Samantha R. Santacruz, Ph.D.

2231 Sol St., San Leandro, CA 94578 | 805-450-1225 | srsummerson@berkeley.edu

Education

PHD – ELECTRICAL AND COMPUTER ENGINEERING | MAY 2014 | RICE UNIVERSITY

Thesis: *Engineering Deep Brain Stimulation as a Treatment for Parkinson's Disease: from Models to Materials**

Advisors: Dr. Behnaam Aazhang and Dr. Caleb Kemere

GPA: 4.08

*awarded **Best Thesis Award** from the ECE Department

MS – ELECTRICAL AND COMPUTER ENGINEERING | MAY 2010 | RICE UNIVERSITY

Thesis*: A Hybrid Relaying Protocol for the Multiple-Relay Network*

Advisor: Dr. Behnaam Aazhang

GPA: 4.06

BA* – APPLIED MATHEMATICS | DEC. 2006 | UNIVERSITY OF CALIFORNIA, BERKELEY

Thesis: *Wavelets Multiresolution Analysis: Wavelets and Biorthogonal Wavelet Theory*

Advisor: Dr. Alberto Grunbaum

GPA: 3.63

*Bachelor of Arts awarded with **Honors**

Research Interests

Experimental and computational neuroscience, brain-machine interfaces, deep brain stimulation, machine learning, electrophysiology, information theory, signal processing.

Honors & Awards

ECE Department Best Doctoral Thesis Award, 2014

First Place (Graduate Student Poster), 20th Annual Neuroscience Poster Session, 2013

Best Graduate Poster, School of Engineering Poster Session of the Century, 2012

Schlumberger Graduate Fellowship, 2010-2011

National Science Foundation Graduate Research Fellowship, 2008 - 2011

Texas Instruments Distinguished Graduate Fellowship, 2007 - 2012

Rice University Graduate Fellowship, 2007 - 2008

Academic Honors from UC Berkeley, 2006

*Publications**

**last name changed to Santacruz from Summerson in 2016*

JOURNAL ARTICLES

Santacruz S.R., Wallis J.D. and Carmena J.M. Closed-loop microstimulation of prefrontal cortical targets induces neural and mood-state changes (in preparation).

Neely R.M., **Santacruz S.R.**, and Carmena J.M. Representation of task-relevant parameters by population activity in the dorsomedial striatum (in preparation).

Zhou, A.J.[†], **Santacruz, S.R**.[†], Johnson, B.C.[†], Alexandrov, G., Moin, A., Burghardt, F.L., Rabaey, J.[‡], Carmena, J.M[‡], and Muller, R. [‡] (2017) WAND: A 128-channel, closed-loop, wireless artifact-free neuromodulation device. (submitted to *Nature Biomedical Engineering*)

Neely R.M., Piech D., **Santacruz S.R.**, Maharbiz M.M.[†] and Carmena J.M.[†] (2017) Recent advances in Neural Dust: towards a neural interface platform. *Current Opinion in Neurobiology* (accepted for publication).

Santacruz, S.R., Rich, E., Wallis, J.D., and Carmena, J.M. (2017) Caudate microstimulation increases value of specific choices. *Current Biology* **27**(21), 3375 – 3383.

Summerson, S.R., Aazhang, B., and Kemere C. (2015) Reducing Parkinsonian Entropic Noise and Activity with Irregular Deep Brain Stimulation Patterns. *Frontiers of Computational Neuroscience* **9**(78), 1 – 10.

Vitale, F., **Summerson, S.R.**, Aazhang, B., Kemere, C. and Pasquali, M. (2015) Neural Stimulation and Recording with Bidirectional, Soft Carbon Nanotube Fiber Microelectrodes. *ACS Nano* **9**(4), 4465 – 4474.

Summerson, S.R., Aazhang, B. and Kemere, C.T. (2014) Characterizing Motor and Cognitive Effects Associated with Deep Brain Stimulation in the GPi of Hemi-Parkinsonian Rats. *IEEE Trans. Neural Systems and Rehabilitation Engineering* **22**, 1218 - 1227. (cover)

CONFERENCE PROCEEDINGS

Santacruz S.R., Athalye V.R., Neely R.M. and Carmena J.M. (2017) Brain-machine interface paradigms for neuroscience and clinical translation. *Proceedings of the National Academy of Engineering, Frontiers of Engineering Symposium*, East Hartford, CT, Sept. 25 – 27, 2017.

