LinkedIn: madhurimanath | GitHub: madhurima-nath

Multi-cloud certified data scientist and engineer with 8+ years of experience in algorithm development and computational modeling, recognized for immense business, leadership and management skills.

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

SKILLS

Programming: Python, SQL, PySpark, R | CI/CD¹: Git/GitHub/Azure DevOps/BitBucket Certifications: Azure Data Scientist Associate, Databricks Lakehouse Data Engineer Associate, GCP³ Associate Cloud Engineer, AWS² Cloud Practitioner, Domino Data Lab Data Science Practitioner, Tableau Desktop Specialist, Matillion Associate

Others: Data Modeling, Gap Analysis, Technical and Data Architecture Diagrams, Data Flows, Agile Delivery **Awards**: Slalom Mogul Award recognizing outstanding client service and delivery excellence, Q1 2023, Q2 2022, Q4 2020.

INDUSTRY EXPERIENCE

Senior Data Scientist, Data & Analytics, Slalom Consulting, LLC, New York, NY Technical Experience Jan 2020 – Present

- Co-led the development and deployment of a text classification model using NLP⁴ techniques and XGBoost in Azure to categorize product data into multiple groups defined by a standardized template. This accelerated the data foundation launch roadmap by over a year and provided a comprehensive view of \$35B global procurement spend for a consumer packaged goods client.
- Led the development and deployment of sentiment analysis and topic modeling NLP⁴ pipelines in Azure Databricks to uncover safety-related themes from auto-refreshed free-form data. The resulting PowerBI dashboard enabled the executive safety committee of a large Midwest utility provider to identify risky practices and improve the policies to safeguard their employees.
- Designed and implemented a prototype interactive knowledge-based tool to assist sales representatives to service customer inquiries in an efficient and concise manner, using AWS² services and large language models, as the first digital innovation project for one of the largest equipment rental clients.
- Co-led the design and development of fuzzy matching rules and data engineering pipelines to integrate syndicated retail data from multiple vendors including Nielson, IRI and Skupos into a centralized platform on Azure, replacing existing manual processes and improving efficiency for product comparison by $\sim 28\%$ for a consumer packaged goods client.
- Created a segmentation model using historical customer viewership of sports events to implement better reporting, personalized marketing strategies and data governance for a media and television client.

¹CI/CD: Continuous Integration & Continuous Development, ²AWS: Amazon Web Services, ³GCP: Google Cloud Platform, ⁴NLP: Natural Language Processing

Consulting Experience

- Built a reputation for proactively taking on new projects and shepherding them to success, i.e., showcasing potential machine learning solutions to senior-level executives and contributing to proposals for potential client.
- Coached and mentored summer interns, served as go-to resource on advanced analytics solutions and computational modeling.
- Co-led multiple solution accelerators initiatives on Azure Databricks, including data ingestion pipelines using
 medallion structure, data quality frameworks, NLP⁴ solution to implement semantic search, to jumpstart product
 delivery for clients.
- Performed gap analysis, gathered business requirements and analyzed customer engagement from historical data in Snowflake to define key performance metrics of a new product launch for a media and television client.

RESEARCH EXPERIENCE

Post-graduate Research Assistant, Virginia Tech, VA

Mar 2019 - Dec 2019

- Developed an algorithm using Monte-Carlo simulations and perturbative methods to efficiently estimate the solution of a NP-hard problem with sufficiently good precision for all practical purposes.
- Applied aforementioned algorithm to food networks data from United Nations Comtrade database to detect significant communities important to prevent global distribution of pestilence, this method outperforms the well-known heuristic solution by $\sim\!12\%$ on average.

Graduate Research Assistant, Virginia Tech, VA

May 2014 - Dec 2018

- Developed an algorithm to efficiently approximate real-world scenarios for epidemic outbreaks as a function of interactions and infection rate. Policymakers can be equipped with better and more accurate estimates, instead of using existing methods which overestimate the number of infections by ~50%.
- Identified vulnerabilities in international food trade networks and estimated effects of mitigating contagion conditions with 96% accuracy to guide informed decision-making.
- Developed an algorithm using concepts of Moore–Shannon network reliability to estimate the energy states of an interacting magnetic system, reducing the time complexity from $O(n^2)$ to O(n).

