

BINGNI WEN BRUNTON

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RESEARCH INTERESTS

- ▷ Data-driven dynamic models of large-scale neural data
- ▷ Neural computation underlying task-free, naturalistic behavior
- ▷ Efficient algorithms for closed-loop neuroengineering
- ▷ Sparse sensors for biological and engineered systems

EDUCATION

Ph.D., 2012 **Princeton University**, Neuroscience
B.S., 2006 **California Institute of Technology (Caltech)**, Biology

POSITIONS

2014–	University of Washington (UW) Washington Research Foundation Innovation Assistant Professor ◇ Department of Biology ◇ UW Institute of Neuroengineering ◇ Data Science Fellow of the UW eScience Institute ◇ Faculty Member, Graduate Program in Neuroscience	Seattle, WA
2012–2014	University of Washington Postdoctoral Research Associate Dept. of Applied Mathematics and Center for Sensorimotor Neural Engineering (CSNE) Advised by J. Nathan Kutz and Tom Daniel	Seattle, WA
2006–2012	Princeton University Graduate Researcher Princeton Neuroscience Institute and Dept. of Molecular Biology Advised by Carlos Brody Thesis: <i>Optimal accumulation of evidence for decision-making in rats and humans</i>	Princeton, NJ
2003–2006	California Institute of Technology Undergraduate Researcher Biology Division Advised by Grant Jensen <i>Structure of intact nuclei visualized by electron cryo-tomography</i>	Pasadena, CA
2001–2002	National Institute of Health National Institute for Deafness and other Communication Disorders Advised by Doris Wu <i>The spatial and temporal patterns of programmed cell death in the developing inner ear</i>	Bethesda, MD

PUBLICATIONS

JOURNAL PAPERS:

Brunton, B. W., Brunton, S. L., Proctor, J. L. & Kutz, J. N. Sparse sensor placement optimization for classification. *SIAM Journal on Applied Mathematics* (2016).

Wang, N. X. R., Olson, J. D., Ojemann, J. G., Rao, R. P. N. & **Brunton, B. W.** Unsupervised decoding of long-term, naturalistic human neural recordings with automated video and audio annotations. *Front Human Neuroscience* (2016) 10, 165.

Brunton, S. L., **Brunton, B. W.**, Proctor, J. L. & Kutz, J. N. Koopman observable subspaces and finite linear representations of nonlinear dynamical systems for control. *PLoS ONE* (2016) 11(2): e0150171.

Brunton, B. W., Johnson, L. A., Ojemann, J. G. & Kutz, J. N. Extracting spatial-temporal coherent patterns in large-scale neural recordings using dynamic mode decomposition. *J Neuroscience Methods* (2016) 258, 1–15.

Kopec, C. D., Erlich, J. C., **Brunton, B. W.**, Deisseroth, K. & Brody, C. D. Cortical and subcortical contributions to short-term memory for orienting movements. *Neuron* (2015) 88 (2), 367–377.

Erlich, J. C., **Brunton, B. W.**, Duan, C. A., Hanks, T. D., & Brody, C. D. Distinct behavioral effects of prefrontal and parietal cortex inactivations on an accumulation of evidence task in the rat. *eLife* (2015) 4:e05457.

Hanks, T., Kopec, C. D., **Brunton, B. W.**, Duan, C. A., Erlich, J. C. & Brody, C. D. Distinct relationships of parietal and prefrontal cortices to evidence accumulation. *Nature* (2015) 520, 220–223.

Proctor, J. L., Brunton, S. L., **Brunton, B. W.** & Kutz, J. N. Exploiting sparsity and equation-free architecture in complex systems. *European Physical Journal Special Topics* (2014) 223, 1–20.

Brunton, B. W., Botvinick, M. M. & Brody, C. D. Rats and humans can optimally accumulate evidence for decision-making. *Science* (2013) 340:95–98.

* Featured in News & Views by Kauffman, M. T. & Churchland, A. K, *Nature* (2013) 496:172–173.

Granstedt, A. E., **Brunton, B. W.** & Enquist, L. W. Imaging the transport dynamics of single alphaherpesvirus particles in intact peripheral nervous system explants from infected mice. *mBio* (2013) 4:e00358.

Kubaneck, J., Snyder, L. H., **Brunton, B. W.**, Brody, C. D. & Schalk, G. A low-frequency oscillatory neural signal in humans encodes a developing decision variable. *NeuroImage* (2013) 83:795–808.

