Aaron Trowbridge

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Education

Syracuse University

- B.S. in Physics, with distinction (3.6 GPA); B.S. in Mathematics (3.8 GPA) — Sep 2015 – Dec 2020
- One Semester as Graduate Physics Student and TA (4.0 GPA) [atypical situation due to COVID]

Experience

Private Tutor — Mar 2021 – Present

- Taught subjects including: physics, statistics, calculus, and programming in python

Teaching Assistant (Syracuse Physics Department)

- One semester as graduate TA: introductory mechanics - under Prof. Walter Freeman — Jan 2021 – May 2021
- Four semesters as undergrad TA: astronomy, mechanics, E & M, computational physics — Jan 2019 – Dec 2020

Research Assistant (Syracuse Physics Department)

- Lattice quantum gravity group, under Prof. Jack Laiho — May 2020 – May 2021
- Plourde Research Lab (superconducting quantum devices), under Prof. Britton Plourde — May 2018 – Dec 2020

Research & Projects

Personal Website and Blog

- Used the Hugo static website framework to develop my personal website and blog; learning HTML, CSS, Markdown, Go, and (just a little) JavaScript in the process.
- I have written blog posts about interactive web-based plotting with Julia, quantum field theory, and quantitative finance, as well as other topics, and plan on writing more about data science and machine learning in the near future.

Deep Generative Models

- Implemented generative adversarial networks for image generation from scratch in Julia using the Flux.jl machine learning library. Code can be found by clicking here and a blog post here.
- Implemented various variational autoencoder models in python using the PyTorch library.
- Read various papers about optimized generative techniques, including β-VAE, Wasserstein GAN/VAE, and Riemannian Manifold Hamiltonian Monte Carlo sampling.
- Currently researching other generative techniques, e.g. flow based models using gauge equivariant layers to sample configurations for lattice gauge theory (a technique for simulating quantum field theories).

Monte Carlo Methods for Lattice Quantum Gravity

- Worked with the lattice gravity group to develop, implement, and test a novel rejection free variant of the Metropolis algorithm.
- MCMC methods, i.e. simulation of a stochastic process to estimate expectation values, are extremely useful in a wide range of subjects including machine learning, quantitative finance, and risk analysis.
- A recorded talk I gave can be found on youtube by clicking here and a github repo can be found here.

Quantum Computer Simulation

- As final project for a quantum information theory course, I implemented a custom quantum gate programming language and virtual quantum processor, in Julia. A github repo can be found here.
- Quantum computation is becoming popular paradigm in various data analytical fields, where it can be used to efficiently calculate expectation values and assist with machine learning tasks.

Additional Information

Programming Languages:	Julia, Python, C, C++, Haskell, Bash, Git, HTML, CSS, Markdown, LaTeX
Operating Systems:	Linux (Arch, Manjaro i3), MacOS, Windows 10, Arduino, Visual Studio Code
Hobbies:	Reading, Chess, Snowboarding, Surfing, Skateboarding, Horseback Riding, Hiking