Sean Bittner

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EDUCATION	**Columbia University**, New York, New York, USA	
	▪ Ph.D., Neurobiology and Behavior	Aug 2016 – May 2021 (expected)
	• Focus: Machine learning, theoretical neuroscience.	
	• Advisor: John Cunningham, Cumulative GPA: 3.95 / 4.0	
	▪ M.Phil., M.A., Neurobiology and Behavior	Aug 2016 – May 2019
	Carnegie Mellon University, Pittsburgh, Pennsylvania, USA	
	▪ B.S., Electrical and Computer Engineering	Aug 2012 – May 2016
	• Minor in Neural Computation, Cumulative GPA: 3.78 / 4.00	

RESEARCH EXPERIENCE	**Center for Theoretical Neuroscience**, Columbia University	
	▪ Ph.D. Candidate, Neurobiology and Behavior	Feb 2019 – present
	• Developed novel method enabling statistical inference in theoretical neuroscience: emergent property inference (EPI). Enhanced theories of neural computation with EPI.	
	∘ Supervisor: John Cunningham	
	▪ Ph.D. Student, Neurobiology and Behavior	Aug 2016 – Feb 2019
	• Produced a novel two-network architecture, exponential family networks (EFNs), for learning statistical *models* rather than single distributions as in traditional VI.	
	∘ Supervisor: John Cunningham	
	• Evaluated dynamical systems hypotheses of neural population activity in motor cortex during cyclic pedaling using a novel trajectory prediction algorithm and RNNs.	
	∘ Supervisors: John Cunningham, Larry Abbott, Mark Churchland	
	ECE Department, Carnegie Mellon University	
	▪ Undergraduate Research Assistant	May 2014 – Aug 2016
	• Characterized population activity structure according to neuron-type composition.	
	∘ Supervisors: Byron Yu, Steven Chase, and Matthew Smith	
	• Produced fast algorithm for connectivity inference from calcium fluorescence activity.	
	∘ Supervisor: Jelena Kovačević	

AWARDS & SCHOLARSHIPS	▪ Methods in Comp Neuro Course Scholarship - Marine Biological Laboratory	Jul 2018 – Aug 2018
	▪ International Conference on Machine Learning Travel Award	Aug 2017
	▪ National Science Foundation Graduate Research Fellowship	Aug 2016 - May 2020
	▪ Frank J Marshall Scholar Award - CMU, ECE	May 2016
	Awarded to a graduating senior demonstrating outstanding scholastic and research achievement.	
	▪ Undergraduate Research Fellowship - Center for the Neural Basis of Cognition	May 2015 – Aug 2016
	▪ ThinkSwiss Research Scholarship - Swiss Federal Government	Jun 2015 – Aug 2015
	Funded internship at Translational Neural Engineering Lab at École Polytechnique Fédérale de Lausanne.	

OTHER WORK EXPERIENCE	**Facebook Reality Labs**, New York, NY, USA	
	▪ Research Internship, Neural Interfaces	May 2020 – Aug 2020
	• Substantially improved performance of brain computer interface for text production using modern natural language processing techniques.	
	• Facilitated new collaboration between neural interface researchers and FAIR within Facebook.	
	∘ Supervisors: Patrick Kaifosh and Viswanath Sivakumar	
	National Robotics Engineering Center, Pittsburgh, PA, USA	
	▪ Software Development Intern, DARPA Robotics Challenge	Jun 2013 – Nov 2013
	• Developed hardware diagnostic tool for humanoid robot CHIMP.	
	∘ Supervisors: David Stager and Clark Haynes	

PROGRAMMING	▪ Languages: Python (Tensorflow, Torch), Matlab, C++. Validation: Travis CI, CircleCI, pytest, codecov.
	▪ Sole developer: epi, efn, tf_util (on cunningham-lab), and torch_nf. Github: https://srbittner.github.io/.