Johnson, B.C., Gambini, S., Izyumin, I., Moin, A., Zhou, A., Alexandrov, G., **Santacruz, S.R.**, Rabaey, J.M., Carmena, J.M., Muller, R., "An implantable 700 uW 64-channel neuromodulation IC for simultaneous recording and stimulation with rapid artifact recovery," to be presented at *2017 Symposia on VLSI Technology and Circuits*, Kyoto, Japan, June 5 – 8, 2017.

Summerson, S.R., Grealish, C., Aazhang, B. and Kemere, C.T., "Randomized Stimulation Signal Design to Create Partial Informational Lesions in Parkinsonian Neuronal Networks," *2014 IEEE Int'l Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Florence, Italy, May 4 - 9, 2014, pp 3626-3630.

Summerson, S.R., Aazhang, B., and Kemere, C.T., "Behavioral Effects of Disrupted Direct Pathway Signal Flow Caused by Dopamine Depletion," *Computational Neuroscience Symposium (CNS)*, Paris, France, July 2013.

Summerson, S.R., Kemere, C.T., and Aazhang, B., "Current Amplitude-Dependent Modulation of Rotational Behavior with GPi Stimulation in the Rodent Model of Parkinson's Disease," *Engineering in Medicine and Biology Conference (EMBC)*, Osaka, Japan, July 2013.

Summerson, S.R. and Batra, A., "Convolutional Network Codes for Reliable Point-to-Point Wireless Communication," *Proc. Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, CA, November 2012.

Summerson, S.R. and Aazhang, B., "Outage Analysis for Hybrid Relaying in the Parallel Relay Network," *Proc. Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, CA, November 2010.

BOOK CHAPTER

S.R. Summerson and C. Kemere, "Multi-electrode Recording of Neural Activity in Awake Behaving Animals," in *Basic Electrophysiological Methods*, Oxford, UK: Oxford University Press, 2015, Ch.4, pp. 76 - 107. (invited)

Posters and Abstracts

Santacruz, S.R., de Tonnac, A., Wallis, J.D., and Carmena, J.M., "Neural and mood-state changes with closed-loop stimulation in prefrontal areas", to appear at *Neuroscience (SfN) 2017*, Washington, DC, November 2017.

Zhou, A.J., **Santacruz, S.R.**, Johnson, B., Alexandrov, G., Moin, A., Burghardt, F.L., Gambini, S., Izyumin, I., Alon, E., Rabaey, J., Carmena, J.M., and Muller, R., "WAND: A Wireless, 128-Channel Closed-Loop Neuromodulation Device", to appear at *Neuroscience (SfN) 2017*, Washington, DC, November 2017.

Santacruz, S.R., and Carmena, J.M., "High-frequency caudate microstimulation biases decision-making in a multi-armed bandit task," *39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, Jeju Island, Korea, July 2017.

Santacruz, S.R., Rich, E.L., Wallis, J.D., and Carmena, J.M., "Stimulation in primate caudate nucleus mediates decision-making behavior in free-choice task," *Neuroscience (SfN) 2016*, San Diego, CA 2016.

Alexandrov, G., **Santacruz, S.R.**, Moin, A., Zhou, A.J., Johnson, B.C., Alon, E., Rabaey, J., Carmena, J.M., and Muller, R., "OMNI: A Distributed and Modular Device for Wireless Neural Recording and Closed-loop Neuromodulation," *Neuroscience (SfN) 2016*, San Diego, CA, November 2016.

Summerson, S.R., Khanna, P., Rich, E.L., Wallis, J.D., and Carmena, J.M., "Stimulation in Primate Caudate Nucleus Modulates Action Selection in Probabilistic Reward Task," *Neuroscience (SfN) 2015*, Chicago, IL, October 2015.

Vitale, F., **Summerson, S.R.**, Aazhang, B., Kemere, C.T. and Pasquali, M., "Carbon nanotube fiber (CNTf) Implantable Neural Electrodes for Chronic Recording and Stimulation," *Neuroscience (SfN) 2014*, Washington DC, November 2014.

Summerson, S.R., Aazhang, B. and Kemere, C.T., "Irregularly Patterned Deep Brain Stimulation Reduces Pathological Cortical Activity in Hemi-Parkinsonian Rats," *Neuroscience (SfN) 2014*, Washington DC, November 2014.

