Adam Willats

Researcher completing a Ph.D in Biomedical Engineering focused at the intersection of neuroscience and closed-loop control.

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Objective

Computational systems neuroscientist with experience expanding the toolkit for understanding the brain using data-driven mathematical models of neural dynamics, and responsive closed-loop perturbation of neural circuits. **Highly motivated teacher** committed to developing interactive and intuitive ways to communicate concepts to students. Seeking a position which balances **collaborative research** in understanding and treating the brain through closed-loop neuroengineering with additional impact through **educating students** in systems neuroscience and control theory.

Research Experience

Graduate Research Assistant, *Georgia Institute of Technology & Emory University, SIPLAB* 2014-present
- Developed 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*
- Actively participated in both neuro-engineering and machine learning communities

Undergraduate Researcher, *Purdue University, Center for implantable Devices* Jan 2014-Jun 2014
- Developed 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 collection and visualization 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

Teaching Experience

Biotransport - project-based / hybrid course - Teaching Assistant 2015-2016
- student review score 4.8/5

Information Processing Models in Neural Systems - Teaching Assistant 2021
- Graduate Teaching Fellow
- 3 lectures *(in preparation)*

Tutorials & Guest Lectures

Deep Neural Networks & Cortical Dynamics - *for Info Processing course*
- *(in preparation)*

Inkscape - vector graphics tutorial

Education

Ph.D. in Biomedical Engineering, *Georgia Institute of Technology & Emory University* 2014-2021

B.Sc. in Biomedical Engineering, *Purdue University* 2010-2014

Select Courses

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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
- The goal of this summer course is to help researchers find new exciting research areas and at the same time to strengthen quantitative expertise in the field of neuroscience.
- The 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

Honors & Awards

Computational Neuroscience Training Grant - *NIH, Emory University, Georgia Institute of Technology* 2014 - 2018
- This program supports cross-institute and interdisciplinary training in computational neuroscience, machine learning, and neural engineering.
- As a trainee in this program I participated in research across multiple laboratories, led journal clubs, organized retreats, and attended training at UC Berkeley.

President's Fellowship - *Georgia Institute of Technology* 2015
- Through the continued support of the Georgia Tech Foundation, PFs are offered annually to a select number of highly qualified applicants who intend to pursue doctoral degrees. Fellowship recipients bring exemplary levels of scholarship and innovation to the academic departments who host their study and research.

Publications

Journal Articles

ORCiD Google Scholar

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

When are open- and closed-loop control necessary for causal inference in neural circuits? 2020
Neuromatch.io

State-aware control of neural activity: design & analysis - *COSYNE* II-38 in 2018

Closed loop optogenetic control of neural circuits: Tracking dynamic trajectories of neural activity - *COSYNE* II-42 in 2016

Understanding optogenetic stimulation strategies: a study of opsin-neuron models and their spiking behaviors - *Society for Neuroscience (SfN)* 2016

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 & Mentoring

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