Alexander Atanasov

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Education

Harvard University Aug 2018 - Aug 2024
PhD., M.S. Theoretical Physics, advised by Prof. Cengiz Pehlevan (Applied Math) GPA: 4.00
- Studied deep learning and neural scaling laws, leveraging high dimensional statistics, random matrix theory, and extensive empirics.
- Published in top machine learning venues (NeurIPS, ICML, ICLR).
- Extensive prior work in string theory and quantum field theory (4+ papers).

Yale University Graduated: May 2018
M.S. and B.S. Mathematics, B.S. Physics—*magna cum laude, Phi Beta Kappa* GPAs: Physics 3.97; Math 4.00; Total 3.92
- **Undergrad Coursework in:** Systems Programming, Algorithm Design, Modern Combinatorics, Game Theory
- **Graduate Coursework in:** Statistical Physics, Algebraic Geometry, Representation Theory, Quantum & Conformal Field Theory

Experience

Jane Street – Quantitative Research Intern, PhD May – Aug 2023
Machine Learning in Financial Markets *New York, NY*
- Quantitative research in financial markets leveraging modern machine learning and statistical methodologies. Given return offer.

Protein Evolution – Senior Scientist, AI Dec 2021 – May 2023.
Deep Learning for Protein Discovery - Consultant while in PhD *Remote*
- Applied **transformer language models to discover novel structure** in protein sequences for industrial application.

Quantum Si – Consultant, Machine Learning Mar – Dec 2022
Time Series for Proteomic Data - Consultant while in PhD *Remote*
- Achieved **high accuracy in extracting sparse signal** from noisy time series using random kernel methods.
- Combined **Kalman filters and clustering methods to effectively detect and segment binding events** in a protein sequencer.

Google – Software Engineering Intern May – Aug 2017
Machine Learning and Computer Vision – Supervised by Dr. Nhat Vu *Mountain View, CA*
- Achieved a **6x speedup** in face detection and recognition for TensorFlow model on embedded devices **without drop in accuracy**.

Perimeter Institute for Theoretical Physics – Visiting Researcher May 2016 – Jul 2018
Sparse Grid Finite Element Methods for Relativistic Astrophysics – Supervised by Dr. Erik Schnetter *Waterloo, ON*
- Wrote Julia package reducing # elements in finite-element solver from $O(N^D)$ **to** $O(N \log^{D-1} N)$ in dimension D.
- **Successfully simulated 6D wave equations**. Posted result to arXiv.

Yale School of Medicine, N3 Division – Undergraduate Researcher Dec 2015 – May 2018
Working Memory in Recurrent Neural Networks – Supervised by Dr. John Murray *New Haven, CT*
- **Built popular TensorFlow package** for modeling neural behavior in cognitive tasks via RNNs. **Published results.**

Selected Publications

For a full up-to-date list of all 15+ papers, see my Google Scholar.

A Dynamical Model of Neural Scaling Laws Jan 2024
B. Bordelon, **A. Atanasov**, and C. Pehlevan. ICML 2024.

Neural Networks as Kernel Learners: The Silent Alignment Effect Nov 2021
A. Atanasov, B. Bordelon and C. Pehlevan. ICLR 2022. Won 3rd place at Citadel Securities' inaugural PhD Summit.

Conformal Block Expansion in Celestial Conformal Field Theory Apr 2021
A. Atanasov, W. Melton, A. Raclariu, and A. Strominger. Physical Review D.

Complex Analysis: In Dialogue Oct 2013
In high school, independently published a 500-page textboook on complex analysis. Made for-sale on Amazon.

Honors and Awards

- **Fannie & John Hertz Fellowship** – One of 11 students chosen from 850 to receive full graduate support ($250k) over 5 years 2019
- **DoD Graduate Fellowship (NDSEG)** – One of 200 students chosen from 3,000 to receive full graduate support for 3 years 2019
- **NSF Graduate Fellowship** (declined) – One of 2k students chosen from 12k to receive full graduate support for 3 years 2019
- **Howard L. Schultz Prize in Physics** – To an outstanding senior in physics at Yale 2018
- **Mellon Grant Recipient** – To attend international conference on the Langlands program as part of senior thesis 2018
- **William L. Putnam Mathematics Competition** – Taken twice. Top 300 nationally both times. 2016, 2018

Skills

Programming: *(most to least experience)* Python, Julia, Mathematica, Java, C, C++, MATLAB, Excel
Tools: JAX, PyTorch, TensorFlow, NumPy, Pandas, SkLearn, LightGBM. Strong background in data science & HPC.
Teaching: Grad School: "Inference, Info Theory, Stat Mech, and Learning" (for S Ramanathan), Deep Learning & Databases
Undergrad: Representation Theory, Abstract Algebra, Complex Analysis, Vector Analysis, Deep Learning
Mentor and Lecturer for Perimeter Institute's ISSYP (lecture video), SRS Bulgaria, and MIT's RSI Program (twice).
Languages: English (native), Bulgarian (native), Latin (read and write, graduate coursework)
Other: Frequent public speaker and lecturer. Classically trained guitarist with a passion for Bach. Last but not least, LaTeX.