Samantha R. **Santacruz**

ASSISTANT PROFESSOR · BIOMEDICAL ENGINEERING · UNIVERSITY OF TEXAS AT AUSTIN

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EDUCATION

MAY 2014

PHD – ELECTRICAL & COMPUTER ENGINEERING, RICE UNIVERSITY

- Thesis: Engineering Deep Brain Stimulation as a Treatment for Parkinson's Disease: from Models to Materials
- Advisors: Dr. Behnaam Aazhang, Dr. Caleb Kemere
- GPA: 4.08
- Awarded **Best Thesis Award** from the ECE Department.

MAY 2010

MS – ELECTRICAL & COMPUTER ENGINEERING, RICE UNIVERSITY

- Thesis: A Hybrid Relaying Protocol for the Multiple-Relay Network
- Advisor: Dr. Behnaam Aazhang
- GPA: 4.06

DECEMBER 2006

BA (WITH HONORS) – APPLIED MATHEMATICS, UNIVERSITY OF CALIFORNIA, BERKELEY

- Thesis: Wavelets Multiresolution Analysis: Wavelets and Biorthogonal Wavelet Theory
- Advisor: Dr. Alberto Grunbaum
- GPA: 3.66

ACADEMIC INTERESTS

- Experimental and computational neuroscience
- Brain-machine interfaces
- Deep brain stimulation
- Machine learning
- Electrophysiology
- Signal processing

EXPERIENCE

OCTOBER 2018 -

ASSISTANT PROFESSOR, UNIVERSITY OF TEXAS AT AUSTIN

Assistant professor in the Department of Biomedical Engineering. The lab focuses on developing brain-machine interfaces and electrical stimulation neurotherapies for treating a variety of neurological disorders, including depression, anxiety, and addiction.

OCTOBER 2017 –

VISITING RESEARCHER, CALIFORNIA NATIONAL PRIMATE RESEARCH CENTER (CNPRC), UNIVERSITY OF CALIFORNIA, DAVIS

Visiting appointment to collaborate with Dr. John Morrison, director of the CNPRC, and Dr. Karen Moxon on a CNPRC pilot project investigating *in vivo* 1-photon calcium imaging in rhesus macaques during motor behaviors.

JUNE 2014 – OCTOBER 2018

POSTDOCTORAL FELLOW, UNIVERSITY OF CALIFORNIA, BERKELEY

Postdoctoral research in the lab of Dr. Jose M. Carmena, with a focus on large-scale electrophysiology, closed-loop deep brain stimulation, and brain-machine interfaces in the nonhuman primate model.

JANUARY 2012 – MAY 2014

GRADUATE STUDENT RESEARCHER, RICE UNIVERSITY

Graduate research with Ph.D. co-advisor Dr. Caleb T. Kemere. Topics included developing a rodent model of Parkinson's disease, novel materials and methods for deep brain stimulation, data analysis, and computational modeling of corticostriatal interactions.

MAY 2011 – AUGUST 2011

CO-OP INTERN, TEXAS INSTRUMENTS

Developed error correction code designs for reliable wireless communications under the supervisor of Dr. Anuj Batra. Results of this summer internship include one conference paper and five awarded patents.

MAY 2008 – JUNE 2008

VISITING GRADUATE STUDENT RESEARCHER, UNIVERSITY OF OULU

Visiting graduate research position on the impact of utilizing network state information in making routing decisions in wireless networks.

AUGUST 2007 – MAY 2014

GRADUATE STUDENT RESEARCHER, RICE UNIVERSITY

Graduate research with Ph.D. co-advisor Dr. Behnaam Aazhang. Early M.S. research focus was on relaying protocols and resource allocation in cooperative wireless networks using information theoretic metrics. Ph.D. research focus was on computational models of corticostriatal interactions and information theory applied in neural signal processing.

JUNE 2006 – AUGUST 2006

UNDERGRADUATE STUDENT RESEARCHER, CHINESE UNIVERSITY OF HONG KONG

Performed research as a part of the U.S.-H.K. NSF Research Experience for Undergraduates (REU) in Numerical Analysis and Scientific Computing, under the supervision of Drs. Graeme Fairweather and Raymond Chan. Research focuses on high-resolution and super-resolution image reconstruction using wavelet algorithms.

JANUARY 2006 – MAY 2006

UNDERGRADUATE RESEARCH ASSISTANT, UNIVERSITY OF CALIFORNIA, BERKELEY

Assisted a Math Education doctoral student, Rozy Brar, 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.

