

Adam Willats

Collaborative, interdisciplinary researcher focused at the intersection of neuroscience, machine-learning, and closed-loop control. Currently completing a PhD in Biomedical Engineering.

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Objective

Data scientist experienced in analysis and visualization of complex neural data. **Science communicator** driven by developing interactive and intuitive ways to demonstrate concepts to others. Successful **engineer and innovator of responsive technologies** for understanding and regulating the nervous system resulting in two patents, five publications, and development of an open-source codebase. Looking to expand the efficacy of neurostimulation therapies through design and development of closed-loop algorithms and individualized data-driven models of the nervous system. Eager to apply expertise within a **collaborative research and development team** to improve quality of life for those experiencing neurological disorders.

Experience

Graduate Research Assistant, Georgia Institute of Technology & Emory University, SIPLAB

2014-present

- Developed recurrent, dynamical systems models of neural responses to optogenetic stimulation
- Characterized algorithms for decoding and controlling brain states *in silico*
- Implemented real-time closed-loop control algorithms to regulate neural firing *in vivo* with <2ms compute times 🌐
- Contributed to writing collaborative multi-year research grant which was successfully funded for \$1.6 million
- Actively participated in both neuro-engineering (Neuro@GT) and machine learning communities (ML@GT)
- Organized retreats, methods clinics, and journal clubs across two universities as a member of the Computational Neuroscience Training Leadership Committee
- Mentored one undergraduate and three graduate researchers in statistical modeling and neural stimulation technology

Undergraduate Researcher, Purdue University, Center for implantable Devices

Jan 2014-Jun 2014

- Developed and patented technology and signal processing algorithms for a novel approach to control intraocular pressure (IOP) to treat glaucoma
- Conducted surgeries and data analysis to verify prototype performance

Intern - R&D, Cyberonics (now LivaNova)

May 2013-Aug 2013

- Characterized, and tested radio frequency programming system for vagus nerve stimulator
- Streamlined analysis of oscilloscope data by developing a MATLAB GUI
- Researched security concerns associated with wireless-enabled implantable medical devices

Undergraduate Researcher, Purdue University, e-Lab

May 2012-Aug 2012

- Integrated computer vision systems with mobile robotics platforms as part of the Purdue Summer Undergraduate Research Fellowship (SURF) program 📺
- Programmed in C++ and Lua using Robot Operating System (ROS) and torch7 machine learning framework

Education

Ph.D. in Biomedical Engineering, Georgia Institute of Technology & Emory University

2014-2021

- *Thesis*: Developing, characterizing, and applying closed-loop control to understand neural circuits
- Computational Neuroscience Training Grant Fellow
- Graduate Teaching Fellow
- President's Fellowship

B.Sc. in Biomedical Engineering, Purdue University

2010-2014

Select Courses

Data science and scientific computing, Institute for Data Engineering and Science (IDEaS), Georgia Institute of Technology

2017

Mining and modeling neuroscience data, UC Berkeley

2015

- This course integrated lectures from prominent researchers in computational neuroscience, with hands-on analysis of a variety of neuroscience data sets.

Machine Learning for Control Systems, Georgia Institute of Technology

2015






Data Skills

- **Programming languages:** MATLAB, Python, C++, JavaScript
- **Interactive visualization:** MATLAB LiveScript, Jupyter Notebooks, Processing.js
- **Probability & statistical models:** Generalized linear models (GLM), hidden Markov models (HMM), linear dynamical systems, maximum a posteriori estimation. NumPy, SciKit-Learn
- **Databases:** [pandas](#)
- **High-performance, parallel computing:** Portable Batch System (PBS) script, parallel computation in MATLAB, python
- **Real-time signal processing:** [RTXI](#), Arduino
- **Version control:** [GitHub](#)






Publications

 [ORCID](#)  [Google Scholar](#) *indicates co first-author



Reviewed Articles

- K. Fallah*, **A. Willats***, N. Liu, C. Rozell, "**Learning sparse codes from compressed representations with biologically plausible local wiring constraints**", *Neural Information Processing Systems (NeurIPS)*, (2020) 
- M. Bolus, **A. Willats**, C. Rozell, G. Stanley, "**State-space optimal feedback control of optogenetically driven neural activity**", *Journal of Neural Engineering*, (2020) 
- A. Cakmak, G. Poian, **A. Willats**, A. Haffar, R. Abdulkaki, Y. Ko, A. Shah, V. Vaccarino, D. Bliwise, C. Rozell, G. Clifford, "**An unbiased, efficient sleep-wake detection algorithm for a population with sleep disorders: change point decoder**", *Sleep*, (2020) 
- M. Bolus, **A. Willats**, C. Whitmire, C. Rozell, G. Stanley, "**Design strategies for dynamic closed-loop optogenetic neurocontrol in vivo**", *Journal of Neural Engineering*, (2018) 
- E. Chow, H. Joshi, **A. Willats**, D. Thompson, K. Cotton, S. Nair, C. Warren, B. Tomayko, A. Adkins, A. Shen, M. Morris, B. Byerman, "**Commercial development of RF medical implantable devices**", *2013 IEEE MTT-S International Microwave Workshop Series on RF and Wireless Technologies for Biomedical and Healthcare Applications (IMWS-BIO)*, (2013) 

Conference Presentations

- A. Willats**, M. O'Shaughnessy, K. Johnsen, C. Rozell, "**When are open- and closed-loop control necessary for causal inference in neural circuits?**", *Neuromatch.io*, (2020)  
- A. Willats**, M. Bolus, C. Whitmire, G. Stanley, C. Rozell, "**State-aware control of neural activity: design & analysis**", *Cosyne Abstracts*, (2018) [II-38 in](#) 
- M. Bolus, **A. Willats**, C. Whitmire, C. Rozell, G. Stanley, "**Closed-loop optogenetic control of thalamocortical activity**", *Society for Neuroscience*, (2017) [BB21 in](#) 
- M. Bolus, **A. Willats**, C. Whitmire, Z. Costello, M. Egerstedt, C. Rozell, G. Stanley, "**Closed-loop optogenetic control of neural circuits: Tracking dynamic trajectories of neural activity**", *Cosyne Abstracts*, (2016) [II-42 in](#) 

Patents

- G. Clifford, A. Cakmak, **A. Willats**, C. Rozell, "**System for Automated Analysis of Sleep and Wake States**", *PCT/US2020/049392*, (2020) 
- P. Irazoqui, S. John, A. Kokini, **A. Willats**, A. Chelminski, M. Matuscak, G. Simon, "**Optical Pressure Treatment through Electrical Stimulation**", *US20190001134A1*, (2020) 

Outreach

Lab Training Guide

2020-2021

- Initiated and developed document for helping graduate students succeed at research

Georgia Intern Fellowship for Teachers (GIFT) program, Center for Education Integrating Science, Mathematics, and Computing (CEISMC)

2018

- Mentored teacher in developing curriculum centered around digital signal processing

Kids Interested In Technology, Engineering, and Science (KITES) festival [\[2018](#) [\[2016](#)

2016-2018

- Built Arduino-based recording unit for real-time signal measurement and display based on [Backyard Brains EMG kit](#)
- Helped develop activity plan for 4th grade students to plot and analyze data