# Jason Rute

**Greater Boston Area, USA**

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www.github.com/jasonrute

## Skills

**Programming** Python (NumPy, Pandas, Scikit Learn, Keras/TensorFlow), Scala, SQL, functional programming, Git, AWS, Lean theorem prover, Coq

**Machine Learning** Transformers, graph neural networks, Bayesian inference (MCMC, hierarchical models), deep reinforcement learning, natural language processing

## Professional and Academic Experience

**MIT-IBM Watson AI Lab, Cambridge MA** Postdoctoral Research Scientist Nov 2021–Present

- Developed state-of-the-art neural theorem-proving model for the Coq proof assistant
- Improved large language models for generating code and tool use

**CIBO Technologies, Cambridge MA** Lead Data Scientist Apr 2018–Nov 2021

- Developed Scala code to improve an in-house Bayesian MCMC model calibration engine
- Managed a cross-functional team of software engineers, data scientists, and agronomists to create a software library of statistical agricultural data for production use
- Devised statistical methods to use this agricultural data to improve crop model performance

**Pennsylvania State University, University Park PA** Research Associate Sep 2013–Jun 2017

- Developed a theory of algorithmic randomness for capacities solving two open math questions
- Coordinated a large multi-section calculus course, overseeing other instructors
- Taught calculus and logic courses, with student evaluation scores well above department average

**University of Hawaii, Manoa HI** Junior Researcher Feb 2013–Jul 2013

- Researched algorithmically random Brownian motion and computable martingales

**Carnegie Mellon University, Pittsburgh PA** Graduate Teaching Assistant Aug 2008–Dec 2012

- Investigated theoretical limitations of simulating exchangeable random graph networks
- Studied the convergence of random points within time series with computable distributions

## Selected Projects

**AI for Theorem Proving**

- Developed a novel graph neural network for Coq prover which learns to incorporate new definitions not seen during training. SoTA results. Accepted to ICML. (Paper: arXiv:2401.02949)
- Extracted a large dataset (github.com/jasonrute/lean_proof_recording) of tactic proof steps from the mathlib library of Lean. Collaborated with OpenAI to train a language model on this data, resulting in a proof suggestion tactic (github.com/jesse-michael-han/lean-gptf) and automatic proof discovery. Accepted to ICLR. (Paper: arXiv:2102.06203, Talk: youtube:EXpmbAfBNnw)

**Formal Theorem Proving** Formally verified mathematics in HOL-Light/OCaml as part of the Flyspeck project (github.com/flyspeck) to formally check Tom Hale's proof of the Kepler conjecture

## Education

**Carnegie Mellon University, Pittsburgh PA** Sep 2008–Aug 2013

Ph.D. in Mathematical Sciences

M.S. in Mathematical Sciences

**University of Wisconsin, Madison WI** Sep 1999–Aug 2004

B.S. in Mechanical Engineering, Mathematics, and Philosophy

## Papers, Talks, and Patents

**15 papers** covering AI, Mathematics, and Computer Science–including two in top AI conferences.
**30+ talks** including an invite to speak at the 2025 Joint Math Meetings on topic of AI for Math.
**2 patents.** US Patent 10,477,756 B1. US Patent 10,498,888.