Huang, K. C., Mukhopadhyay, R., **Wen, B.**, Gitai, Z. & Wingreen, N. S. Cell shape and cell-wall organization in Gram-negative bacteria. *Proc Natl Acad Sci U.S.A.* (2008) 105:19282–19287.

PEER-REVIEWED CONFERENCE PAPERS:

Wu, J., Shuman, B. R., **Brunton, B. W.**, Steele, K. M., Olson, J. D., Rao, R. P. N. & Ojemann, J. G. Multi-step model for predicting upper-limb 3D isometric force application from pre-movement electrocorticographic features. *IEEE Engineering in Medicine and Biology Society Conference (EMBC 2016)*.

BOOKS AND BOOK CHAPTERS:

Kutz, J. N, Brunton, S. L., **Brunton, B. W.**, & Proctor, J. L. Dynamic Mode Decomposition: Data-Driven Modeling of Complex Systems. *SIAM* (2016) ISBN: 9781611974492.

Bai, Z., Brunton, S. L., **Brunton, B. W.**, Kutz, J. N., Kaiser, E., Spohn, A., & Noack, B. R. Data-Driven Methods in Fluid Dynamics: Sparse Classification from Experimental Data. *Whither Turbulence and Big Data in the 21st Century?*, 2017, pp323–342.

IN REVIEW, PREPRINT AVAILABLE:

Brunton, S. L., **Brunton, B. W.**, Proctor, J. L., Kaiser, E. & Kutz, J. N. Chaos as an intermittently forced linear system. *arXiv:1608.05306*, *In Review*.

Johnson, L. A., Weaver, K, **Brunton, B. W.**, Wander J., Hakimian, S., & Ojemann, J. G. Spatiotemporal sleep spindle networks reflect the intrinsic connectivity revealed by waking behavior and resting state fMRI. *In Review*.

AWARDS AND HONORS

Alfred P. Sloan Research Fellowship (2016–2018)
NSF Graduate Research Fellowship Honorable Mention (2007, 2008)
Caltech, Richter Research Fellowship (2005)
Caltech, Perpall Speaking Competition Semifinalist (2005)
Caltech, McKinney Prize in Literature (2005)
Caltech Summer Undergraduate Research Fellowship (2003, 2004)
International Science and Engineering Fair (ISEF) Finalist (2002)
Intel Science Talent Search Semifinalist (2002)

CURRENT RESEARCH SUPPORT

NSF (PI Brunton), 9/1/2016–8/31/2019

NCS-FO: Understanding neural processing in long-term, naturalistic human brain recordings using data-intensive approaches

DOD/AFRL (PI Brunton), 1/4/2016–1/3/2019

Integrating compressive sensing and classification for dynamic target tracking

Sloan Research Fellowship (PI Brunton), 9/1/2016–8/31/2018

NSF (PI R. Curtu, Co-PI Brunton), 9/1/2015–8/31/2018

Collaborative Research: Dynamic models of human auditory perceptual switching informed by large-scale ECoG recordings

