BRENDAN HARRIS

Computational Neuroscientist

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SUMMARY

Computational neuroscientist and software developer with a PhD in physics (thesis submitted) from The University of Sydney. Experience developing real-time EEG-based neurofeedback systems for monitoring and controlling brain-network activation. Skilled in Matlab, Python, and Julia, with expertise in time-series analysis, machine learning, and large-scale neural data.

EDUCATION

2022	**Current Physics PhD Student** *Cross-scale dynamics in the working regime of the visual cortex*	**The University of Sydney**
2021	**Physics Honours, Class I and the University Medal** *Inferring parametric variation across non-stationary time series*	**The University of Sydney**
2018 – 2020	**Bachelor of Science/Bachelor of Advanced Studies (Dalyell Scholar)** Majored in Physics and Neuroscience	**The University of Sydney**

INDUSTRY EXPERIENCE

Mar – Dec 2023	**Resonait Medical Technologies** *Dr. Cameron Higgins* Worked on a casual basis writing Matlab code to interface with EEG headsets, infer the activation of brain networks, and implement neurofeedback for the monitoring and treatment of depression	**Software developer**

PUBLICATIONS AND PREPRINTS

2026	***Nested spatiotemporal theta–gamma waves organize hierarchical processing across the mouse visual cortex*** **Brendan Harris** and Pulin Gong	**Nature Communications** *In press*
2026	***Anomalous dynamics in the working regime of the visual cortex*** **Brendan Harris** and Pulin Gong	**In preparation**
Jul 2025	***Canonical time-series features for characterizing biologically informative dynamical patterns in fMRI*** 🔓 ⬡ Imran Alam, **Brendan Harris**, Patrick Cahill, Oliver Cliff, Marija Markicevic, Valerio Zerbi, and Ben D. Fulcher	**Aperture Neuro** **vol. 5, pp.**
Aug 2024	***Tracking the Distance to Criticality in Systems with Unknown Noise*** 🔓 ⬡ **Brendan Harris**, Leonardo L. Gollo, and Ben D. Fulcher	**Physical Review X** **vol. 14, pp. 031021**
May 2024	***Distributed and dynamical communication: a mechanism for flexible cortico-cortical interactions and its functional roles in visual attention*** 🔓 Shencong Ni, **Brendan Harris**, and Pulin Gong	**Communications Biology** **vol. 7, pp. 550**
Jul 2021	***Approximate Modal Cut-Off Wavelengths and the V-Parameter for M-type Optical Fibers and Its Novel Applications*** Deepak Jain, Mark A George, **Brendan Harris**, and Simon Fleming	**Journal of Lightwave Technology** **vol. 39, pp. 4478–4488**

CONFERENCES

Jun 2025	**OHBM 2025** 🔓 Brisbane, QLD, Australia 2072: *Nested spatiotemporal dynamics organize hierarchical processing in the mouse visual cortex* **Brendan Harris** and Pulin Gong	**Poster**
Jun 2025	**EPC/APCV 2025** The University of New South Wales *Spatiotemporal theta–gamma waves organize hierarchical processing in the mouse visual cortex* **Brendan Harris** and Pulin Gong	**Talk**
Mar 2025	**COSYNE 2025** 🔓 Montreal, QC, Canada 1–117: *Tracking the distance to criticality across the mouse visual hierarchy* **Brendan Harris**, Leonardo Gollo, and Ben Fulcher	**Poster**
Feb 2025	**NeuroEng 2025** The University of Melbourne *Nested spatiotemporal theta–gamma waves organize hierarchical visual processing* **Brendan Harris** and Ben Fulcher	**Talk**
Jul 2024	**2024 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)** 1–4: *Default Mode Network Detection using EEG in Real-time* Navin Cooray, Chetan Gohil, **Brendan Harris**, Shaun Frost, and Cameron Higgins	**Conference paper**
Oct 2023	**IBRO Neuroscience Reports (IBRO World Congress 2023)** Granada, Spain S783: *Nested and non-stationary oscillatory bursts underlie flexible inter-areal neural communication* **Brendan Harris** and Pulin Gong	**Poster**
Jul 2022	**31st Annual Computational Neuroscience Meeting: CNS*2022** Melbourne, Australia P36: *Summarizing non-stationarity in spatio-temporal neural data* **Brendan Harris** and Ben Fulcher	**Poster**
Jun 2022	**28th Annual Meeting of the Organization for Human Brain Mapping** *Summarizing non-stationarity in spatio-temporal neural data* **Brendan Harris** and Ben Fulcher	**Virtual Poster**
Sep 2020	**Frontiers in Optics / Laser Science (2020)** FM4D.2: *Approximate normalized frequency (V-parameter) and modal cut-off wavelengths of M-type optical fibers* Deepak Jain, Mark George, **Brendan Harris**, and Simon Fleming	**Oral presentation**

