Alexander Atanasov

Email: atanasov@g.harvard.edu Website: ABAtanasov.com
Github: ABAtanasov Orcid: 0000-0002-3338-0324

Education

Harvard University Aug 2018 - May 2024 (Expected)
PhD., M.S. Theoretical Physics, advised by Prof. Cengiz Pehlevan (Applied Math) GPA: 4.00
- Work on deep learning, kernel machines, and Bayesian methods. Published in top machine learning venues.
- Extensive prior work (4+ papers) in string theory.

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 and Organization, Algorithm Design, Modern Combinatorics, Game Theory
- **Graduate Coursework in:** Algebraic Geometry, The Langlands Program, Quantum & Conformal Field Theory, Statistical Physics

Experience

Protein Evolution – Senior Scientist, AI Dec 2021 - Pres.
Deep Learning for Protein Discovery - Consultant while in PhD *Remote*
- Applied **transformer language models to discover novel structure** in protein sequences for industrial application.
- Consulted for QuantumSi. Achieved **top accuracy on extracting sparse signal** from noisy time series using random kernel methods.

Google – Software Engineering Intern May – Aug 2017
Machine Learning and Computer Vision – Supervised by Dr. Nhat Vu *Mountain View, CA*
- Ported TensorFlow models to run on embedded devices for real-time face detection and recognition on video streams.
- Achieved a **6x speedup** in run-through time for inference vs. the start of the summer, **without loss in accuracy**.

Perimeter Institute for Theoretical Physics – Visiting Researcher May 2016 – Jul 2018
Sparse Grid Discretization for Relativistic Astrophysics – Supervised by Dr. Erik Schnetter *Waterloo, ON*
- One of seven students selected internationally to participate in Perimeter's undergraduate program.
- Wrote Julia package for solving partial differential equations in higher dimensions. Published results to arXiv.
- **Obtained speedup from $O(N^6)$ to $O(N \log^5 N)$** in 6D at resolution N along each axis.

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.

MITRE Corporation – Student Researcher Jun 2014 – Jan 2016
Multi-scale Modeling of Carbon Nanomaterials – Supervised by Dr. James Ellenbogen *McLean, VA*
- Developed electrostatics-based model for quantum capacitance of carbon nanomaterials. Published results.

Select Publications

For a full up-to-date list of all 10+ papers, see my Google Scholar.

Neural Networks as Kernel Learners: The Silent Alignment Effect Nov 2021
- In collaboration with 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
- In collaboration with W. Melton, A. Raclariu, and A. Strominger. Physical Review D

Bootstrapping the Minimal 3D Superconformal Field Theory Jul 2018
- In collaboration with A. Hillman and D. Poland. Journal of High Energy Physics

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
- **James Mills Pierce Fellowship** – Full support for first-year graduate study in physics at Harvard 2018
- **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
- **United States Physics Olympiad Semifinalist** 2013

Skills

Programming: *(most to least experience)* Python, Julia, Mathematica, C, C++, Java, MATLAB, Excel
Tools: JAX, TensorFlow, PyTorch, NumPy, SkLearn, Pandas, SQL. Strong background in data science & HPC.
Teaching: TA for Graduate Deep Learning & Databases (both at Harvard & Yale)
Representation Theory, Abstract Algebra, Complex Analysis, Vector Analysis.
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: Strong background in statistical consulting, mentoring, public speaking, and lecturing. Last but not least, LaTeX.