David Brandfonbrener

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Employment

2023-Present **Harvard University**, Research Fellow, Kempner Institute.
Working with Sham Kakade.
Helped scale up LLM research efforts at Kempner on a cluster of 384 H100s. Led papers and codebases for dataset and optimization projects for pre-training 1000s of models of up to 3B parameters on up to 96 H100s per model using FSDP and OLMo. Also contributed to projects on tree search with LLMs, comparing SSMs with transformers, and length generalization as well as ongoing work on synthetic data.

Education

2018-23 **New York University**, PhD, Computer Science Department, Courant Institute.
Advised by Joan Bruna in the CILVR group
Thesis: Bridging the Gap from Supervised Learning to Control

2014-18 **Yale University**, Bachelor of Arts in Mathematics (Intensive) with distinction and Bachelor of Arts in Computer Science with distinction, magna cum laude.

Internships

2022 **Google Brain Robotics (NYC)**, hosted by Jake Varley and Stephen Tu.

2021 **Microsoft Research (Montreal)**, hosted by Romain Laroche and Remi Tachet des Combes.

2019 **Facebook AI Research (Paris)**, hosted by Alessandro Lazaric and Matteo Pirotta.

Awards and Grants

2022-23 **Google Research Collab Grant**, working with Ofir Nachum.

2019-22 **National Defense Science and Engineering Graduate (NDSEG) Fellowship**.

Preprints

2024 **CoLoR-Filter: Conditional Loss Reduction Filtering for Targeted Language Model Pre-training**, D. Brandfonbrener, H. Zhang, A. Kirsch, J.R. Schwarz, S. Kakade.
In Submission, `https://arxiv.org/abs/2406.10670`

2024 **Universal Length Generalization with Turing Programs**, K. Hou, D. Brandfonbrener, S. Kakade, S. Jelassi, E. Malach.
In Submission, `https://arxiv.org/abs/2407.03310`

2024 **SOAP: Improving and Stabilizing Shampoo using Adam**, N. Vyas, D. Morwani, R. Zhao, I. Shapira, D. Brandfonbrener, L. Janson, S. Kakade.
In Submission, `https://arxiv.org/abs/2409.11321`

2024 **Deconstructing What Makes a Good Optimizer for Language Models**, R. Zhao*, D. Morwani*, D. Brandfonbrener*, N. Vyas*, S. Kakade.
In Submission, `https://arxiv.org/abs/2407.07972`

2024 **VerMCTS: Synthesizing Multi-Step Programs using a Verifier, a Large Language Model, and Tree Search**, D. Brandfonbrener, S. Henniger, S. Raja, T. Prasad, C. Loughridge, F. Cassano, S. Hu, J. Yang, W. Byrd, R. Zinkov, N. Amin.
In Submission, https://arxiv.org/abs/2402.08147

Conference Papers

2024 **Repeat After Me: Transformers are Better than State Space Models at Copying**, S. Jelassi, D. Brandfonbrener, S. Kakade, E. Malach.
International Conference on Machine Learning (ICML) 2024,
https://arxiv.org/abs/2402.01032

2024 **Q-probe: A Lightweight Approach to Reward Maximization for Language Models**, K. Li, S. Jelassi, H. Zhang, S. Kakade, M. Wattenberg, D. Brandfonbrener.
International Conference on Machine Learning (ICML) 2024,
https://arxiv.org/abs/2402.14688

2023 **Inverse Dynamics Pretraining Learns Good Representations for Multitask Imitation**, D. Brandfonbrener, O. Nachum, J. Bruna.
Conference on Neural Information Processing Systems (NeurIPS) 2023,
https://arxiv.org/abs/2305.16985

2023 **Visual Backtracking Teleoperation: A Data Collection Protocol for Image-Based Offline RL**, D. Brandfonbrener, S. Tu, A. Singh, S. Welker, C. Boodoo, N. Matni, J. Varley.
The International Conference on Robotics and Automation (ICRA) 2023,
https://arxiv.org/abs/2210.02343

2022 **When Does Return-Conditioned Supervised Learning Work for Offline RL?**, D. Brandfonbrener, A. Bietti, J. Buckman, R. Laroche, J. Bruna.
Conference on Neural Information Processing Systems (NeurIPS) 2022,
https://arxiv.org/abs/2206.01079

