

Researching quantum information, numerical optimization, deep learning, and optimal transport.

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| EDUCATION | University Of Illinois, Urbana-Champaign | Urbana, IL |
| | <i>B.S. Physics, Specialization in Mathematical Physics</i> • <i>Graduate:</i> High-Dimensional Probability, Dynamical Systems, Measure Theory, Representation Theory • <i>Undergraduate:</i> Machine Learning Theory, Data Structures & Algorithms, Quantum Information Processing, Electromagnetic Fields, Classical Mechanics, Special Relativity | 2023 – 2027 (expected) |
| TALKS & POSTERS | Approximating Tensor Contractions with Annealed Importance Sampling, | 08.2025 |
| | Poster developed for QSim 2025, New York, NY | |
| | • Implemented Annealed Importance Sampling (AIS) with Markov Chain Monte Carlo (MCMC) to efficiently approximate tensor network contractions. • Analyzed algorithmic accuracy and convergence behavior across tensor difficulties, highlighting AIS advantages over uniform sampling in challenging regimes. • Identified minimal mixing requirements for optimal AIS performance, paving the way toward scalable contraction algorithms for quantum simulation. | |
| | Quantum Circuit Volume for Graph Models, Illinois Math Lab Open House | 12.2024 |
| | Poster developed with the <i>Illinois Mathematics Lab</i> | |
| | • Developed quantum circuits simulating birth-death process graph channels with optimized resource scaling using EQ_k , P_k , and RY gates. • Established $O(\sqrt{n}) \leq l(\Phi) \leq O(n)$ bounds on simulation cost via Lipschitz complexity and Kraus rank methods. • Optimized circuit depth ($O(n \log n)$) and ancilla space ($O(n)$) under locality constraints, presenting a general framework for graph channel simulation. | |
| RESEARCH | Computation & Neurodynamics Lab Urbana, IL | 01.2025 – Present |
| | • Simulating heterogeneous FitzHugh–Nagumo neuron networks under noisy time-varying inputs; analyzing intrinsic timescale covariances and applying neural-symbolic regression to uncover interpretable governing equations. • Deriving Lie brackets between closure ODEs and infinitesimal generators to identify symmetry-preserving perturbations and neural code invariants via geometric and algebraic methods. • PI: Dr. Matthew Singh | |
| | Lab for Parallel Numerical Algorithms Urbana, IL | 09.2024 – Present |
| | • Collaborating on the development of a novel Monte Carlo algorithm for contracting general tensor networks, with applications to quantum circuit simulation. • Investigating randomized methods such as TensorSketch for efficient estimation of trace-like quantities in large-scale tensor networks. • PI: Dr. Edgar Solomonik | |
| | Polymer Physics Theory Group Urbana, IL | 08.2024 – 01.2025 |
| | • Performed computational simulations of free-draining bottle brush polymers with explicit side-chains using a coarse-grain model • Refactored and improved coarse-grain model using stochastic differential equations and brownian motion results. Implemented the model in C. | |

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| INDUSTRY | Space Dynamics Laboratory Ionospheric Analyst Intern 05 - 08.2024 <ul style="list-style-type: none"> Developed a Python scraper to expedite the data collection of NICT ionograms to 600+ ionograms downloaded per hour. Researched numerical analysis methods to improve the noise reduction of ionograms using various filtering methods. Implemented filters in Python and Julia and ran statistical analysis (PSNR, MSE, SSIM) to compare efficiencies. Researched methods to improve automatic ionogram scalars using deep learning architecture (CNNs) and techniques. |
| LEARNING | Independent Study– Neural Operators for Neuroscience, 08.2025–Present with Dr. Matthew Singh QSim Summer School – NSF RQS (hosted at IBM, NYC), 08.2025 Lectures covering theoretical and experimental perspectives on quantum error correction, simulation, and algorithms. Uncertainty Quantification & Machine Learning for Physical Systems – 05.2025 IMSI hosted at the University of Chicago, Lectures on Bayesian inference, sensitivity analysis, and physics-informed neural networks, with applications to complex physical systems. LPNA Reading Group – University of Illinois, 01.2025 – Present Weekly discussions on random matrix theory, graph partitioning, tensor network applications, and quantum error correction. |
| OUTREACH | Membership Director SIAM @ University of Illinois, 05.2025 - Present SIAM@UIUC executive officer. Responsibilities include managing membership status, involvement, and recruitment. |
| PROFESSIONAL AFFILIATIONS | Society of Industrial & Applied Mathematics, 05.2025 - Present Member |
| SKILLS | Programming: Python, C/C++, Java, Julia, Mathematica Scientific Computing: Numerical simulation, stochastic modeling, time series analysis, statistical signal processing, sliding window statistics, ODE/SDE solvers Libraries & Frameworks: NumPy, SciPy, Pandas, Matplotlib, scikit-learn, SymPy, Jupyter Tools & Environments: Git, \LaTeX , Conda, Shell, Jupyter |