Daniel Beaglehole

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University of California, San Diego, Computer Science and Engineering

EDUCATION

University of California, San Diego, La Jolla, CA — Sep 2021 – Present
Ph.D., Computer Science and Engineering
Advised by: Mikhail Belkin

Columbia University, New York, NY — Sep 2019 – Feb 2021
M.S., Computer Science, Theory Track
Advised by: Alexandr Andoni

University of Chicago, Chicago, IL — Sep 2015 – June 2019
B.S., Mathematics with General Honors, Minor in Chemistry

PUBLICATIONS

1. Adityanarayanan Radhakrishnan*, **Daniel Beaglehole***, Parthe Pandit, Mikhail Belkin. *Mechanism for feature learning in neural networks and backpropagation-free machine learning models*. Science.
2. **Daniel Beaglehole**, Mikhail Belkin, and Parthe Pandit. *On the inconsistency of kernel ridgeless regression in fixed dimensions*. SIAM Journal on Mathematics of Data Science (SIMODS). Also appeared at Conference on the Mathematical Theory of Deep Neural Networks (DeepMath 2022).
3. **Daniel Beaglehole***, Max Hopkins*, Daniel Kane*, Sihan Liu*, Shachar Lovett*. *Sampling Equilibria: Fast No-Regret Learning in Structured Games*. Symposium on Discrete Algorithms (SODA 2023).
    - Originally appeared as *An Efficient Approximation Algorithm for the Colonel Blotto Game*, preprint by **Daniel Beaglehole**.
4. Alexandr Andoni*, **Daniel Beaglehole***. *Learning to Hash Robustly, Guaranteed*. International Conference on Machine Learning (ICML 2022).
5. **Daniel Beaglehole**, Ioannis Mitliagkas, Atish Agarwala. *Feature learning as alignment: a structural property of gradient descent in non-linear neural networks*. Workshop on High-dimensional Learning Dynamics (HiLD) at ICML 2024. Preprint available at arXiv:2402.05271.
6. **Daniel Beaglehole***, Adityanarayanan Radhakrishnan*, Parthe Pandit, Mikhail Belkin. *Mechanism of feature learning in convolutional neural networks*. Preprint available at arXiv:2309.00570v1.
7. **Daniel Beaglehole***, Peter Súkeník*, Marco Mondelli, Mikhail Belkin. *Average gradient outer product as a mechanism for deep neural collapse*. Preprint available at arXiv:2402.13728.
8. Neil Mallinar, **Daniel Beaglehole**, Libin Zhu, Adityanarayanan Radhakrishnan, Parthe Pandit, Mikhail Belkin. *Emergence in non-neural models: grokking modular arithmetic via average gradient outer product*. Preprint available at arXiv:2407.20199.
9. Thomas Valles, **Daniel Beaglehole**. *Fast, optimal, and dynamic electoral campaign budgeting by a generalized Colonel Blotto game*. Preprint available at arXiv:2406.15714.

(* denotes equal contribution)

INDUSTRY EXPERIENCE

Google DeepMind, Mountain View, CA — May 2023 – March 2024
Student Researcher

- Working with Atish Agarwala (Google DeepMind) and Ioannis Mitliagkas (Google DeepMind, MILA).

- Clarified the theoretical mechanism for *Mechanism for feature learning in neural networks and backpropagation-free machine learning models*.

Goldman Sachs, New York, NY June – September 2021
Summer Research Intern

- Interned with the Core ML team (now the Data Science and Machine Learning Products team) researching the application of machine learning methods to financial markets.
- Developed a novel reinforcement learning algorithm for asset price prediction.

Portside Group, San Diego, CA August 2024
Technical consultant

- Contracted as a technical consultant for a boutique hedge fund, Portside Group LLC.
- Reviewed and contributed to writing a patent application for a machine learning tool for financial documents.

INVITED TALKS

- UW-Madison MLOPT Idea Seminar (2023)
  Mechanism of feature learning in neural networks
- Princeton ML Theory Summer School (2023)
  Feature learning in neural networks and kernel machines that recursively learn features
- UCSD Data Science Industry Day (2023)
  Feature learning in neural networks and kernel machines that recursively learn features
- Google Brain (2023)
  Feature learning in neural networks and kernel machines that recursively learn features
- Yale University: Inference, Information, and Decision Systems Group (2023)
  Feature learning in neural networks and kernel machines that recursively learn features
- Conference on the Mathematical Theory of Deep Neural Networks (2022)
  On the inconsistency of kernel ridgeless regression in fixed dimensions
- UCSD: Theory Seminar (2021)
  Learning to Hash Robustly, Guaranteed
- Goldman Sachs: Data Science and Machine Learning paper club (2021)
  Learning to Hash Robustly, Guaranteed
- Goldman Sachs: Summer internship final presentation (2021)
  Predictive Clustering Time Series for Finance
- Biological Sciences Collegiate Division Fall Symposium (2016, 2017)
- University of Chicago Undergraduate Research Symposium in (2016)

AWARDS

- Biological Sciences Collegiate Division Summer Fellowship, twice awarded (2016 and 2017).
- ARCS Foundation Scholar ($10,000 scholarship awarded to a single student in each science and engineering department), twice awarded (2023 and 2024).
- University of Chicago Deans List 2016, 2017, 2018 (GPA in Top 20% of the class each year)

ACADEMIC SERVICE

- Journal reviewer: Mathematics of Operations Research (2023), Neural Computation (2024)
- Conference reviewer: SODA 2025
- Conference area chair: Theoretical Foundations of Foundation Models @ ICML 2024