Glaxo-Smith-Klein (PI Moritz, Co-PI Brunton), 1/1/2016–12/31/2016

Bidirectional interface for organ nerve integrated control

INVITED TALKS AND PRESENTATIONS

- 2016 Nov. University of Washington, Graduate Program in Neuroscience Seminar (Seattle WA, planned)
- 2016 Nov. Society for Mathematical Psychology and Psychonomics, Workshop on Rethinking Biological Plausibility (Boston MA, planned)
- 2016 Nov. Harvard University, Center for Brain Science (Cambridge MA, planned)
- 2016 Oct. University of Washington Institute for Neuroengineering Seminar (Seattle WA)
- 2016 Oct. BrainKDD: The 3rd International Workshop on Data Mining and Visualization for Brain Science (Seattle WA)
- 2016 July University of Maryland, Brain and Behavior Initiative Seminar (College Park MD)
- 2016 June NeuroFutures Conference (Seattle WA)
- 2016 April Institute for Disease Modeling Annual Symposium (Bellevue WA)
- 2016 April Society for Industrial and Applied Mathematics (SIAM) Conference on Uncertainty Quantification (Lausanne, Switzerland)
- 2016 Mar. DARPA/ISAT Workshop on Bio-Integrated Processing, Sensing, and Storage (Seattle WA)
- 2016 Feb. Computational and Systems Neuroscience (COSYNE), Workshop on Dimensionality Reduction in High-Dimensional Neural Datasets (Snowbird UT)
- 2016 Feb. University of Washington, Neuroengineering and Computational Neuroscience Connection (Seattle WA)
- 2016 Feb. University of Washington, Behavioral Neuroscience Research Seminar (Seattle WA)
- 2016 Jan. Workshop on Neuromechanics & Dynamics of Locomotion (New Orleans LA)
- 2015 Dec.. DARPA/ISAT Workshop on Making-Sense (Washington DC)
- 2015 Oct. Columbia University, Center for Theoretical Neuroscience (NYC NY)
- 2015 Oct. New York University, Center for Data Science (NYC NY)
- 2015 Oct. University of Washington, Dept. of Electrical Engineering Colloquium (Seattle WA)
- 2015 Oct. Moore-Sloan Data Science Environment Annual Summit (Suncadia WA)
- 2015 May Society for Industrial and Applied Mathematics (SIAM) Conference on Applications of Dynamical Systems (Snow Bird UT)
- 2014 Dec. University of Washington, Department of Statistics Seminar (Seattle WA)
- 2014 Nov. New Perspectives on Neuroengineering and Neurotechnologies, DFG-NSF Research Conference (Washington DC)
- 2014 Aug. University of Iowa, Department of Neurosurgery Research Seminar (Iowa City IA)
- 2014 June Sloan-Swartz Center for Theoretical Neurobiology Annual Meeting (Seattle WA)
- 2014 June NeuroFutures Conference (Seattle WA)
- 2014 May University of Washington Institute for Neuroengineering (UWIN) and Department of Biology (Seattle WA)
- 2014 May Allen Institute for Brain Science (Seattle WA)
- 2014 Apr. Harvard University, Center for Brain Science (Cambridge MA)
- 2013 Dec. University of Washington, Center for Sensorimotor Neural Engineering (CSNE), Kavli Seminar (Seattle WA)
- 2013 Oct. Allen Institute for Brain Science (Seattle WA)
- 2011 Dec. Brandeis University, Decision-making Seminar (Waltham MA)
- 2011 Oct. University of Washington, Computational Neuroscience Seminar (Seattle WA)
- 2011 July Sloan-Swartz Centers for Theoretical Neurobiology Annual Meeting (Ashburn VA)

TEACHING

- 2015–17 UW, BIOL 419/519, **Data Science for Biologists**
2016 UW, BIOL 300, **Introduction to Neuroscience**
2016 MOOC, **Data Science for Biologists**, lectures openly available on YouTube

INVITED GUEST LECTURES

- 2017 UW, CSE 491 **Data Science and Society**
2014, 15, 16 UW, NBIO 490 **Seminar Course in Computational Neuroscience**
2016 May UW, PSYCH 502 **Core Concepts in Behavioral Neuroscience**
2014 Nov UW, GEN ST 391B **Different Ways of Knowing**

MENTORING

† **Current group members** in bold.

POST GRADUATE

- 2016– **Eurika Kaiser, Ph.D.**, co-advised with Steve Brunton, *Moore-Sloan-WRF Data Science Postdoctoral Fellow*
2016– **Bethany Lusch Ph.D.**, co-advised with Nathan Kutz, *Postdoctoral Research Associate in Applied Mathematics*
2016– **C. Liz Gass, M.D.**, *Psychiatry Resident at UW Medicine*

GRADUATE

- 2015– **Nancy X. R. Wang**, co-advised with Rajesh Rao, *Ph.D. student in UW Computer Science & Engineering, Neuroengineering and Data Science Graduate Fellow, National Science and Engineering Research Council (NSERC) of Canada Graduate Fellow*
2015 Kristian Eschenburg, rotation student, *Ph.D. student in UW Bioengineering*

UNDERGRADUATE AND POST-BACCALAUREATE

- 2016– **Ryan Shean**, undergraduate researcher and UWIN fellow, *Microbiology major at UW*
2016– **Wilven Smoody**, undergraduate researcher, *Physics major at UW*
2016– **Mathi Manavalan**, undergraduate researcher, *Psychology major at UW*
2016 Sam Kinn, undergraduate researcher and UW Institute of Neuroengineering (UWIN) fellow, *Electrical Engineering graduate at UW*
2016 Mycole Brown, undergraduate researcher, *Biology major at UW*
2015–2016 Karl Marrett, post-baccalaureate researcher and UW Institute of Neuroengineering (UWIN) Fellow, *Neurobiology/Computational Neuroscience graduate at UW*
2015 Christine McCreary, undergraduate researcher sponsored by UWIN and the Center for Sensorimotor Neural Engineering (CSNE), *Computer Science and Neurobiology major at UW*
2015 Monica Lamirand, undergraduate researcher sponsored by the CSNE, *Math/Psychology major at Hanover College*
2013–2014 Justin Thompson, *post-baccalaureate researcher at UW, Center for Sensorimotor Neural Engineering (CSNE) Research Experience for Veterans–University Projects (REV-UP)*