RESEARCH EXPERIENCE

2022	**Cross-scale dynamics in the working regime of the visual cortex** *Dr. Pulin Gong, Complex Systems Group, The University of Sydney* In my PhD work, I aim to understand the principles of computation in spatiotemporal neural systems and their role in transforming complex stimuli into flexible behavior. Specifically, I focus on analyzing spatiotemporal patterns, criticality, cross-scale dynamics, and nonlocal diffusion in mouse electrophysiology data, spiking neural circuits and their mein-field reductions, as well gaze trajectories.	**PhD research**

Mar – Nov 2021	**Inferring parametric variation across non-stationary time series**	**Honours research**
	Dr. Ben Fulcher, Complex Systems Group, The University of Sydney	
	Developed a method to summarize non-stationary dynamics using time-series features and dimensionality reduction, along with a new approach to dimensionality reduction that uses baseline datasets to account for redundant measurements. I applied this method to both simulated data and mouse electrophysiology recordings.	

Aug – Nov 2020	**Relating BOLD dynamics, interneuron densities, and DREADD activation**	**Dalyell project**
	Dr. Ben Fulcher, Complex Systems Group, The University of Sydney	
	Explored links between BOLD dynamics, neuronal excitability, and cell densities by combining fMRI, DREADD activation, and neuron-count data with time-series features (*hctsa*) and machine-learning classifiers.	

Jan – Mar 2020	**Quantum Control Laboratory**	**Denison project**
	Dr. Cornelius Hempel, School of Physics, The University of Sydney	
	Completed lab projects in optics, instrumentation, and Python/Julia/C++ programming, including building an interferometer for ion trap vibration measurements, testing signal generator stability, and developing Arduino-based sensors.	

Aug – Nov 2019	**Classifying the stability of near-critical systems** ⦿	**Undergraduate project**
	Dr. Ben Fulcher, Complex Systems Group, The University of Sydney	
	Used machine-learning algorithms and time-series features to classify time series from monostable and bistable regions of dynamical systems.	

Jul – Aug 2019	**Interneuron densities and intrinsic timescales in the mouse brain**	**Casual lab assistant**
	Dr. Ben Fulcher, Complex Systems Group, The University of Sydney	
	Investigated the relationship between interneuron subtypes and brain dynamics by analysing fMRI time-series features (*hctsa*) and interneuron density datasets in Matlab and Python.	

Mar – Jun 2019	**Numerical analysis of M-type optical fibers**	**Undergraduate project**
	Dr. Deepak Jain, School of Physics, The University of Sydney	
	Modelled M-type optical fibres in COMSOL and formulated expressions describing their unique properties, cut-off wavelengths, anticrossings, and mode profiles.	

Aug 2018 – Aug 2021	**Tracking the distance to criticality in systems with unknown noise** ⦿	**Undergraduate project**
	Dr. Ben Fulcher, Complex Systems Group, The University of Sydney	
	Searched for time-series features that best predict the distance to criticality in noisy dynamical systems; this involved numerical simulation and time-series analysis (hctsa) in Matlab and with the School of Physics HPC cluster.	

REFEREES

Dr. Benjamin D. Fulcher	**Dr. Pulin Gong**	**Dr. Cameron Higgins**
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The University of Sydney	The University of Sydney	Resonait Medical Technologies
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