Vitale, F., **Summerson, S.R.**, Aazhang, B., Kemere, C., and Pasquali, M., "Stability and sub-chronic biocompatibility of carbon nanotube fiber microelectrodes," *Biomedical Engineering Society (BMES) 2014 Annual Meeting*, San Antonio, TX, October 2014.

Summerson, S.R., Aazhang, B. and Kemere, C.T., "Motor Behavior Tuning as a Function of Stimulation Frequency in the 6-OHDA Rat Model of GPi-Deep Brain Stimulation," *Neuroscience (SfN) 2013*, San Diego, CA, November 2013.

Vitale, F., **Summerson, S.R.**, Kemere, C. and Pasquali, M., "Carbon Nanotube Fiber Microelectrodes for Neural Recording and Stimulation," *Biomedical Engineering Society (BMES) 2013 Annual Meeting*, Seattle, WA, September 2013.

Summerson, S.R. and Kemere, C., "Investigating Cognitive Side Effects of GPi Deep Brain Stimulation for Parkinson's Disease," *2012 Annual Symposium for the Center for NeuroEngineering*, Rice University, TX, September 2012.

Summerson, S.R. and Aazhang, B., "Parkinson's Disease: Interference in the Neural Communication Channel," *IEEE Women's Workshop on Communications and Signal Processing*, Banff, Canada, July 2012.

Summerson, S.R. and Aazhang, B., "Relay Selection in the Parallel Relay Network," *IEEE 2010 School of Information Theory*, USC, August 5-8, 2010.

Summerson, S.R. and Aazhang, B., "Hybrid Relaying for the Parallel Relay Network," *IEEE 2009 School of Information Theory*, Northwestern University, August 10-13, 2009, and the *Winedale Workshop*, October 23, 2009.

Summerson, S.R. and Aazhang, B., "Utilizing Network Information for Optimal Path Selection in Multi-hop Networks," *IEEE Communication Theory Workshop*, US Virgin Islands, May 2008.

Belinski, M.[†], Martinez, A.[†], **Summerson, S.**[†] and Chan, R., "Wavelet Algorithms for High-Resolution Image Reconstruction," *SIAM Conference on Computational Science and Engineering*, Costa Mesa, CA, February 19-23, 2007.

Patents

1. **Samantha Rose Summerson**, Anuj Batra, Srinath Hosur and Georgios Angelopoulos, "Systems and Methods for Network Coding Using Reed-Solomon Codes," US Patent Application #20130170433, issued Nov. 3, 2015.
2. **Samantha Rose Summerson** and Anuj Batra, "Systems and Methods for Network Coding Using Maximum Distance Separable (MDS) Linear Network Codes," US Patent #9,113,470, issued Aug. 18, 2015.
3. **Samantha Rose Summerson** and Anuj Batra, "Systems and Methods for Construction of and Network Coding Using Near-Maximum Distance Separable (MDS) Linear Network Codes," US Patent #9,112,916, issued Aug. 18, 2015.
4. **Samantha Rose Summerson** and Anuj Batra, "Systems and Methods for a Soft-Input Decoder of Linear Network Codes," US Patent #8,839,085, issued Sept. 16, 2014.
5. **Samantha Rose Summerson**, Anuj Batra, and June Chul Roh, "Systems and Methods for Network Coding Using Convolutional Codes," US Patent #8,924,831, issued Dec. 30, 2014.

Invited Talks

Innovative Approaches for Multimodal Neural Interfaces Minisymposium, to occur at Neuroscience (SfN) 2017, Washington, DC, November 2017
Society for Brain Mapping & Therapeutics, Los Angeles, CA, April 2017
Schaal Lab, USC, January 2017
Center for Neural Engineering & Prostheses Annual Retreat, UCB-UCSF, December 2016
Advanced Topics in Bioelectronics Seminar, Guest Lecture, October 2016
Shadmehr Lab, Johns Hopkins University, December 2014
Center for Neural Engineering & Prostheses Annual Retreat, UCB-UCSF, December 2014
Advanced Topics in Bioelectronics Seminar, Guest Lecture, November 2016
Carmena Lab, University of California, Berkeley, March 2014
Grill Lab, Duke University, March 2014
Asilomar Conference on Signals, Systems and Computers, November 2012
Asilomar Conference on Signals, Systems and Computers, November 2010

