# SAMUEL HARSHE

Undergraduate / Eventual Mathematics or Philosophy PhD Applicant / sharshe.org

## EDUCATION

BA in Mathematics and Philosophy. Expected May 2024.
Yale University, New Haven, Connecticut.

## RESEARCH EXPERIENCE

Undergraduate Research Assistant. February 2024 - Present.
Gerstein Lab, Yale University, New Haven, Connecticut.
• Developed E(3)-equivariant message-passing graph neural network (EGNN) with PyTorch Geometric to predict properties of organic molecules in QM9.
• Assisting computer science PhD candidate Yunyang Li in project on EGNNs.
• Studying mathematics of EGNNs.

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

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).

## RESEARCH INTERESTS & PERSONAL STATEMENT

Generally interested in mathematics and philosophy and fundamental work in applying them. Currently especially interested in machine learning, particularly the study of inductive biases that allow models to respect fundamental insight into the fields on which they are trained. Planning to pursue research concurrently with a career in professional soccer, then applying for a PhD in mathematics or philosophy.

## PROGRAMMING

• Python, including PyTorch, PyTorch Geometric, Weights & Biases, NumPy, pandas, Matplotlib, and Beautiful Soup (intermediate/advanced).
• HTML/CSS/JS (intermediate).
• Mathematica (beginner/intermediate).
• Git and command line tools.

## TECHNICAL COURSES

Taken at Yale:
• Mathematical Topics (senior seminar; lectured and submitted paper on 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).
• MIT Introduction to Machine Learning (Alexander Amini and Ava Soleimany).
• Machine Learning (Andrew Ng).
• Analysis of Algorithms (Steven Skiena).
• Introduction to Financial Markets (Robert Shiller).
• Quantum Computing for the Very Curious (Michael Nielsen).

## SOCCER

Yale University Men's Soccer. August 2020 - November 2023.
Started all 20 games, averaging 89 minutes, for Ivy League Tournament champion and NCAA second-round team in 2023.

Loudoun United FC. Summers 2021 - 2023.
Trained with professional soccer team Loudoun United, DC United's second team (US 2nd division), and occasionally also with DC United (US 1st division).