BLAKE BORDELON

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EDUCATION

Harvard University *July 2019-Present*
Program: PhD in Applied Mathematics Advisor: Cengiz Pehlevan GPA: 4.0/4.0
Washington University in St. Louis *August 2015 - May 2019*
Majors: Systems Engineering and Physics. Minor: Computer Science GPA: 4.0/4.0

REFEREED CONFERENCE PRECEEDINGS

A Dynamical Model of Neural Scaling Laws , *Bordelon*, Atanasov, Pehlevan, *ICML* 2024.
Depthwise Hyperparameter Transfer in Residual Networks: Dynamics and Scaling Limit , *Bordelon**, Noci*, Li, Hanin, Pehlevan. *ICLR* 2024.
Grokking as the Transition from Lazy to Rich Training Dynamics , Kumar, *Bordelon*, Gershman, Pehlevan. *ICLR* 2024.
Dynamics of Finite Width Kernel and Prediction Fluctuations in Mean Field Neural Networks , *Bordelon*, Pehlevan. *Neurips* 2023 **spotlight**.
Loss Dynamics of Temporal Difference Reinforcement Learning, *Bordelon*, Masset, Kuo, Pehlevan. *Neurips* 2023.
Feature-Learning Networks Are Consistent Across Widths At Realistic Scales, Vyas*, Atanasov*, *Bordelon**, Morwani, Sainathan, Pehlevan, *Neurips* 2023.
Influence of Learning Rule on Representation Dynamics in Wide Neural Networks, *Bordelon*, Pehlevan. *ICLR* 2023. **notable-top 25%**
The Onset of Variance-Limited Behavior for Networks in the Lazy and Rich Regimes, Atanasov*, *Bordelon**, Sainathan, Pehlevan. *ICLR*, 2023.
Self-Consistent Dynamical Field Theory of Kernel Evolution in Wide Neural Networks *Bordelon*, Pehlevan. *Neurips* 2022 + JSTAT 2023 Machine Learning Special Issue.
Neural Networks as Kernel Learners: The Silent Alignment Effect Atanasov* *Bordelon**, Pehlevan *ICLR*, 2022
Capacity of Group-invariant Linear Readouts from Equivariant Representations, Farrell*, *Bordelon**, Trivedi, Pehlevan, *ICLR*, 2022
Learning Curves for SGD on Structured Features, *Bordelon*, Pehlevan, *ICLR*, 2022
Out-of-Distribution Generalization for Kernels, Canatar, *Bordelon*, Pehlevan, *Neurips* 2021
Efficient Online Inference for Nonparametric Mixture Models, Shaeffer, *Bordelon*, Khona, Pan, Fiete *Uncertainty in Artificial Intelligence* 2021
Spectrum Dependent Learning Curves in Kernel Regression and Wide Neural Networks, *Bordelon*, Canatar, and Pehlevan, *International Conference of Machine Learning (ICML)*, 2020.

JOURNAL PUBLICATIONS

Population Codes Enable Learning from Few Examples By Shaping Inductive Bias *Bordelon*, Pehlevan, *eLife.* 2021. .
Spectral Bias and Task-Model Alignment Explain Generalization in Kernel Regression and Infinitely Wide Neural Networks, Canatar, *Bordelon*, Pehlevan, *Nature Comms.* 2021.
Dispersive optical model of Pb-208 generating a neutron-skin prediction beyond the mean field, Atkinson, Mahzoon, Keim, *Bordelon*, Pruitt, Charity, and Dickhoff, *Phys. Rev. C*, 2020
Pre-Synaptic Pool Modification (PSPM): A supervised learning procedure for recurrent spiking neural networks, Bagley, *Bordelon*, Moseley, Wessel, *PLOS ONE*, 2020

UNDER REVIEW

Infinite Limits of Multi-head Transformer Dynamics, Bordelon, Chaudhry, Pehlevan 2024.
Integration of flexible nanoelectronics with artificial intelligence-driven circuits for long-term stable and self-programmable brain decoding, Guo, Zhao, Tang, *Bordelon*, Partarrieu, Lee, Pehlevan, Liu, 2021. Under Review at *Nature Machine Intelligence*.

PRESENTATIONS AND INVITED TALKS

Analytical Connectionism School DMFT Exercises (link), Flatiron Institute and CCN, 2024. (*Math and coding exercises here*)
Mean Field Limits of Learning Dynamics in Neural Networks, ICTP Junior Theoretical Neuroscientist Workshop 2024 (*recording here*).
Depthwise Hyperparameter Transfer: Dynamics and Scaling Limit, Mathematics of Modern Machine Learning Workshop Neurips 2023 (Oral)
Mean Field Approaches to Deep Learning Dynamics, Van-Vreeswick Theoretical Neuroscience Seminar 2023 (Invited Talk)
Mean Field Theory of Neural Network Learning Dynamics at Large Width and Depth, Analytical Approaches to Neural Network Dynamics 2023 (Invited Talk)
Insights from Deep Learning Theory for Neuroscience Cosyne 2023 (Co-organized Workshop)
Dynamical Field Theory of Feature Learning in Wide NNs, DeepMath 2022 (Poster)
Field Theory of Deep Feature Learning Two Sigma Research Symposium 2022 (Invited Talk)
Infinite Neural Networks: Lazy and Rich Regimes Google Brain 2022 (Invited Talk)
Statistical Mechanics of Kernel Regression and Wide Neural Networks, APS 2022
When are Neural Networks Kernel Learners? APS 2022.
Structured Neural Codes Enable Generalization Through Code-Task Alignment, APS 2022.
How many objects can be classified under all possible views?, Cosyne 2022
Learning Curves for SGD on Structured Features, Deepmath 2021 (Invited Talk)
Neural Populations Learn from Few Examples through Code-Task Alignment, Cosyne 2021.
Statistical Mechanics of Generalization in Kernel Regression Deepmath 2020

AWARDS

Google PhD Fellowship Award	*August 2023-Present*
NSF Simons Harvard Center Quantitative Biology Fellowship	*June 2021-2022*
McKelvey School of Engineering Valedictorian	*May 2019*
Nishi Luthra Senior Prize in Physics	*May 2019*

TEACHING EXPERIENCE

Teaching Assistant for Analytical Connectionism Summer School	*Summer 2024.*
Teaching Fellow for Introduction to Applied Math	*Spring 2022*
Teaching Fellow for Neural Computation (Certificate of Distinction)	*Fall 2020*
Teaching Assistant for Engineering Math	*August 2017-May 2018*

PROGRAMMING LANGUAGES

Strong Proficiency in Python (numpy, scipy, JAX, Pytorch, etc). Proficient in Matlab and C++.