

# DANIELLE RAGER, PhD

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[cortical.network](http://cortical.network) ♦ [github.com/dmrager](https://github.com/dmrager)

## SKILLS

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Recurrent neural network simulation	Systems neuroscience expertise
Mathematical modeling	Statistical and Machine Learning models
Data analysis	Scientific computing in Julia, Python, Matlab, R, C++, C
Parallel and distributed computing solutions	Scientific writing and research communication

## EDUCATION

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**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

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**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

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**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*.

**Scalable Factor Analysis** *2016*  
Led a team of Computer Science and Data Science graduate students in developing a scalable, distributed implementation of Factor Analysis using cluster-computing framework Apache Spark.

**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.

## **WORK EXPERIENCE**

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**Postdoctoral researcher, Carnegie Mellon University Neuroscience Institute** 2020

**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**

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**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**

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**Computational and Systems Neuroscience (Cosyne)** 4.5% talk acceptance rate. 2020

**The Tactile Research Group Meeting** 2011

## **PUBLICATIONS**

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**Rager, D. M.**, Alvares, D., Birznies, 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.