2021 **Offline RL Without Off-Policy Evaluation**, D. Brandfonbrener, W. Whitney, R. Ranganath, J. Bruna.
Conference on Neural Information Processing Systems (NeurIPS) 2021 *(spotlight, top 3%)*,
https://arxiv.org/abs/2106.08909

2021 **Offline Contextual Bandits with Overparameterized Models**, D. Brandfonbrener, W. Whitney, R. Ranganath, J. Bruna.
International Conference on Machine Learning (ICML) 2021,
https://arxiv.org/abs/2006.15368

2020 **Frequentist Regret Bounds for Randomized Least-Squares Value Iteration**, A. Zanette*, D. Brandfonbrener*, E. Brunskill, M. Pirotta, A. Lazaric.
International Conference on Artificial Intelligence and Statistics (AISTATS) 2020,
https://arxiv.org/abs/1911.00567

2020 **Geometric Insights into the Convergence of Nonlinear TD Learning**, D. Brandfonbrener, J. Bruna.
International Conference on Learning Representations (ICLR) 2020,
https://arxiv.org/abs/1905.12185

Workshop Papers

2022 **Incorporating Explicit Uncertainty Estimates into Deep Offline Reinforcement Learning**, D. Brandfonbrener, R. Tachet des Combes, R. Laroche.
The 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM) 2022,
https://arxiv.org/abs/2206.01085

2022 **Don't Change the Algorithm, Change the Data: Exploratory Data for Offline Reinforcement Learning**, D. Yarats*, D. Brandfonbrener*, H. Liu, M. Laskin, P. Abbeel, A. Lazaric, L. Pinto.
The 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making (RLDM) 2022,
https://arxiv.org/abs/2201.13425

2021 **Quantile Filtered Imitation Learning**, D. Brandfonbrener, W. Whitney, R. Ranganath, J. Bruna.
The Offline Reinforcement Learning Workshop at NeurIPS 2021,
https://arxiv.org/abs/2112.00950

2021 **Evaluating Representations by the Complexity of Learning Low-loss Predictors**, W. Whitney, M.J. Song, D. Brandfonbrener, J. Altosaar, K. Cho.
Neural Compression: From Information Theory to Applications Workshop at ICLR 2021,
https://arxiv.org/abs/2009.07368

Publications Outside of Computer Science

2021 **PsychRNN: An Accessible and Flexible Python Package for Training Recurrent Neural Network Models on Cognitive Tasks**, D. Ehrlich, J. Stone, D. Brandfonbrener, A. Atanasov, J. Murray.
ENeuro, Volume 8, Issue 1, Society for Neuroscience,
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7814477/

2018 **Two-vertex Generators of Jacobians of Graphs**, D. Brandfonbrener, P. Devlin, N. Friedenberg, Y. Ke, S. Marcus, H. Reichard, and E. Sciamma.
The Electronic Journal of Combinatorics, 25 (2018),
https://arxiv.org/abs/1708.03069

Teaching

2021 **Teaching assistant**, DS-GA-3001: Tools and Techniques for Machine Learning.

2020 **Teaching assistant**, CSCI-GA-3033-020: Mathematics of Deep Learning.

Service

Outstanding reviewer (or equivalent), ICLR 2021, ICLR 2022, ICML 2022, NeurIPS 2022.

Reviewer, NeurIPS 2019-24, ICML 2020-24, ICLR 2020-23, TMLR 2022-24, AISTATS 2021, CoRL 2023.

Organizer, ML in NYC speaker series 2022-present, CILVR lab seminar 2019-2021, NYU Reinforcement Learning reading group 2019-2021.

Talks

2024 **What do we do when the data doesn't quite do what we want?**.
Google DeepMind

2024 **Q-probe: A Lightweight Approach to Reward Maximization for Language Models**.
IBM Zurich

2024 **Repeat After Me, Transformers are Better than SSMs at Copying**.
Flatiron Institute

2023 **Bridging the Gaps: Supervised Learning to Control and Theory to Practice**.
Berkeley, Stanford, MIT, Microsoft, Harvard

2022 **Simplifying Deep Offline RL**.
FAIR RL Seminar

2022 **Tutorial: Foundations of Offline Reinforcement learning (with Romain Laroche)**.
Microsoft, https://www.youtube.com/watch?v=lH9DzugrejY

2021 **Offline RL without Off-Policy Evaluation**.
Microsoft RL Seminar