GRADUATE COMMITTEES

Yoni Browning	(Co-advisors: Beth Buffalo & Adrienne Fairhall, Physiology & Biophysics), thesis committee member
David Bjanas	(Advisor: Chet Moritz, Electrical Engineering), graduate school representative (GSR)
David Caldwell	(Co-advisors: Raj Rao, Jeff Ojemann & Eric Chudler, MD/PhD in BioE), thesis committee member
Gideon Dunster	(Advisor: Horacio de la Iglesia, Biology), thesis committee member
Andrew Haddock	(Advisor: Howard Chiczek, Electrical Engineering), thesis committee member
Eleanor Lutz	(Advisor: Jeff Riffell, Biology), thesis committee member
Claire Rusch	(Advisor: Jeff Riffell, Biology), thesis committee member
Maggie Thompson	(Advisor: Howard Chiczek, Electrical Engineering), graduate school representative (GSR)
Nile Wilson	(Co-advisors: Raj Rao, Jeff Ojemann & Eric Chudler, BioE), thesis committee member
James Wu	(Co-advisors: Raj Rao, Jeff Ojemann & Eric Chudler, BioE), thesis committee member
James Kunert	Ph.D. in Physics 2016, (Advisor: Nathan Kutz), graduate school representative (GSR)
Vamsi Talla	Ph.D in Electrical Engineering 2016, (Advisor: Josh Smith), graduate school representative (GSR)
Brad Dickerson	Ph.D. in Biology 2015, (Advisor: Tom Daniel), thesis committee member and reader

PROFESSIONAL ACTIVITIES

UNIVERSITY OF WASHINGTON

2016–2017	UW Dept of Biology, Member of Graduate & Postdoc Committee
2014–2017	UW eScience Institute, Member of Education Working Group
2015–2017	UW Graduate Program in Neuroscience, Member of Admissions Committee
2016–2017	UW Dept of Biology, Member of Seminar Committee
2015–2016	UW Dept of Biology, Chair of Seminar Committee

CONFERENCE ORGANIZING

2016–2017	Society for Industrial and Applied Mathematics (SIAM) Conference on Dynamical Systems, Mini-Symposium Organizer for <i>Equation-free modeling of biological systems</i>
2016–2017	Organization for Human Brain Mapping (OHBM) Annual Meeting, Symposium Organizer for <i>Uncovering complexity with long-term naturalistic recordings</i>
2015–2017	Computational and Systems Neuroscience Conference (COSYNE 2016 and 2017), Member of Program Committee
2015–2016	International Conference on Brain Informatics & Health (BIH 2016), Co-Chair of Workshops and Tutorials

INVITED WORKSHOPS, PANELS, AND EVENTS

- 2016 Dec. BRAIN Initiative Annual PI Meeting (Bethesda MD)
- 2016 Nov. Society for Mathematical Psychology and Psychonomics, Workshop on Rethinking Biological Plausibility (Boston MA)
- 2016 Oct. NSF CRCNS Annual PI Meeting (Paris, France)
- 2016 Oct. BrainKDD: The 3rd International Workshop on Data Mining and Visualization for Brain Science (Seattle WA)
- 2016 Sept. Plenary Speaker at the University of Washington Annual TA/RA Conference (Seattle WA)
- 2016 Sept. NeuroHack Week (Seattle WA)
- 2016 Mar. DARPA/ISAT Workshop, Bio-Integrate Processing, Sensing and Storage (Seattle WA)
- 2016 Feb. Computational and Systems Neuroscience (COSYNE), Workshop on Dimensionality Reduction in High-Dimensional Neural Datasets (Snowbird UT)
- 2015 Dec. DARPA/ISAT Workshop, Making Sense (Washington DC)
- 2015 Oct. Moore-Sloan Data Science Environment Annual Summit (Suncadia WA)
- 2015 Mar. DARPA/ISAT Workshop, Silicon Meets Biotechnology (Seattle WA)
- 2014 Oct. Moore-Sloan Data Science Environment Annual Summit (Asilomar CA)

VOLUNTEER AND OUTREACH

- 2015–2017 Girls in Science volunteer instructor, Burke Museum of Natural History and Culture
- 2012 Women in Science and Engineering (WISC) panel discussion on grad school, panelist
- 2007–2009 New Jersey Science Olympiad, event coordinator and judge
- 2009 Science Expo at Princeton University, volunteer
- 2009 Trenton Area Science Fair, volunteer