PUBLICATIONS	[6] S Bittner, A Palmigiano, A Piet, C Duan, C Brody, K Miller, and JP Cunningham. "Interrogating theoretical models of neural computation with deep inference." bioRxiv (2019): 837567. (In review at eLife, link)

[5] A Russo, R Khajeh, S Bittner, S Perkins, JP Cunningham, LF Abbott, and M Churchland "Neural trajectories in the supplementary motor area and primary motor cortex exhibit distinct geometries, compatible with different classes of computation." Neuron (2020). (link)

[4] S Bittner and JP Cunningham. "Approximating exponential family models (not single distributions) with a two-network architecture." ICML Workshop on Invertible Neural Networks and Normalizing Flows (2019). (link)

[3] A Russo, S Bittner, S Perkins, J Seely, B London, A Lara, Andrew Miri, N Marshall, A Kohn, T Jessell, LF Abbott, JP Cunningham, and M Churchland. "Motor cortex embeds muscle-like commands in an untangled population response." Neuron 97.4 (2018): 953-966. (link)

[2] S Bittner, R Williamson, A Snyder, A Litwin-Kumar, B Doiron, M Smith, S Chase, and B Yu. "Population activity structure of excitatory and inhibitory neurons." PloS one 12.8 (2017). (link)

[1] S Bittner, S Chen, and J Kovačević. Fast algorithm for neural network reconstruction." In Proc. IEEE Int. Sympo. Biomed. Imag., Brooklyn, NY, Apr. 2015. (link)

INVITED TALKS	[5] "Interrogating models in theoretical neuroscience with emergent property inference." Bernstein Network Workshop on Infer. and test. opt. in perception and neurons, Berlin (Virtual), Sept. 2020.
	[4] "Interrogating theoretical models of neural computation with deep inference." Computational Neuroscience Journal Club, Princeton University, Princeton, NJ, Nov. 2019.
	[3] "Degenerate solution networks (DSNs) for theoretical neuroscience." Group for Neural Theory, École normale supérieure, Paris, France, Feb. 2019.
	[2] "Controlling for known structure in population neural recordings using maximum entropy processes (MEPs). Bernstein Network Workshop on Dimensions of Neural Coding, Computation and Communication, Berlin, Germany, Sept. 2018.
	[1] "Maximum entropy processes for population-level hypothesis testing." Jazayeri Lab Meeting, Massachusetts Institute of Technology, Boston, MA, July 2018.

SELECTED ABSTRACTS	[4] S Bittner, A Piet, C Duan, C Brody, and JP Cunningham. Task-selective connectivity improves rapid task switching in an interpretable model of SC. CoSyNe, Denver, CO, 2020.
	[3] S Bittner, A Piet, C Duan, A Palmigiano, K Miller, C Brody, and JP Cunningham. Examining models in theoretical neuroscience with degenerate solution networks. Bernstein Network Computational Neuroscience Conference, Berlin, Germany, 2019.
	[2] S Bittner and JP Cunningham. Controlling for known structure in population neural recordings using maximum entropy processes (MEPs). Bernstein Conference, Berlin, Germany, Sept. 2018.
	[1] S Bittner, R Williamson, A Snyder, A Litwin-Kumar, B Doiron, S Chase, M Smith, and B Yu. Effects of excitatory versus inhibitory neuron sampling on outputs of dimensionality reduction. CoSyNe, Salt Lake City, Utah, Feb. 2016.

REVIEWED FOR	**eLife**	Dec 2020 – present

OUTREACH/ ADVOCACY	**Columbia University Neuroscience Outreach**	Aug 2016 – present

- Developed interactive lessons for Saturday Science to educate children in the local community about the brain and careers in STEM.
- Developed organization website (link).

	Diversity and Inclusion Committee, Center for Theoretical Neuroscience	Aug 2019 – present

- Organized educational workshop.
- Presented research on gender-based discrimination in science.

REFERENCES	- **Professor John Cunningham**, Associate Professor of Statistics, Columbia University email: jpc2181@columbia.edu - **Professor Larry Abbott**, William Bloor Professor of Theoretical Neuroscience, Columbia University email: lfa2103@columbia.edu - **Dr. Patrick Kaifosh**, Research Manager, Facebook Reality Labs email: kaifosh@fb.com