SAM YU

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EXPERIENCE

Graduate Researcher
Sept 2022 - April 2024

University of Alberta - Group of Prof. Massimo Boninsegni — Edmonton, Alberta, Canada

- Researched the low-temperature physics of superfluid helium-4 adsorbed onto graphene substrate, advancing current theoretical understanding of quantum fluids
- Designed and executed large-scale C++ quantum Monte Carlo (QMC) simulations on computing clusters
- Estimated statistical errors in averages of correlated QMC data through renormalization group method
- Developed parallelized bootstrap & MCMC routines to statistically model superfluid response, published results

Undergraduate Researcher
May - Aug 2021

University of Waterloo - Group of Prof. Andrea Scott — Waterloo, Ontario, Canada

- Expanded Seq2Seq model forecasting domain 10x (to entire Canadian Arctic) by optimizing memory usage during training
- Engineered infrastructure for containerizing and deploying new models into forecasting webpage hosted on AWS
- Developed algorithm for extracting freeze-up/break-up dates from sea ice concentration maps

Undergraduate Researcher
Sept - Dec 2020

University of Waterloo - Group of Prof. Vasudevan Lakshminarayanan — Waterloo, Ontario, Canada

- Researched the relationship between retinal disorders and fractal dimension of the retinal vasculature, and published the results
- Derived confidence intervals on effect size for different disease categories by applying statistical models to data pooled from available studies

Numerical Environmental Modeller
Jan - April 2020

Environment and Climate Change Canada — Dorval, Quebec, Canada

- Developed web interface using Django/Python/Javascript for comparing tidal water levels with harmonic analysis reconstructions, and displaying interactive maps
- Integrated postprocessing framework with numerical storm surge solver for detiding and computing power spectra/statistics

Software Analyst Intern
Jan - April, Sept - Dec 2019

Thales Rail Signaling Solutions — Toronto, Ontario, Canada

- Created Python tool that connects to system hardware and plots live data during train operation, allowing efficient diagnosis of issues
- Developed Python scripts to automate fixing of errors in Doxygen documentation generation spanning multiple train projects, reducing completion time by 90%
- Executed software integration tests using simulation software/hardware lab, and performed test analysis/verification of data logs

PROJECTS

Identifying Phase Transitions of Confined 2D Liquid Crystals
2022

- Rewrote Monte Carlo simulation package from scratch in C++, achieving a 200% simulation speedup
- Combined large scale parameter-sweeps with unsupervised learning (PCA, DBSCAN, etc..) to successfully identify critical points
- Developed computational geometry algorithms for detecting extended-object collisions, aided by calculations in Mathematica

Quantum State Tomography with Recurrent Neural Networks
2021

- Reconstructed the ground state of a quantum XY spin chain with up to 30 spin sites using an RNN in PyTorch
- Incorporated physical symmetries into recurrent neural network, demonstrating significant speedup during training

EDUCATION

University of Alberta
Sept 2022 - April 2024

MSc. in Physics - grade: 4.0/4.0

University of Waterloo
Sep 2017 – Sept 2022

BSc. in Honours Mathematical Physics, Co-op program - grade: 84/100

SKILLS

Programming: Python, C++, MATLAB, SQL, Mathematica

Software tools: Linux, HPC, Git, Jupyter, PyTorch, Docker, SKLearn, NumPy, Pandas

Statistical methods: Machine learning, Monte Carlo methods