Andrew Bender

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Education

Neurosciences — *Doctor of Philosophy* August 2019 - June 2025
Computational Neuroscience Specialization GPA: 3.911
UC San Diego, La Jolla, CA

Neuroscience — *Bachelor of Arts* August 2015 - May 2019
Highest Honors in Neuroscience, Minor in Scientific Computing, *magna cum laude* GPA: 3.914
Vanderbilt University, Nashville, TN

Work Experience

Neurocrine Biosciences — *Associate Scientist, Computational Neuroscience* August 2024 - Present
- Created comprehensive Python package that automates the critical data processing bottleneck of sleep stage classification, saving 130 hours of focused work per animal cohort and increasing my team's throughput by 100%.

Neurocrine Biosciences — *In Vivo Eletrophysiology Intern* June 2024 - August 2024
- Built custom, GPU-implemented convolutional neural network (CNN) that matches the performance of trained experts (90% accuracy) in labelling rat sleep stages from neural electrophysiological recordings across multiple animals and drug conditions.

Research Experience

Neural and Data Analytics Lab, UC San Diego — *Graduate Student Researcher* August 2019 - June 2025
Advisor: Bradley Voytek, Ph.D.
- Designed signal processing pipeline to isolate neural rhythms from resting-state electroencephalography (EEG) data and identify biomarkers for autism and ADHD in dataset of nearly 3000 children.
- Developed cutting-edge, sliding window spectral analysis technique to decode spatial location of stimuli from neural alpha rhythms across seven different visual working memory tasks and 112 adults.
- Isolated bursts of rhythmic alpha activity from non-human primate local field potentials (LFPs) and leveraged hierarchical bootstrapping to demonstrate that two modes of alpha activity differentially affect neural spiking.

Multisensory Research Lab, Vanderbilt University — *Undergraduate Researcher* August 2016 - May 2019
Advisors: David Tovar, M.D., Ph.D., and Mark Wallace, Ph.D.
- Devised and implemented binocular rivalry paradigm to improve attentional deficits following acute stroke.
- Constructed GPU implementation of custom, deep 14-layer 3D residual neural network in TensorFlow that decreased training time over 5000%.
- Published and defended Honors Thesis comprising four different machine learning models that diagnosed autism with 60% accuracy from ensemble of minimally processed, multi-modal brain recordings.

Technical Projects

Personal Project — *AzulRL* June 2021 - Present
- Created custom gym environment for reinforcement learning (RL) agents to play Azul, a popular board game.
- Implemented multi-agent, proximal policy optimization (PPO) using RLLib and Ray to train agents to play Azul.
- Developed software to visualize games played by trained agents.

Personal Project — *My eDict* January 2020 - Present
- Designed and developed mobile application using BeeWare to enable users to create personal electronic dictionaries, create their own lists of words to learn, and improve their vocabulary.

Skills

Technical skills: digital signal processing, time series analysis, machine learning, deep learning, reinforcement learning, computational modeling, parallel computing, GPU programming, cluster computing, statistics, data visualization

Data tools and programming languages: Python, NumPy, SciPy, pandas, seaborn, MNE, TensorFlow, PyTorch, scikit-learn, Keras, RLLib, Ray, matplotlib, Jupyter, Git, bash/zsh, LaTeX, MATLAB

Publications

- **A. Bender**, C. Zhao, E. Awh, E. Vogel, B. Voytek. Differential representations of spatial location by aperiodic and alpha oscillatory activity in working memory. Accepted by *PNAS*. doi: https://doi.org/10.1101/2025.03.21.644412.

- **A. Bender**, B. Voytek*, N. Schaworonkow*. Resting-state alpha and mu rhythms change shape across development but lack diagnostic sensitivity for Attention-Deficit/Hyperactivity Disorder and Autism. Accepted by *Journal of Cognitive Neuroscience*. doi: https://doi.org/10.1162/jocn_a_02323. *These authors contributed equally to this work.
- **A. Bender***, E.J. Peterson*, B. Voytek. Alpha oscillations control cortical gain by modulating excitatory-inhibitory background activity. *In preparation.* *These authors contributed equally to this work.
- S.C. Zhao, Y. Hu , J. Lee, **A. Bender**, T. Mazumdar, M. Wallace, D.A. Tovar. Shifting Attention to You: Personalized Brain-Inspired AI Models. *arXiv*. doi: https://doi.org/10.48550/arXiv.2502.04658.

Selected Presentations

- **A. Bender**, B. Voytek. Representations of spatial location by aperiodic and alpha oscillatory activity in working memory. *Cognitive Neuroscience Society*; 2024, April 14; Toronto, ON.
- **A. Bender**, B. Voytek. Decoding spatial location from aperiodic and alpha oscillatory activity in working memory. *Society for Neuroscience*; 2023, November 13; Washington, DC. (presentation)
- **A. Bender**, N. Schaworonkow, B. Voytek. Age-related changes in alpha and mu oscillation amplitude and waveform asymmetry. *Society for Neuroscience*; 2022, November 16; San Diego, CA. (poster)
- **A. Bender**, N. Schaworonkow, B. Voytek. Quantifying waveform shape of EEG alpha and mu oscillations across development. *Cognitive Neuroscience Society*; 2022, April 26; San Francisco, CA. (poster)
- **A. Bender**, D.A. Tovar, M. Wallace. Classification of autism spectrum disorder using machine learning. *Honors Thesis Defense*; 2019, April 18; Nashville, TN. (presentation)
- **A. Bender**, D.A. Tovar, R. Ramachandran, M. Wallace. ASDNet: classification of autism from MRI images using residual neural networks. *Vanderbilt Translational Research Forum*; 2018, October 26; Nashville, TN. (poster)

Workshops and Invited Talks

- **A. Bender**, Q. van Engen, E. Kosik, B. Voytek. A hands-on technical workshop for cognitive neuroscientists. *Cognitive Neuroscience Society*; 2024, April 15; Toronto, ON. (repository)
- **A. Bender**, D. Cellier, Q. van Engen, R. Hammonds, E. Kosik, M. Preston, S. Smith. Methods for analyzing neural oscillations and aperiodic activity. *Society for Psychophysiological Research*; 2023, September 27; New Orleans, LA. (repository)
- **A. Bender**, Q. van Engen, R. Hammonds, E. Kosik, M. Preston, S. Smith, B. Voytek. Methods for analyzing neural oscillations and aperiodic activity. *Society for Psychophysiological Research*; 2022, September 28; Vancouver, BC. (repository)

Mentorship

Veritas AI — ***Lead Teaching Mentor and Project Mentor*** June 2022 - July 2023
- Led AI Scholars crash course in machine learning and artificial intelligence for high school students.
- Mentored student through development of machine learning model to diagnose Down Syndrome from neural protein expression patterns in mice through AI Fellowship program.

Polygence — ***Project Mentor*** January 2022 - October 2023
- Directed four high school students to develop, execute, and report findings for independent reserach projects, ranging in topic from decoding inner speech for brain-computer interfaces (BCIs) to identifying genetic factors distinguishing normal aging from Alzheimer's Disease.

Grants and Awards

Phi Beta Kappa Centennial Award May 2019
Alpha of Tennessee chapter of Phi Beta Kappa, Vanderbilt University

ACCRE Summer Scholar June 2018 - August 2018
Advanced Computing Center for Research and Education (ACCRE), Vanderbilt University

Voucher Award for Allocentric and Egocentric Neglect Study September 2017 - May 2018
Vanderbilt Institute for Clinical and Translational Research (VICTR), Vanderbilt University

Summer Undergraduate Research Fellowship (SURF) June 2017 - August 2017
Mayo Clinic