Trenton Blitz Bricken

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Education

Harvard University - Boston, Massachusetts, 2020 - Present (Doctoral Degree)

• 3rd year PhD student in the Systems, Synthetic and Quantitative Biology program in the Kreiman lab

• PhD thesis is on the extent to which Deep Learning and the brain are convergent. I am using Sparse Distributed Memory, a biologically plausible associative memory model, to investigate these connections.

• Awarded the NSF Graduate Research Fellowship that provides three years of funding for my PhD research

• Annual reviewer for ICML, ICLR and NeurIPS. NeurIPS 2022 Top Reviewer

Duke University - Durham, North Carolina, 2016 - 2020 (Undergraduate Degree)

• Duke and UNC Robertson Scholar. Merit scholarship with a focus on leadership. Included full funding of all university expenses for four years, including summer experiences

• Major in "Minds and Machines: Biological and Artificial Intelligence", a self-made 'Program II' major covering Computer Science, Neuroscience, Statistics and Biology

• Cumulative GPA overall: 3.775, GPA in major: 3.781, took 7 grad. classes, featured four times on the Dean's List

Eton College - Windsor, England, 2011 - 2016 (Secondary school)

• A2 subjects and results: A* Economics, A Politics, A Maths, 5 Computer Science AP (self-taught)

Publications (reverse chronological order)

Emergence of Sparse Representations from Noise
Trenton Bricken, Rylan Schaeffer, Bruno Olshausen, Gabriel Kreiman
*(First author)
ICML, May 2023
Paper in press

Sparse Distributed Memory is a Continual Learner
Trenton Bricken, Xander Davies, Deepak Singh, Dmitry Krotov, Gabriel Kreiman
*(First author)
ICLR, September 2022
Paper - https://arxiv.org/abs/2303.11934
Tweet-thread - https://twitter.com/TrentonBricken/status/1639302453295476737?s=20

Attention Approximates Sparse Distributed Memory
Trenton Bricken, Cengiz Pehlevan
*(First author)
NeurIPS, December 2021
Paper - https://arxiv.org/abs/2111.05498
Talk at MIT Center for Brains Minds+ Machines: https://cbmm.mit.edu/video/attention-approximates-sparse distributed-memory
Blog post - https://www.trentonbricken.com/Attention-Approximates-Sparse-Distributed-Memory/ Code - https://github.com/TrentBrick/attention-approximates-sdm
Tweet-thread - https://twitter.com/TrentonBricken/status/1458465726503784449?s=20

High-content screening of coronavirus genes for innate immune suppression reveals enhanced potency of SARS CoV-2 proteins
Erika J Olson*, David M Brown*, Timothy Z Chang, Lin Ding, Tai L Ng, H. Sloane Weiss, Peter Koch, Yukiye Koide, Nathan Rollins, Pia Mach, Tobias Meisinger, ***Trenton Bricken***, Joshus Rollins, Yun Zhang, Colin Molloy, Yun Zhang, Briodget N Queenan, Timothy Mitchison, Debora Marks, Jeffrey C Way, John I Glass, Pamela A Silver
 *(First authors)
bioRxiv, March 2021
Preprint - https://www.biorxiv.org/content/10.1101/2021.03.02.433434v1

Tweet-thread - https://twitter.com/TrentonBricken/status/1367141915666317312?s=20

Computationally Optimized SARS-CoV-2 MHC Class I and II Vaccine Formulations Predicted to Target Human Haplotype Distributions
Ge Liu*, Brandon Carter*, **Trenton Bricken**, Siddhartha Jain, Mathias Viard, Mary Carrington, David K Gifford
*(First authors)
Cell Systems, July 2020
Paper - https://www.cell.com/cell-systems/fulltext/S2405-4712%2820%2930238-6#%20
Code - https://github.com/gifford-lab/optivax
Preprint - https://www.biorxiv.org/content/10.1101/2020.05.16.088989v1
Tweet-thread - https://twitter.com/TrentonBricken/status/1262407888842170370?s=20

Research and Work Experience

Anthropic - Resident, January 2023 – Present
• Member of the Mechanistic Interpretability team working on disentangling superposition using sparse coding
Redwood Theoretical Neuroscience Institute at Berkeley - Visiting Researcher, September 2022 – January 2023
• Worked with Bruno Olshausen, Fritz Sommer, and Pentti Kanerva while staying in contact with my PhD supervisor
Gabriel Kreiman Lab - PhD Student, Boston Children's Hospital/Harvard Medical School, Biophysics, July 2021 – Present
• Researching Associative Memory models, Vector Symbolic Architectures and their relations to Deep Learning models
• Mentoring/supervising two Harvard undergraduates on related research projects
David Gifford Lab - Visiting Researcher, MIT CSAIL, Computational Biology, April 2020 – August 2020
• Second author on COVID vaccine design (see Publications)
Debora Marks Lab - Undergraduate Researcher, Harvard Medical School, Systems Biology, May 2019 - April 2020
• SARS-CoV-2 mutation effects and 3D structure prediction from sequence covariation, Summer 2020
    • Website: https://marks.hms.harvard.edu/sars-cov-2
• IARPA FunGCAT Project - identifying novel viral genes that suppress host immune response (see Publications)
• DARPA Biostasis Project - re-engineering cryptobiotic proteins from extremophiles to function in humans Michael Lynch Lab - Research Assistant, Duke University, BME Department, June 2018 - May 2019
• Making genetic engineering more safe, precise, and efficient by developing machine learning models to predict CRISPR cutting and homology directed repair rates for more optimal guide RNA design
Sunflower County Freedom Project - Teaching Intern, Sunflower County Mississippi, May 2017 - July 2017
• Taught math to 9th and 7th grade students in a summer remedial education program
    • Designed and ran extra-curricular program titled: "From Kendrick to Le-Bron - The Secrets of Success"

Interests and Activities

Harvard University:
• Member of Theoretical Neuroscience Group - Boston graduate students meet, share research, and brainstorm
• Member of Boston Effective Altruism Community
Duke University:
• Developed "Tail-Free Sampling" - a new method to generate sequences from autoregressive neural networks, July 2019 - December 2019
    • Work currently published as a blog post (https://trentbrick.github.io/Tail-Free-Sampling/)
• Investigated the ability for deep reinforcement learning agents to discover and prove Byzantine Fault Tolerant consensus protocols. Supervised by Dr. Kartik Nayak, September 2019 – September 2020
• Winning team at the American Statistical Association's (ASA) "Datafest @ Duke", April 2018 & 2019
    • ~400 competitors each year. 2019 won "Best Insight", 2018 won "Judges Pick"
• Co-founder and Discussion Leader for the "Arete Fellowship", September 2018 - May 2018
    • 10-week crash course in Effective Altruism for undergraduates. Had 70 applicants, accepted and taught 18 of them. End of course anonymous survey had the course rated as a 4.53 out of 5
Eton College:
• Co-House Captain of Boarding House: Appointed by Housemaster as Co-Head of House of 55 boys, 2015 - 2016
• Founder and Chairman of The Eton and Holyport College Investment Club, 2014 - 2016
    • 24-member Investment Club of Sixth Form students (high school juniors and seniors) who independently raised from donors and managed a real money philanthropic fund of over £20,000

Skills, Qualifications and Personal Interests

Computer programming including: Java, Python, Matlab, JavaScript & R; US, Canadian, and UK citizenship; Hobbies include squash, travel, and film photography (website: https://blitz-analog.github.io/)