

DANIELLE RAGER

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EDUCATION

Carnegie Mellon University

August 2013 - April 2020

Doctor of Philosophy, Neural Computation

Dissertation: *The structure and dimension of variability across multi-area cortical circuits*

My thesis research used non-parametric regression models, dimensionality reduction techniques, and spiking network models to examine the propagation of shared variability across cortical regions as a means to understand the dynamics of multi-area brain computation.

University of Pittsburgh

August 2008 - April 2012

Bachelor of Science, Bioengineering, *magna cum laude*

Minors, Neuroscience and Music

FELLOWSHIPS AND SCHOLARSHIPS

US Dept. of Energy Computational Science Graduate Fellowship *August 2014 - August 2018*

4.5% acceptance rate

Whitaker International Fellowship for Biomedical Research

July 2012 - August 2013

Fulbright Scholarship Finalist

2012

Undergraduate Program in Neural Computation Fellowship

May 2010 - August 2011

Carnegie Mellon University and University of Pittsburgh

Swanson School of Engineering Scholarship

August 2008 - April 2012

University of Pittsburgh

University Honors College Full Tuition Scholarship

August 2008 - April 2012

University of Pittsburgh

RESEARCH

Tuned assemblies expand the dimension of shared variability in cortical networks *2016-2020*

Advisor: Brent Doiron, University of Pittsburgh Department of Mathematics

Data: Smith Lab, Carnegie Mellon University Department of Biomedical Engineering

Presented new evidence that the dimension of shared variability increases from V4 to PFC during distributed processing of visual stimuli. Developed a mechanistic, multi-layer spiking network model of V4 and PFC with tuned assemblies that, through non-linear recurrent dynamics, replicated the dimensionality expansion observed *in vivo*.

Proprioceptive feedback modulates motor tuning during human BMI control *2013-2016*

Advisor: Valerie Ventura, Carnegie Mellon University Department of Statistics

Data: University of Pittsburgh Rehab Neural Engineering Lab

Discovered that motor tuning was overwhelmed by low-rank, shared variability in M1 activity when a human subject with a motor neuropathy and intact sensation received proprioceptive feedback during use of an intracortical brain machine interface. Developed a new, generalized linear model of M1 encoding that accounted for this latent, low-rank shared variability.

Tactile afferent stimulation patterns for sensory feedback in neural prostheses *2012-2013*

Advisor: Richard Vickery, University of New South Wales School of Medical Sciences

Demonstrated that a new, multi-axial tactile sensor composed of gold nanoparticle strain gauges was

able to reconstruct the three dimensional forces incident on the sensors surface when it recorded a slipping object. Used a spiking model to encode the sensor's recorded slip forces as a pattern of electrical activity intended for biomimetic stimulation of tactile afferents in patients with neuroprosthetics.

Spline regression models for real-time decoding of primary afferent activity 2010-2012

University of Pittsburgh Rehab Neural Engineering Lab

Developed a flexible, non-parametric spline regression model to predict limb kinematics from primary afferent activity for closed loop neuroprostheses using functional electrical stimulation.

INTERNSHIPS

Lawrence Berkeley National Laboratory, Department of Energy Office of Science 2015

Biological Systems and Engineering Division

Developed hierarchical regression models of auditory tuning and recurrent connectivity in auditory cortex using the Union of Intersections Lasso technique, a novel statistical framework for model selection.

Johns Hopkins University Applied Physics Laboratory

National Security Analysis Division

2010 - 2012

Contributed to the Stage 3 of the Defense Advanced Research Projects Agency Revolutionizing Prosthetics Initiative by studying cortical stimulation thresholds and complex percept feedback. Designed a training environment for a situational awareness experiment using transcranial direct current stimulation (tDCS). Collected and analyzed EEG and physiological data for a neuropsychological experiment.

Cyber Operations Division

2009 - 2011

Developed a semantic web ontology designed to support the next generation of the Information Sharing and Collaboration Environment for governmental computer emergencies and cybersecurity attacks.

TEACHING EXPERIENCE

MATH 1370: Introduction to Computational Neuroscience, University of Pittsburgh 2015

Teaching assistant to Prof. Brent Doiron. Responsible for teaching recitations and holding office hours.

SELECTED TALKS

Computational and Systems Neuroscience (Cosyne) 2020

4.5% talk acceptance rate

The Tactile Research Group Meeting 2011

PUBLICATIONS

Rager, D. M., Alvares, D., Birznieks, I., Redmond, S. J., Morley, J. W., Lovell, N. H., & Vickery, R. M. (2013, July). Generating tactile afferent stimulation patterns for slip and touch feedback in neural prosthetics. *2013 35th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 5922-5925). IEEE.

Osorno, M., Millar, T.J., & **Rager, D.** (2011). Coordinated Cybersecurity Incident Handling: Roles, Processes, and Coordination Networks for Crosscutting Incidents.