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Aniket Deshpande

My interests lie in mathematical and statistical methods for quantum information, namely tensor network methods, random matrix theory, and representation theory. I also enjoy learning about mathematical finance and theoretical neuroscience.

Education

University Of Illinois, Urbana-Champaign — Urbana, IL

B.S. Physics, Specialization in Mathematical Physics — 2023 - 2027 *(expected)*

- *Relevant Coursework:*

  Undergraduate: Quantum Mechanics I, Electromagnetic Fields I, Classical Mechanics I & II, Special Relativity & Mathematical Methods, Stochastic Processes, Real Analysis, Differential Equations, Abstract Linear Algebra

  Graduate-level: Differentiable Manifolds I, Real Analysis, Representation Theory for Quantum Information, Quantum Information Processing

- Minors in Mathematics and Scientific Computing

Talks & Posters

Quantum Circuit Volume for Graph Models, *Illinois Math Lab Open House* *12.2024*

Poster developed through the *Illinois Mathematics Lab*; available on website.

Research

Computation & Neurodynamics Lab | Urbana, IL — 01.2025 - Present

- Simulating heterogeneous networks of FitzHugh-Nagumo neurons under noisy time-varying inputs; analyzing sliding window covariances between intrinsic timescales and membrane potential dynamics to uncover interpretable neuron-level models.
- Applying neural-symbolic regression to extract compact, interpretable equations describing neuron activity as a function of internal parameters and shared time-varying inputs.
- PI: Dr. Matthew Singh

Lab for Numerical Parallel 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`.

Learning

LPNA Reading Group, *University of Illinois* *01.2025 – Present*

Weekly discussions on various literature in random matrix theory, graph partitioning, tensor network applications, and quantum error correction.

QSim Summer School, *NSF RQS (hosted at IBM, NYC)* *08.2025*

Attending lectures covering theoretical and experimental perspectives on quantum error correction, simulation, and state tomography.

Industry

Space Dynamics Laboratory | Ionospheric Analyst Intern 05 - 08.2024

- 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 scalers using deep learning architecture (CNNs) and techniques.

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