Rajinder Mavi, Ph.D.

Remote (U.S. Citizen)
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Scientific Computing & Mathematical Modeling (Python)

Ph.D.-trained mathematician with 10+ years of research experience and peer-reviewed publications in mathematical physics, probability, and network models. Strong background designing and solving research-grade problems, translating formal assumptions into correct computational implementations, and validating solution paths through analytical and numerical reasoning. Experienced in scientific Python, stochastic modeling, and technical review.

Technical Skills

Scientific Computing & Programming: Python (NumPy, SciPy, scikit-learn), MATLAB; numerical linear algebra; stochastic simulation; Monte Carlo methods.

Mathematical & Statistical Methods: Stochastic processes; Markov chains & MCMC; Bayesian inference; uncertainty quantification; spectral analysis; dynamical systems; random operators; random graphs and network models.

Algorithms & Structured Reasoning: Graph algorithms; dependency modeling; DAGs; combinatorial/structured representations.

Model Validation & Reasoning: Assumption testing; sanity checks; limiting/edge-case analysis; failure-mode identification; logical and mathematical consistency verification.

Technical Communication: Graduate-level problem formulation; clear documentation of assumptions and solution paths; peer review of technical/mathematical content.

Selected Research & Engineering Projects

FLIP — Programmatic Analysis of ETL & Data Lineage (Python)

- Designed a Python system to parse and represent ETL workflows as directed graphs for dependency analysis and impact tracing.
- Developed graph-based checks to identify unused, redundant, or logically inconsistent transformations; emphasized traceability and explicit assumptions.

Mathematical Document Retrieval & Reasoning (RAG, Python)

- Built a pipeline to ingest LaTeX/Markdown papers into structured representations; designed chunking/indexing that preserves logical structure of arguments.
- Evaluated retrieval quality by verifying whether returned context supports valid solution steps; focused on ambiguity and failure cases.

Experience

Entertainment Partners — Remote
Senior Data Analyst — *Oct 2021 – Present*

- Developed Python-based analytics to support business operations, including anomaly detection in financial and payroll processes.
- Implemented clustering and rules-based methods with emphasis on interpretability and auditability.

- Built internal tooling to monitor data quality, timeliness, and consistency across systems.
- Collaborated cross-functionally to translate business questions into well-defined analytical tasks.

University of Cincinnati Cincinnati, OH
Assistant Professor *Aug 2019 – Jul 2021*

- Modeled COVID-19 dynamics using compartmental **SIR-type models**, including extensions with interacting geographic patches.
- Implemented simulation and scenario analysis in Python; performed **parameter inference/calibration via MCMC**.
- Produced policy-facing technical summaries clearly stating assumptions, limitations, and sensitivity to intervention scenarios.

Ripon College Ripon, WI
Assistant Professor *Aug 2018 – Jul 2019*

- Mentored undergraduate research in mathematical modeling and computational experimentation; emphasized verification and clear exposition.

Michigan State University Lansing, MI
Postdoctoral Research Associate *Aug 2015 – Jul 2018*

- Conducted research on correlated disorder models, localization phenomena, and spectral theory; complemented analysis with computational experiments.
- Senior personnel for NSA-funded SURIEM undergraduate program; mentored students in rigorous problem solving and scientific coding.

University of Virginia Charlottesville, VA
Postdoctoral Research Associate *Aug 2012 – Jul 2015*

- Researched quantum mechanical operators and random environments; studied perturbations and localization phenomena.

Education

Ph.D. in Mathematics, University of California, Irvine (2012)
Dissertation: *Quantum Mechanical Models with Strictly Ergodic Disorder*

M.S. in Applied Mathematics, Rensselaer Polytechnic Institute (2006)
B.S. in Mathematics, University of California, Santa Barbara (2003)

Selected Publications

- *Spectral and Dynamical Contrast on Highly Correlated Anderson-Type Models*, Annales Henri Poincaré, 2024.
- *Localization in the Disordered Holstein Model*, Communications in Mathematical Physics, 2018.
- *Ground States for Exponential Random Graphs*, Journal of Mathematical Physics, 2018.
- *Universal Gröbner Bases of Toric Ideals of Combinatorial Neural Codes*, Involve, 2021.