [ARENA 3.0 - AI Alignment](#) | ARENA Education  
2023 | [Extracellular Ephys Acquisition](#) | Cajal Advanced Neuroscience Training | Lisbon, Portugal  
2023 | [Machine Learning Summer School](#) | Stellenbosch University | Gordon's Bay, South Africa  
2016 | Programming Languages Specialization | Coursera  
2016 | Machine Learning Specialization | Coursera

## TECHNICAL SKILLS & KNOWLEDGE

(items in each subsection in descending, rightward rank by proficiency)

### *Computer Science & Programming*

#### *General Programming Languages (Active Projects)*

Python (including Numpy, Jax, PyTorch, TensorFlow, Keras, Avalanche, Scipy, Scikit-learn, and Pandas packages)

Bonsai Mojo Javascript Rust

#### *General Programming Languages (Past Projects)*

MATLAB (including NI-DAQ mx, Data Acquisition, Signal Processing, Wavelet, Statistics and Machine Learning, and Neural Network toolboxes)

C Racket Lisp ML Ruby CUDA Java R Wolfram Julia

#### *Command & Database Languages*

Bash Zsh Git PS Conda / Mamba SQL / MySQL

#### *Markup Languages*

Markdown  $\text{\LaTeX}$  HTML CSS

#### *Data Serialization Languages*

YAML JSON XML

#### *Programming Paradigms*

Procedural Object-Oriented Functional Reactive

#### *Development Practices and Processes*

Versioning (DVCS) Test-driven development (TDD) Continuous integration (CI) Continuous delivery (CD) Software Development Lifecycle (SDLC) Models: Waterfall, V, Agile (Kanban, Scrum)

### *Statistics & Mathematics*

#### *Basic Data Visualization & Analysis*

Dimensionality Reduction Procedures: PCA, Wavelet Analysis, t-SNE

Clustering Techniques: k-means, FCM, MoG, HDBSCAN, OPTICS

Inferential Statistics: Frequentist & Bayesian hypothesis testing

Regression Methods: Logistic, Multilinear (incl. L1 / L2 norm), GLMs, Random Forests

## *Deep & Reinforcement Learning*

ANN Architectures: Transformer, VAE, GAN, LSTM, RNN, CNN

Training Optimizers: Adam and variants, RMSprop, SGD, BFGS

Regularization Techniques: K-Fold and Cross-validation, Layer and Gradient Normalization, Dropout

RL Models: DQN, Distributional, (Gradient-)TD, Bandit

Distributed Training, Apps, & Services: DDP, FSDP, RAG, Wandb, AWS (S3, EC2, ECS), GCP, HF 🤖

## *Signal Processing*

Basic Digital Filter Design: IIR and FIR filters.

## *Mechatronics*

Creating basic mechatronic circuits

Designing simple PID and Kalman Filter Control Systems

Assembling experiment rigs, via 3d printing and laser-cutting

Designing and building hobbyist robots, controlled via microcomputers (including Raspberry Pis (using ROS / RosPy), LattePandas, Jetson Nanos) and microcontrollers (including Arduinos, FPGAs)

Assembling computer acquisition systems from components

Wiring tetrodes and building tetrode drives

## *Wet Lab*

Behavioral tasks on humans and rodents

Genotyping (via PCR and gel electrophoresis) on rodents

Electrophysiology and fiberphotometry neural recordings on rodents

Optogenetic and pharmacologic neural manipulations on rodents

Stereotaxic surgeries on rodents

Perfusions, histology, and post-mortem fluorescence microscopy on rodents