Rishi Leburu

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Education

Emory University Atlanta, GA
Bachelor of Science in Applied Mathematics, GPA: 4.0 *Aug. 2023 – May 2026 (expected)*

Experience

Oak Ridge National Laboratory Oak Ridge, TN
Research Intern, Mentor: Dr. Guannan Zhang *Summer 2025*

- Developed stochastic optimal control (SOC) approaches using conditional diffusion models to solve Bayesian inverse problems
- Researched hybrid methods combining diffusion posterior sampling with SOC techniques
- Implemented multiple SOC solvers, including adjoint matching, finite element method, neural ODEs, and neural-FBSDE solvers
- Designed reproducible experiments varying in dimensionality to test the performance of our solver against baseline methods

Emory University REU - Computational Mathematics for Data Science Atlanta, GA
Undergraduate Researcher, Advisor: Dr. Deepanshu Verma *Summer 2024*

- Investigated methods to enhance variational autoencoders using conditional normalizing flows on the posterior
- Built and trained VAE models using Pyro with PyTorch to better capture complex multimodal distribution objects for the posterior and prior
- Utilized LaTeX, Beamer, Markdown, Git, and VSCode to document and share research results
- Presented a poster at the Joint Mathematics Meetings (JMM) 2025 Undergraduate Poster Session

Publications and Papers in Progress

1. (in preparation) **R. Leburu**, L. Nurbekyan, & L. Ruthotto. *Differentiating through Stochastic Differential Equations: A Primer.*
2. (in preparation) **R. Leburu**, L. Nurbekyan, L. Ruthotto, & G. Zhang. *Matching Algorithms for High-Dimensional Stochastic Optimal Control.*
3. (in preparation) J. Solomon, **R. Leburu**, M. Li, & M. Chung. *Variational Sparse Paired Autoencoders for Inverse Problems.*

Research Interests

Generative modeling, control theory, scientific machine learning, inverse problems, numerical analysis, variational inference

Technical Skills

Languages: Java, Python, C#, R, HTML/CSS
Scientific Computing & Frameworks: Pytorch, Pyro, FEniCS, NumPy, SciPy, Matplotlib
Tools: Git, MATLAB, VS Code, LaTeX, job scheduling (SLURM)

Relevant Coursework

Graduate: Topics in Computational Mathematics (Generative Modeling), Matrix Analysis, Numerical Analysis (*in progress*), Real Analysis (*in progress*), Numerical Partial Differential Equations (*in progress*)
Undergraduate: Mathematical Statistics, Nonlinear Optimization, Linear Algebra (*proof-based*), Differential Equations, Partial Differential Equations (*in progress*), Data Structures and Algorithms

Awards & Honors

Chair's Achievement Award, Emory Math Department (2025)

Dean's List, Emory University (2023–2025)