Adam Willats

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

■ adamwillats@gmail.com

→ +1 (812) 371-0379

• github.com/awillats in linkedin.com/in/adam-willats

Objective

Data scientist experienced in analysis and visualization of complex neural data. 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. Science communicator driven to develop interactive and intuitive ways to demonstrate concepts to others. Eager to apply expertise within a collaborative research and development team to improve quality of life for those experiencing neurological disorders through machine learning and neurostimulation therapies.

Experience

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

2014-2021 (expected)

- 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 <2 millisecond compute times **Q**
- Contributed to writing a collaborative multi-year research grant which was successfully funded for \$1.6 million
- Collaborated and published with peers in both neuroengineering (Neuro@GT) and machine learning communities (ML@GT)
- 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

Intern - R&D, Cyberonics (now LivaNova)

May 2013-Aug 2013

- Characterized and tested radio frequency programming system for vagus nerve stimulator
- Researched security concerns associated with wireless-enabled implantable medical devices

Undergraduate Researcher, Purdue University, e-Lab

May 2012-Aug 2012

- Integrated machine learning computer vision systems (C++, Lua, Torch7) with mobile robotics platforms (ROS) as part of the Purdue Summer Undergraduate Research Fellowship (SURF) program

Education

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

2014-2021 (expected)

- Thesis: Developing, characterizing, and applying closed-loop control to understand neural circuits

B.Sc. in Biomedical Engineering, Purdue University

2010-2014

Data Skills

- **Probability & statistical models:** NumPy, SciKit-Learn. Generalized linear models (GLM), hidden Markov models (HMM), linear dynamical systems.
- Programming languages: MATLAB, Python, C++, JavaScript
- Teaching through interactive visualization: MATLAB LiveScript, Jupyter Notebooks, Processing.js
- Databases: pandas, Version control: GitHub
- High-performance, parallel computing: _Parallel computation in MATLAB, python.
- **Real-time signal processing:** <u>RTXI</u>, Arduino
- Relevant courses: <u>Machine Learning for Control Systems</u>, <u>Data Science and Scientific Computing</u>, <u>Mining and Modeling Neuroscience Data</u>,

Honors & Awards

Graduate Teaching Fellow - Georgia Institute of Technology

2021

2014-2018

<u>Computational Neuroscience Training Grant Fellow</u> - NIH, Emory University, Georgia Institute of Technology

- This program supports cross-institute and interdisciplinary training in computational neuroscience, machine learning, and neural engineering.

President's Fellow - Georgia Institute of Technology

2015

Publications

ORCiD & Google Scholar *indicates co first-author

Manuscripts In Preparation

A. Willats, M. Bolus, C. Whitmire, G. Stanley, C. Rozell, "State-aware control of switching neural dynamics", (in prep.), (2021)

A. Willats, M. O'Shaughnessy, C. Rozell, "Closed-loop control for causal identification of neural circuits", (in prep.), (2021)

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. Abdulbaki, 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) <u>II-38 in </u>

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 led development of a document for helping graduate students succeed at research

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

- Mentored teacher in developing curriculum centered around digital signal processing

Kids Interested In Technology, Engineering, and Science (KITES) festival [2018 2] [2016 2]

2016-2018

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