

SAMUEL HARSHE

Researcher / Eventual Philosophy PhD Applicant / sharshe.org

EDUCATION

BA in Mathematics and Philosophy.
Yale University, New Haven, Connecticut.

September 2020 - May 2024.

RESEARCH EXPERIENCE

Researcher. February - August 2024.
Gerstein Lab, Yale University, New Haven, Connecticut (Hybrid).

- Developed E(3)-equivariant message-passing graph neural network (EGNN) with PyTorch Geometric to predict properties of organic molecules in QM9.
- Assisted computer science PhD candidate Yunyang Li in paper on EGNNs.
- Studied EGNNs and Geometric and Categorical Deep Learning more generally.

Research Intern. May - August 2023.
NASA Aeronautics Research Institute, Mountain View, California (Remote).

- Led research and published two papers on drone medical deliveries in low-and moderate-income countries.
- Gained close familiarity with current topics in human development, global healthcare, drone technology, and aeronautic regulation.

PUBLICATIONS

Yunyang Li, Zaishuo Xia, Lin Huang, Xinran Wei, Han Yang, **Sam Harshe**, Zun Wang, Chang Liu, Jia Zhang, Bin Shao, Mark B. Gerstein. "Enhancing the Scalability and Applicability of Kohn-Sham Hamiltonians for Molecular Systems." *ICLR* (2025).

Harshe, Samuel, Gavin Lindsay Trostle, and Ryan Teoh. "Drone medical deliveries in low and moderate income countries: insights from Vanuatu, Malawi, Rwanda, and Ghana." *ResearchGate* (2023).

Harshe, Samuel, Gavin Lindsay Trostle, and Ryan Teoh. "Implementation of a drone delivery system for healthcare in Mexico: international precedents and domestic considerations." *ResearchGate* (2023).

PERSONAL STATEMENT

Interested in approaching machine learning research with more rigorous mathematics and philosophy than are currently popular. Equally comfortable programming, doing math and physics, and applying interest in philosophy and literature through abstract critical thinking. Elite work ethic.

Planning to pursue research concurrently with a career in professional soccer, then (tentatively) applying for a PhD in philosophy.

PROGRAMMING

- Python, including PyTorch, PyTorch Geometric, Weights & Biases, NumPy, pandas, and Matplotlib (intermediate), HuggingFace, LangChain, BeautifulSoup, Seaborn, PyMC3, and XGBoost (intermediate).
- HTML/CSS/JS/Flask (intermediate).
- Git and standard version control tools.
- Standard shell scripting and command line tools.

TECHNICAL COURSES

Taken at Yale:

Senior Seminar in Mathematics (lectured and submitted paper on matrix Lie theory); Vector Analysis and Linear Integration on Manifolds; Ordinary Differential Equations; Computability and Logic; Analysis 1; Linear Algebra with Proofs; Advanced Linear Algebra; Discrete Mathematics; Mathematical Logic; Set Theory; Renewable Energy; Classical Mechanics; Philosophy of Mathematics; Philosophy of Language.

Taken independently online:

Neural Networks: Zero to Hero (Andrej Karpathy); LLMOps (Erwin Huizenga); Open Source Models with Hugging Face (Maria Khalusova, Marc Sun and Younes Belkada); Pretraining LLMs (Sung Kim and Lucy Park); Reinforcement Learning from Human Feedback (Nikita Namjoshi); Finetuning Large Language Models (Sharon Zhou); LangChain for LLM Application Development (Harrison Chase and Andrew Ng); Improving Accuracy of LLM Applications (Sharon Zhou and Amit Sangani); Introduction to On-Device AI (Krishna Sridhar); Red Teaming LLM Applications (Matteo Dora and Luca Martial); Building Applications with Vector Databases (Tim Tully); MIT Introduction to Machine Learning (Alexander Amini and Ava Soleimany); Machine Learning (Andrew Ng); Analysis of Algorithms (Steven Skiena); Quantum Computing for the Very Curious (Michael Nielsen).

SOCCER

Yale University Men's Soccer. August 2020 - November 2023.
Started every game, averaging 89 minutes, for Ivy League Tournament champion and NCAA second-round team in 2023. Academic All-District. Gerald Ford Scholar Athlete.

Loudoun United FC. Summers 2021 - 2023.
Trained with professional soccer team Loudoun United, DC United's second team, in the USL Championship (US 2nd division).

Hartford Athletic FC. February - March 2025.
Trained with professional soccer team Hartford Athletic, in the USL Championship (US 2nd division).