

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: