Madhurima Nath

madhurimanath21@gmail.com   LinkedIn: madhurimanath | GitHub: madhurima-nath

Multi-cloud certified senior data scientist with proven success in driving advanced AI and machine learning projects. Demonstrated leadership and collaboration in working with cross-functional teams to align technical solutions with business goals, delivering innovative proofs-of-concept (POCs) and scalable production-grade solutions.

SKILLS

Programming: Python, SQL, PySpark, R ‖ **CI/CD**[1]: GitLab, GitHub, Azure DevOps, BitBucket
Machine Learning & AI: NLP[2], Foundational models & LLMs[3] - LLaMA, Anthropic Claude, OpenAI GPT[4]
Tools & Frameworks: Databricks, MLflow, LangChain, Delta Lake, Apache Spark, MLOps, Delta Lakehouse
Project Management & Collaboration: Agile, Cross-functional team leadership, Stakeholder communication, Data architecture
Certifications: Azure Data Scientist Associate, Databricks Machine Learning Associate, Databricks Data Engineer Associate, AWS[5] Cloud Practitioner, GCP[6] Associate Cloud Engineer, Salesforce AI Associate, Tableau Desktop Specialist

INDUSTRY EXPERIENCE

Senior Data Scientist, Data & Analytics, Slalom, Inc., New York, NY   **Jan 2020 – Present**

- *Generative AI & Chatbot POCs*

  - Lead Data Scientist ‖ Product Discovery Chatbot POC ‖ Financial Services Client
    Led the development of a product discovery chatbot POC using LLaMA 3, LangChain agent framework, and MLflow on Databricks, reducing manual product discovery time by 6%. Defined comprehensive project scope, successfully aligned cross-functional teams for business objectives, and delivered a scalable solution within a 2-month timeline.
  - Data Scientist ‖ Interactive Q&A Chatbot ‖ Healthcare Tech Startup
    Developed an intelligent Q&A chatbot using Anthropic Claude model on AWS[5] Bedrock, designed to extract insights from complex biopharma and medtech datasets, in 6-weeks. Enhanced user interface design to improve accessibility and user satisfaction, resulting in a scalable solution for healthcare sector decision-making.
  - Data Scientist ‖ Knowledge-Based Chatbot for Sales ‖ Equipment Rental Firm
    Engineered and deployed a knowledge-based chatbot using RAG[7] with OpenAI GPT[4] and LangChain, improving document search efficiency and reducing inquiry response times by 22%, delivering the first digital innovation initiative for the client.

- *Key Data Science Projects*

  - Lead Data Scientist ‖ NLP[2] for Safety Analytics ‖ Energy & Utility Client
    Led the development & deployment of advanced NLP[2] pipelines on Azure Databricks, utilizing sentiment analysis and topic modeling to extract critical safety-related insights. Empowered the executive safety committee by providing data-driven analysis that refined organizational policies, directly contributing to enhanced employee safety and measurable reductions in incident frequency and severity.
  - Lead Data Scientist ‖ NLP[2] for e-Discovery Document Evaluation ‖ Legal Services Client
    Spearheaded the design and implementation of an advanced NLP[2]-driven architecture on AWS[5] SageMaker for e-discovery document relevance evaluation, processing millions of documents with sophisticated batch update mechanisms using human-reviewed data. Achieved significant operational efficiency by reducing manual review hours and delivering substantial cost savings for a legal services client through intelligent document processing automation.
  - Data Scientist ‖ NLP[2] for Global Procurement ‖ Consumer Packaged Goods Company
    Led the collaborative implementation of a sophisticated Delta Lakehouse solution on Azure Databricks, developing advanced NLP pipelines with MLOps best practices. Accelerated the data foundation roadmap by over a year for a global consumer packaged goods company, delivering transformative data management capabilities. Achieved significant operational efficiency by generating millions in cost savings through innovative, scalable infrastructure design that improved data consistency and performance.
  - Data Scientist ‖ Syndicated Retail Data Analysis ‖ Consumer Packaged Goods Company
    Designed and implemented advanced fuzzy matching algorithms and robust data engineering pipelines to consolidate syndicated retail data from multiple vendors (Nielsen, IRI, and Skupos) into a centralized Azure Databricks platform. Eliminated manual data reconciliation processes, achieving a 38% efficiency improvement in product comparison and analysis. Leveraged sophisticated data integration techniques to transform complex, disparate data sources into a unified, actionable intelligence repository.

---

[1]*CI/CD: Continuous Integration & Continuous Development*, [2]*NLP: Natural Language Processing*, [3]*LLM: Large Language Model*, [4]*GPT: Generative pre-trained transformer*, [5]*AWS: Amazon Web Services*, [6]*GCP: Google Cloud Platform*, [7]*RAG: Retrieval-Augmented Generation*

INDUSTRY EXPERIENCE

- *Key Data Engineering Project*

    - Data Engineer ‖ Data Migration to Salesforce ‖ Nonprofit Organization
      Successfully migrated 1TB of historical data to Salesforce through meticulously designed SQL stored procedures and optimized ETL[8] pipelines in Azure Data Factory, ensuring comprehensive data integrity and seamless integration. Implemented advanced validation techniques that significantly reduced migration errors and enhanced overall data quality for enterprise-level data management. Demonstrated expertise in large-scale data migration, transformation, and validation across cloud platforms.

- *Proposal Development & Client Engagement*

    - Business Development Contributor ‖ Revenue Growth through Proposals ‖ Various Clients
      Played a pivotal role in developing data-driven client proposals that generated an estimated $1.2M revenue boost in the New York market sales pipeline from 2023 to 2025. Proactively collaborated with sales teams to create strategic, tailored technical solutions that aligned precisely with client needs. Demonstrated exceptional business acumen by driving growth and expanding the business pipeline through innovative, targeted proposal development.

RESEARCH EXPERIENCE

Post-doctoral Research Assistant, Virginia Tech, VA   **Feb 2019 – Dec 2019**
- Formulated an innovative algorithm combining Monte Carlo simulations and perturbative methods to accurately solve NP[9]-hard problems. Applied this method to analyze food network data from the United Nations (UN) Comtrade database, achieving a $\sim 10\%$ improvement over heuristic solutions in identifying crucial communities for preventing global pestilence distribution.

Instructor of Record, Department of Physics, Virginia Tech, VA   **Aug 2018 – Dec 2018**
- Recognized as a top-performing physics instructor for creating a respectful learning environment and delivering engaging lectures, recitations, and one-on-one sessions.
- Facilitated supervised laboratory sessions, held office hours, and offered tailored support, resulting in a $\sim 15\%$ increase in student grades by improving comprehension of course materials.

Graduate Research Assistant, Virginia Tech, VA   **May 2014 – Dec 2018**
- Developed an algorithm employing Monte Carlo simulations to effectively simulate real-world epidemic outbreak scenarios, providing policymakers with improved estimates compared to existing methods which overestimate infections by $\sim 50\%$.
- Identified vulnerabilities within global food trade networks and accurately forecasted the impact of mitigating contagion conditions with $\sim 96\%$ precision to understand and mitigate the spread of pests, guiding strategic decision-making processes.

EDUCATION

Ph.D., Physics, Virginia Tech, Blacksburg, VA   Dec 2018
Dissertation: *Application of Network Reliability to Analyze Diffusive Processes on Graph Dynamical Systems*

   This work explores the effects of the structural properties of an interacting system on the outcomes of a diffusive process on realistic socio-technical systems using an efficient and generalized probabilistic measure based on Monte-Carlo simulations and graph theory techniques.

US Patent (US20210286859A1): *System, method and computer readable medium for sensitivity of dynamical systems to interaction network topology*

M.S., Physics, Virginia Tech, Blacksburg, VA   May 2017

M.Sc., Physics, Indian Institute of Technology Delhi, New Delhi, India   May 2012
Thesis: *Study of Cold Atomic Condensates by Atomic Photon Interactions*
Award: *Best Master of Science Thesis 2011-2012*

B.Sc. (Hons.), Physics, University of Calcutta, Kolkata, India   May 2010
Minors: *Mathematics and Chemistry*

---

[8]*ETL: Extract, Transform, Load*, [9]*NP: non-deterministic polynomial-time hardness*

PUBLICATIONS

- Eubank, S., **Nath, M.**, Mishra, R., and Adiga, A. (2023). Communities in directed weighted food networks using Moore-Shannon network reliability. (submitted Applied Network Science).
- Mishra, R., Eubank, S., **Nath, M.**, Amundsen, M., and Adiga, A. (2022, November). Community Detection Using Moore-Shannon Network Reliability: Application to Food Networks, In International Conference on Complex Networks and Their Applications (pp. 271-282). Cham: Springer International Publishing.
- Eubank, S., **Nath, M.**, Ren, Y., and Adiga, A. (2022). Perturbative methods for mostly monotonic probabilistic satisfiability problems. arXiv preprint arXiv:2206.03550.
- **Nath, M.,** et. al. (2019). Using network reliability to understand international food trade dynamics. In Complex Networks and Their Applications VII: Volume 1 Proceedings The 7th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2018 7 (pp. 524-535). Springer International Publishing.
- **Nath, M.**, Ren Y., and Eubank, S. (2019). An approach to structural analysis using Moore-Shannon network reliability. In Complex Networks and Their Applications VII: Volume 1 Proceedings The 7th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2018 7 (pp. 537-549). Springer International Publishing.
- **Nath, M.**, Ren, Y., Khorramzadeh, Y., and Eubank, S. (2018). Determining whether a class of random graphs is consistent with an observed contact network. Journal of theoretical biology. 440, 121-132.
- **Nath, M.,** and Eubank, S. (2018). Model selection for sequential designs in discrete finite systems using Bernstein kernels. arXiv preprint arXiv:1807.06661.
- Ren, Y., Eubank, S., and **Nath, M.**. (2016). From network reliability to the Ising model: A parallel scheme for estimating the joint density of states. Physical Review E, 94(4), 042125.
- **M. Nath**, et. al. (2015). A two-parameter method to characterize the network reliability for diffusive processes. In Complex Networks VI: Proceedings of the 6th Workshop on Complex Networks CompleNet 2015 (pp. 139-148). Springer International Publishing.
- Agarwala, A., **Nath, M.**, Lugani, J., Thyagarajan, K., and Ghosh, G. (2012). Fock-space exploration by angle resolved transmission through a quantum diffraction grating of cold atoms in an optical lattice. Physical Review A, 85(6), 063606. (*equal contribution as first author*).

CONFERENCE PRESENTATIONS

- **Invited Speaker**: Network reliability: a generic tool to explore diffusive processes on interacting systems, NASA PCE3 (Prebiotic Chemistry and Early Earth Environments) Virtual Workshop 2022 Nano- to Cosmic- Studies of Complex Systems, University of Wisconsin Madison, Madison, WI, Oct. 20, 2022.
- Perturbative methods for estimating relative contributions to network reliability, SIAM (Society for Industrial and Applied Mathematics) Workshop on Network Science, Virtual Workshop, Sep 13-15, 2022.
- Statistical mechanical applications of graph dynamical systems, Condensed Matter Seminar, Department of Physics, Virginia Tech, Blacksburg, VA, Oct. 30, 2017.
- Determining whether a particular contact network is consistent with a network model, 1st North American Social Networks Conference of the International Network for Social Network Analysis, Washington DC, Jul. 26-30, 2017.
- Network reliability: A novel measure to study the effects of network topology on the diffusive dynamics, Symposium for the Society of Young Network Scientists, NetSci 2017, Indianapolis, IN, Jun. 19-23, 2017.
- Network reliability: A measure to study diffusive dynamics on networks, Center for Soft Matter and Biological Physics Symposium 2017, Virginia Tech, Blacksburg, VA, May 17-18, 2017.
- Effects of network structure on propagation of infectious diseases, 33rd Annual Graduate Student Assembly Symposium and Exposition, Virginia Tech, Blacksburg, VA, Mar. 29, 2017.
- Renormalization group approaches for dynamics on irregular networks, APS (American Physical Society) March Meeting 2017, New Orleans, LA, Mar. 13-17, 2017.
- Diffusive dynamics on a network, SESAPS (Southeastern Section of the American Physical Society) Conference 2016, Charlottesville, VA, Nov. 9-12, 2016.
- Effects of network structure on epidemic modeling, Biocomplexity Institute Symposium 2016, Virginia Tech, Blacksburg, VA, Nov. 1, 2016.
- A two-parameter method to characterize the network reliability for diffusive processes, CompleNet 2015, New York City, NY, Mar. 25-27, 2015.
- Four-parameter characterization of network reliability and analysis of critical point phenomenology, APS (American Physical Society) March Meeting 2015, San Antonio, TX, Mar. 2-6, 2015.

OUTREACH

- Reviewer - Machine Learning and the Physical Sciences, NeurIPS2024 - Conference on Neural Information Processing Systems.
- Reviewer - Synergy of Scientific and Machine Learning Modeling, 2023 International Conference on Machine Learning.
- Reviewer - Machine Learning and the Physical Sciences, NeurIPS2022 - Conference on Neural Information Processing Systems.
- Reviewer - Journal - Physical Review E.   2022 – Present
- Industry Ambassador, Women in Network Science Society.   Sep 2022 – Present
- Invited Speaker at Women in Machine Learning and Data Science, Bay area chapter.   Aug 2023
- Speaker at Women Who Code Data Science and San Francisco Backend chapters.   Apr – Jul 2021
- Invited Speaker and Panelist at Women Who Code Statistics in Data Science Workshop Series   Feb – Mar 2021
- Organizer of Women in Network Science Networks 2021 Conference   Jun – Jul 2021
- Invited student speaker of APS Conference for Undergraduate Women in Physics, 2017.   Jan 2017