PUBLICATIONS*

*last name changed to Santacruz from Summerson in 2016

JOURNAL ARTICLES

- **Santacruz, S.R.**, Zippi, E.L., Wallis, J.D. and Carmena, J.M. Closed-loop microstimulation of prefrontal cortical targets induces neural and mood-state changes (in preparation).
- **Santacruz, S.R.**, Zippi, E.L., and Carmena J.M. Modulation of encoding of task-relevant parameters in caudate and anterior cingulate cortex (in preparation).
- Massey, T.L., **Santacruz, S.R.**, Hou, J.F., Pister, K.S.J., Carmena, J.M., and Maharbiz, M.M. (2019) A high-density carbon fiber neural recording array technology. *Journal of Neural Engineering* **16**(1), 016024.
- Zhou, A.J.[†], **Santacruz, S.R**.[†], Johnson, B.C.[†], Alexandrov, G., Moin, A., Burghardt, F.L., Rabaey, J.[‡], Carmena, J.M[‡], and Muller, R. [‡] (2018) A wireless and artefact-free 128-channel neuromodulation device for closed-loop stimulation and recording in non-human primates. *Nature Biomedical Engineering* **3**, 15 – 26.
- Neely R.M., Piech D., **Santacruz S.R.**, Maharbiz M.M.[†] and Carmena J.M.[†] (2018) Recent advances in Neural Dust: towards a neural interface platform. *Current Opinion in Neurobiology* **50**, 64 – 71.
- **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," *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.**, Zippi, E.L., and Carmena, J.M., "Stimulation in primate caudate nucleus modulates striatal and cortical value signals", *Neuroscience (SfN) 2018*, San Diego, CA, November 2018.
- Massey, T., **Santacruz, S.R.**, Pister, K.S.J., Carmena, J.M., and Maharbiz, M.M., "A high-density carbon fiber neural recording array technology", *Neuroscience (SfN) 2018*, San Diego, CA, November 2018.
- **Santacruz, S.R.**, Zippi, E.L., and Carmena, J.M., "Modulation of brain-based value signals using electrical stimulation", *40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, Hawaii, USA, July 2018.
- 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", *Neural Interfaces Conference 2018*, Minneapolis, MN, June 2018.
- **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", *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", *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

- **Samantha Rose Summerson**, Anuj Batra, Srinath Hosur and Georgios Angelopoulos, "Systems and Methods for Network Coding Using Reed-Solomon Codes," US Patent #9,179,362, issued Nov. 3, 2015.
- **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.
- **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.
- **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.
- **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.

HONORS AND AWARDS

- Trainee Professional Development Award, Society for Neuroscience, 2018
- 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

INVITED TALKS

- Making Use of the Future of BCI Implant Technology Workshop, 7th International BCI Meeting, Pacific Grove, CA, May 2018
- Center for Neurotechnology and Neurorecovery, Department of Neurology, Massachusetts General Hospital, March 2018
- Department of Biomedical Engineering, Washington University – St.Louis, March 2018
- School of Engineering and Applied Sciences, University of Virginia, February 2018
- Department of Electrical Engineering, Princeton University, February 2018
- Department of Biomedical Engineering, University of Southern California, February 2018
- Department of Biomedical Engineering, Tulane University, February 2018
- Department of Biomedical Engineering, University of Texas, Austin, January 2018
- Innovative Approaches for Multimodal Neural Interfaces Minisymposium, Neuroscience (SfN), Washington, DC, November 2017 (co-chair and speaker)
- Department of Bioengineering & Therapeutic Sciences, University of California at San Francisco, September 2017
- Girls Advancing in STEM (GAINS) Conference, SLAC National Accelerator Lab, Palo Alto, CA, April 2017
- Society for Brain Mapping & Therapeutics, Los Angeles, CA, April 2017
- Department of Electrical and Computer Engineering, Boston University, April 2017

- Department of Electrical Engineering, University of California at Santa Cruz, March 2017
- Schaal Lab, University of Southern California, January 2017
- Center for Neural Engineering & Prostheses Annual Retreat, UCB-UCSF, December 2016
- Shadmehr Lab, Johns Hopkins University, December 2014
- Center for Neural Engineering & Prostheses Annual Retreat, UCB-UCSF, December 2014
- 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

TEACHING EXPERIENCE

SPRING 2018

BRAIN MACHINE INTERFACES: SCIENCE, TECHNOLOGY, AND APPLICATION (PSYCHOLOGY 287/NEUROSURGERY 287), STANFORD UNIVERSITY

Guest lecturer covering brain-machine interface paradigms for neuropsychiatric conditions.

FALL 2014, 2016, 2017

ADVANCED TOPICS IN BIOELECTRONICS (EE 290P), UNIVERSITY OF CALIFORNIA, BERKELEY

Guest lecturer covering brain-machine interfaces and deep brain stimulation paradigms in animal models.

FALL 2009

FUNDAMENTALS OF ELECTRICAL ENGINEERING (EE 241), RICE UNIVERSITY

Head teaching assistant for introductory course on electrical engineering. Lectured 2 hrs/week on topics such as RLC circuits, op-amps, and signal representations. Managed course and lab assistants, and held regular office hours.

FALL 2008 – SPRING 2011

TEACHING ASSISANT, RICE UNIVERSITY

Assistant for multiple courses including Introduction to Random Processes and Applications (EE 533) for two semesters, Digital Communications (EE 430) for two semesters, and Fundamentals of Electrical Engineering (EE 241) for one semester. Hosted weekly office hours and topic review sessions. Occasionally guest lectured.

LEADERSHIP & TECHNICAL SERVICE

- Member, Program Committee, Collaborative Research in Computational Neuroscience (CRCNS) 2019 Annual Meeting
- Member, Executive Committee, Women in Neural Engineering (WINE), 2019 - present
- Member, Biomedical Engineering Society (BMES), 2018 - present
- 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 inaugural 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, Linux (RHEL/Ubuntu), Matlab, Python, LaTeX, C, Eagle, Microsoft office

ADDITIONAL INFORMATION

- Citizenship: US, UK
- Languages: English (native), Spanish (fluent)
- Amateur cheesemaker