Alessandro R. Galloni

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Summary

Self-motivated and collaborative computational neuroscientist, using machine learning and AI tools to explore biologically plausible learning algorithms in the brain. With a background in systems neuroscience, I have over 8 years of research experience managing both computational and experimental research projects. Specialties include deep learning in PyTorch (particularly computer vision), building exploratory data analysis pipelines, computational modeling, scientific communication, and data visualization.

Research Experience

Rutgers University, Center for Advanced Biotechnology and Medicine
Piscataway (NJ), USA

COMPUTATIONAL NEUROSCIENTIST (EMBO POSTDOCTORAL FELLOW)
Feb. 2021 - present

Experience building and analyzing custom neural networks trained on computer vision and reinforcement learning tasks

- Built a **PyTorch wrapper** for biology-inspired neural networks
- Led a collaboration on neuromorphic computing, developing neuroAI models for reinforcement learning on novel hardware
- Built recurrent neural networks to model neural dynamics in the brain
- Used Principal Component Analysis (PCA) to visualize high-dimensional loss landscapes during neural network learning
- Developed analysis pipeline for fitting GLM models and visualizing experimental neural data recorded from the hippocampus of mice

The Francis Crick Institute / University College London
London, UK

PhD IN NEUROSCIENCE
Sept. 2015 - Feb. 2021

Performing neuroscience experiments (in mice) and running detailed simulations of neuronal biophysics

- Used **Python** and MATLAB to analyze connectivity and activation properties in neurons across different visual areas of the mouse brain
- Created detailed biophysical models to simulate the influence of dendrites on neuronal activation
- Designed and executed experiments, publishing 2 first-author papers

University College London
London, UK

MSci THESIS RESEARCH
Oct. 2014 - March 2015

- Built Arduino-based hardware with custom 3D-printed parts to study sleep patterns in zebrafish
- Analyzed time series of their behavioral data

Education

University College London & The Francis Crick Institute
London, UK

PhD IN NEUROSCIENCE (BOEHRINGER INGELHEIM FONDS FELLOW)
2015 - 2020

- Awarded competitive Boehringer Ingelheim Fonds fellowship

University College London
London, UK

MASTER OF SCIENCE (MSci) IN NEUROSCIENCE (INTEGRATED UNDERGRADUATE AND MASTER'S DEGREE)
2011 - 2015

- **Grade: First Class (Hons.)** (highest grade in the UK system)

Skills

TECHNICAL	**Software engineering**	Deep learning (PyTorch), scientific computing (NumPy, SciPy), jupyter, pandas, matplotlib, git
	Programming Languages	Python, MatLab, Igor Pro
	Imaging	Confocal microscopy, slide scanner fluorescence imaging
	Other Software	Adobe Illustrator, LaTeX
	Electrophysiology	Patch-clamp voltage recordings from live mouse neurons
LANGUAGES	**English**	native level
	Italian	native level
	Swedish	native level speaking, intermediate level writing/reading
	French	Intermediate (B1-B2 level)

Additional Training

Neuromatch Academy – Deep Learning (NMA-DL)   *New York, USA*
3-week course on deep learning using modern neural network architectures   *2021*

CAJAL Course in Computational Neuroscience   *Lisbon, Portugal*
4-week course in computational neuroscience at the Champalimaud Centre for the Unknown   *2018*

Science communication course (Boehringer Ingelheim Fonds)   *Mainz, Germany*
Training on scientific presentation to both technical and lay audiences, data visualization and figure design   *2017*

EMBO Laboratory Leadership course   *New York, USA*
Course covering effective approaches to leadership and communication when building and managing teams   *2024*

Leadership & Management Experience

Workshop organizer at COSYNE 2023   *Cold Spring Harbor, USA*
Co-organized a workshop on biological learning rules at the **Computational & Systems Neuroscience** conference   *March 2023*

Teaching at Cold Spring Harbor Laboratory   *Cold Spring Harbor, USA*
Taught hands-on practical component of brain slice physiology with patch-clamp recordings in the intensive 3-week   *June 2023*
summer school on Ion Channels in Synaptic and Neural Circuit Physiology

Supervising graduate and undergraduate students at Rutgers University   *Piscataway (NJ), USA*
Supervised summer research projects for 6 undergraduate students. Currently co-supervising one PhD student on a   *2021 - 2024*
project spanning both experimental and computational techniques

Teaching assistant at University College London   *London, UK*
Supervised undergraduate laboratory practicals in neurophysiology and histology   *2016 - 2019*

Honors & Awards

Competitive awards

2022   EMBO Postdoctoral Fellowship (value: $125'000)
2016   Boehringer Ingelheim Fonds PhD Fellowship (value: $110'000)
2013   UCL Dean's List award for outstanding academic achievements
2012   UCL Dean's List award for outstanding academic achievements

Minor awards

2023   Best presentation (1st place), Rutgers Postdoctoral Symposium
2017   Poster prize (2nd place), Cortical Feedback spring workshop
2013   UCL Dean's Summer Scholarship (8 week research project)
2012   Wellcome Trust Biomedical Scholarship (8 week research project)

Publications

2024   **Neuromorphic one-shot learning utilizing a phase-transition material**
Galloni, A.R., Yuan, Y., et al., Ramanathan, S., Milstein, A.D., Proceedings of the National Academy of Sciences (PNAS) USA, 121(17)
- **Computational neuroscience / Machine Learning**: Reinforcement learning on neuromorphic hardware

2022   **Recurrent excitatory feedback from mossy cells enhances sparsity and pattern separation in the dentate gyrus**
Galloni, A.R., Samadzelkava, A., Hiremath, K., Oumnov, R., Milstein, A.D., Frontiers in Computational Neuroscience, 16:82
- **Computational Neuroscience**: Neural dynamics in biologically realistic excitatory/inhibitory recurrent networks

2022   **Dendritic domain-specific sampling of long-range axons shapes feedforward and feedback connectivity of L5 neurons**
Galloni, A.R., Ye, Z., Rancz, E.A., Journal of Neuroscience, 42(16) 3394-3405
- **Neurophysiology / Signal Processing**: Spatio-temporal distributions of synaptic activity underlying long-range neural connections

2020   **Apical length governs computational diversity of layer 5 pyramidal neurons**
Galloni, A.R., Laffere, A., Rancz, E.A., eLife, e55761
- **Neurophysiology / Computational Neuroscience**: Impact of dendritic morphology on electrical properties of neurons
- Selected for poster presentation at the 2018 **Computational & Systems Neuroscience (COSYNE)** conference