Curriculum Vitae - **Zachary C. Brown**

National Science Foundation Graduate Research Fellow
Duke University Pratt School of Engineering, Durham, NC 27705
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Research Positions

National Science Foundation Graduate Research Fellow 2022 - Present

Research Assistant, Duke University; *Advisor: Dr. David Carlson* 2020 - Present

- Collaborate with biologists and engineers on brain-computer interface systems using LFP and spiking data
- Develop ML methods for brain-wide network discovery and learning joint representations of LFP and spike train data across 3–28 mouse subjects, emphasizing scientific validity and generalization
- Led development of REDCLIFF-S, a nonlinear generative factor model which attains 22-28% improved f1-scores over baselines in automated hypothesis generation **(ICML 2025)**, to reduce costs in neuroscience

ETI Fellow, Oak Ridge National Laboratory; *Advisor: Dr. Philip Bingham* 2022

- Collaborated on DOE-funded energy infrastructure monitoring research with 3 staff scientists
- Developed signal reconstruction and harmonic detection algorithms for smart grid fault detection systems
- Engineered a custom method for backpropagation through sparse matrices in PyTorch Lightning, enabling the team to use models previously unsupported by the framework

Research Assistant, DRAGN Labs; *Advisor: Dr. Nancy Fulda* 2019 - 2020

- Researched adversarial learning techniques for fine-grained control in text generation, exploring latent-space manipulation in large language model architectures (esp. the GPT family from OpenAI)
- Led research on guiding GPT-2 generation by steering latent activations with GANs, achieving controllable output without altering pretrained weights **(NeurIPS 2020)**

Research Assistant, Perception-Control-and-Cognition Lab; *Advisor: Dr. David Wingate* 2017 - 2019

- Investigated machine reasoning and representation learning for robotic navigation and dialogue systems, with contributions published in **CoRL 2017** and the **2018 Amazon Alexa Prize** proceedings
- Built and tested models for analogical reasoning for common-sense robotic navigation
- Contributed NLU module design and response generation logic as part of 9-member team behind Alexa Prize semi-finalist open-domain dialogue system (2018)

Education

Ph.D. Electrical and Computer Engineering, Duke University; in progress anticipated conferral May 2026

- *Advisor*: Dr. David Carlson

M.S. Electrical and Computer Engineering, Duke University 2023

B.S. Applied Computational Mathematics, Brigham Young University 2020

Publications (see attached publication list)

3 first author, 3 co-author

Relevant Industry Experience

Summer Data Engineering Intern, Capital One 2019 - 2020

- Designed a pipeline to improve virtual-assistant text efficiency via fine-tuned language models
- Devised and document new data cleaning and model testing protocols to support language models

- Assisted in designing an internal cloud-based question answering system to assist company employees

Featured Technical Skills

- Python/Pytorch, Dynamic Causal Modeling, Signal Processing, Graph Theory, HPC, NLP, AWS, Unix, Git

Fellowships, Certificates, & Awards

NSF Graduate Research Fellowship 2022 - Present
Laser Safety - Non Clinical Use Certificate, Duke University 2023
Hands-On High Performance Computing Certificate, Oak Ridge Leadership Computing Facility 2022
Preparing Future engineering Faculty (PFeF) Program Certificate, Duke University 2020
Brigham Young Scholarship 2019
Amazon Alexa Prize Semi-Finalist 2018
John Einar Anderson Scholarship 2018
Computer Science Department Scholarship, Brigham Young University 2018

Teaching

Duke Univ. Pratt School of Engineering, ECE 685D: Introduction to Deep Learning, *Teaching Assistant* 2023

- *Responsibilities*: Lead course reading sections during 2nd half of semester, design and grade final projects for 3 groups, mentor 6+ students on final projects

Duke Univ. Pratt School of Engineering, ECE 684: Natural Language Processing, *Teaching Assistant* 2022

- *Responsibilities*: Lecture on "Gated Networks" (~112 student course), grading, weekly office hours

Preparing Future engineering Faculty (PFeF) Program Certificate, Duke University 2020

Brigham Young University, CS 474: Introduction to Deep Learning, *Teaching Assistant* 2019

- *Responsibilities*: Weekly office hours

Talks & Presentations

Technical Presentations:

- International Conference on Machine Learning (Vancouver, Canada), *poster* July 2025
- 2022 ECE Graduate Student Workshop (Flat Rock, NC), *poster* Sept 2022
- University Program Review (UPR) Meeting (Ann Arbor, MI), *talk* June 2022
- Advances in Neural Information Processing Systems (Remote-Vancouver, Canada), *talk* Dec 2020
- VOICE Summit 2018 (Newark, NJ), *talk* July 2018

Invited Panel Discussions:

- NSF GRFP Workshop (Durham, NC), *panelist* Aug 2023
- NSF GRFP Workshop (Durham, NC), *panelist* Aug 2022
- Society for Industrial and Applied Mathematics (SIAM) at BYU (Provo, UT), *panelist* Apr 2022

Publications (3 first author, 3 co-author)

First Author Publications

1. **Brown, Z.**, & Carlson, D. (2025). On Leveraging Subject-Specific Information to Guide Pretrained General Purpose Models: Joint Embeddings for Neuroscientific Applications. (In-progress, anticipated publication this coming fall)
2. **Brown, Z.**, & Carlson, D. (2025). Generating Hypotheses of Dynamic Causal Graphs in Neuroscience: Leveraging Generative Factor Models of Observed Time Series. *International Conference on Machine Learning, 42*.
3. **Brown, Z.**, Robinson, N., Wingate, D., & Fulda, N. (2020). Towards neural programming interfaces.

Advances in Neural Information Processing Systems, *33*, 17416-17428.

Co-Author Publications

1. Robinson, N., **Brown, Z.**, Sitze, T., & Fulda, N. (2021, January). Text Classifications Learned from Language Model Hidden Layers. In *2021 IEEE 19th World Symposium on Applied Machine Intelligence and Informatics (SAMI)* (pp. 000207-000210). IEEE.
2. Fulda, N., Etchart, T., Myers, W., Ricks, D., **Brown, Z.**, Szendre, J., ... & Wingate, D. (2018). Byu-eve: Mixed initiative dialog via structured knowledge graph traversal and conversational scaffolding. *Proceedings of the 2018 Amazon Alexa Prize*.
3. Fulda, N., Tibbetts, N., **Brown, Z.**, & Wingate, D. (2017, October). Harvesting common-sense navigational knowledge for robotics from uncurated text corpora. In *Conference on Robot Learning* (pp. 525-534). PMLR.