Research Experience

POSTDOCTORAL RESEARCH FELLOW | CARMENA LAB | 2014 – PRESENT

Department of Electrical Engineering and Computer Sciences
University of California, Berkeley
Advisor: Jose M. Carmena

· Large-scale electrophysiology and closed-loop deep brain stimulation in the nonhuman primate model; brain-machine interfaces; data analysis; wireless recording and neuromodulation devices; carbon fiber arrays in rodents

GRADUATE STUDENT RESEARCHER | KEMERE LAB | 2012 – 2014

Department of Electrical and Computer Engineering
Rice University
Advisor: Caleb Kemere

· Developing rodent animal model for Parkinson's Disease; novel materials and methods for deep brain stimulation; data analysis and modeling

CO-OP INTERN | WIRELESS AND MEDICAL SYSTEMS LAB | 2011

Research & Development Center
Texas Instruments
Supervisor: Anuj Batra

· Coding designs for reliable wireless communications; patent development

VISITING GRADUATE STUDENT RESEARCHER | CENTER FOR WIRELESS COMMUNICATIONS | 2008

University of Oulu
Advisor: Behnaam Aazhang

· Research on the impact of utilizing network state information on making routing decisions

GRADUATE STUDENT RESEARCHER | AAZHANG LAB | 2007 – 2014

Department of Electrical and Computer Engineering
Rice University
Advisor: Behnaam Aazhang

· Researching relaying behaviors and resource allocation in cooperative wireless networks.

STUDENT RESEARCHER | U.S.-H.K. NSF RESEARCH EXPERIENCE FOR UNDERGRADUATES IN NUMERICAL ANALYSIS AND SCIENTIFIC COMPUTING | 2006

Colorado School of Mines/Chinese University of Hong Kong
Advisors: Graeme Fairweather, Raymond Chan

· Participated on team performing research on high-resolution and super-resolution image reconstruction using wavelet algorithms; implemented image denoising algorithms in Matlab

UNDERGRADUATE RESEARCH ASSISTANT | EMBODIED DESIGN RESEARCH LAB | 2006

Graduate School of Education

University of California, Berkeley
Advisor: Rozy Brar

- Assisted a Math Education doctoral student with research on the relationship between area models and junior high students' understanding of operations on fractions; aided with data collection, designing test problems, and database maintenance

Teaching Experience

GUEST LECTURER | EE 290P: ADVANCED TOPICS IN BIOELECTRONICS | FALL 2014, FALL 2016, FALL 2017

Department of Electrical Engineering and Computer Sciences
University of California, Berkeley

- Guest lectured on topics such as animal electrophysiology and deep brain stimulation

HEAD TEACHING ASSISTANT | ELEC 241: FUNDAMENTALS OF ELECTRICAL ENGINEERING | FALL 2009

Department of Electrical and Computer Engineering
Rice University

- Lectured 2 hrs/week on topics such as RLC circuits, op-amps, signal representations, etc.; managed course and lab assistants

TEACHING ASSISTANT | FALL 2008 – SPRING 2011

Department of Electrical and Computer Engineering
Rice University

- Assistant for course ELEC 533: Introduction to Random Processes and Applications for two semesters, for ELEC 430: Digital Communications for two semesters and for ELEC 241: Fundamentals of Electrical Engineering for one semester; hosted weekly office hours and topic review sessions; guest lectured

Leadership and Technical Service

Member, IEEE Engineering in Medicine and Biology Society, 2012 – present

Member, Society for Neuroscience, 2011 - present

Member, Women in Information Theory Society, 2010 - 2014

Member, IEEE Information Theory Society, 2009 - 2014

Member-at-large on Student Committee

Member, IEEE Communications Society, 2009 - 2014

ECE Mentoring Program, Rice University, 2008 - 2013

Founding leader, organizer, and mentor

Member, IEEE, 2008 - present

Electrical ⊗ Computer Engineering Leaders (ExCEL), 2008 - 2014

Founding member, served as President and Vice-President

Empowering Leadership Alliance, 2008 - 2011

Former member of the Student Advisory Board and mentor

Math Undergraduate Student Association, UC Berkeley Fall 2004 - Fall 2006

Other Skills

Windows, MAC OS, Linux (RHEL/Ubuntu), Matlab, Microsoft Office, LATEX, C, Python, NSpike

Additional Information

Citizenship: US, UK

Languages: English (native), Spanish (fluent)

Amateur cheesemaker