Instructor of Record, Department of Physics, Virginia Tech, VA

Aug 2018 - Dec 2018

- Ranked as one of the most effective physics instructors by students who fosters an atmosphere of mutual respect.
- Designed and facilitated weekly lectures, one-on-one sessions and recitation sessions for a 3-credit introductory physics course curriculum for ~120 undergraduate engineering students.
- Supervised physics laboratory sessions and office hours for both engineering and non-engineering students, which improved the grades of $\sim \! 15\%$ of the students.

PUBLICATIONS

- S. Eubank, **M. Nath**, R. Mishra, and A. Adiga, Communities in directed weighted food networks using Moore-Shannon network reliability. (submitted Applied Network Science).
- R. Mishra, S. Eubank, M. Nath, M. Amundsen and A. Adiga, Community detection using Moore-Shannon network reliability: Application to food networks, Complex Networks and Their Applications XI: Volume 2 Proceedings of The 11th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2022, Springer International Publishing, 271-282, 2023.
- S. Eubank, **M. Nath**, Y. Ren and A. Adiga, Perturbative methods for mostly monotonic probabilistic satisfiability problems (arXiv preprint arXiv:2206.0355).
- M. Nath et. al., Using network reliability to understand international food trade dynamics, Complex Networks and Their Applications VII: Volume 1 Proceedings The 7th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2018, Springer International Publishing, 524-535, 2019.

- M. Nath, Y. Ren and S. Eubank, An approach to structural analysis using Moore-Shannon network reliability, Complex Networks and Their Applications VII: Volume 1 Proceedings The 7th International Conference on Complex Networks and Their Applications COMPLEX NETWORKS 2018, Springer International Publishing, 537-549, 2019.
- M. Nath, Y. Ren, Y. Khorramzadeh, and S. Eubank, Determining whether a class of random graphs is consistent with an observed contact network, J. Theor. Biol. 440C, 121-132, 2018.
- M. Nath and S. Eubank, Model selection for sequential designs in discrete finite systems using Bernstein kernels (arXiv preprint arXiv:1807.06661).
- Y. Ren, S. Eubank, and **M. Nath**, From network reliability to the Ising model: A parallel scheme for estimating the joint density of states, Phys. Rev. E 94.4: 042125, 2016.
- M. Nath, S. Eubank, M. Youssef, Y. Khorramzadeh, and S. Mowlaei, A two-parameter method to characterize the network reliability for diffusive processes, Complex Networks VI: Proceedings of the 6th Workshop on Complex Networks CompleNet 2015, Springer International Publishing 139-148, 2015.
- A. Agarwala, **M. Nath**, J. Lugani, K Thyagarajan, and S. Ghosh, Fock-space exploration by angle resolved transmission through a quantum diffraction grating of cold atoms in an optical lattice, Phys. Rev. A 85.6: 063606, 2012 (*equal contribution as first author*).

CONFERENCE PRESENTATIONS

- Invited Talk: 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, MI, Oct. 20, 2022.
- Talk: 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.
- Talk: Statistical mechanical applications of graph dynamical systems, Condensed Matter Seminar, Department of Physics, Virginia Tech, Blacksburg, VA, Oct. 30, 2017.
- Talk: 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.
- Talk: 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.
- **Poster**: 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.
- Talk: Effects of network structure on propagation of infectious diseases, 33rd Annual Graduate Student Assembly Symposium and Exposition, Virginia Tech, Blacksburg, VA, Mar. 29, 2017.
- Talk: Renormalization group approaches for dynamics on irregular networks, APS (American Physical Society) March Meeting 2017, New Orleans, LA, Mar. 13-17, 2017.
- **Poster**: Diffusive dynamics on a network, SESAPS (Southeastern Section of the American Physical Society) Conference 2016, Charlottesville, VA, Nov. 9-12, 2016.
- **Poster**: Effects of network structure on epidemic modeling, Biocomplexity Institute Symposium 2016, Virginia Tech, Blacksburg, VA, Nov. 1, 2016.
- Talk: A two-parameter method to characterize the network reliability for diffusive processes, CompleNet 2015, New York City, NY, Mar. 25-27, 2015.
- **Poster**: 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 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

• Data science instructor at Slalom Q2 2022 New York Learning Session.

Jun 2022

• Speaker at Women Who Code Data Science and San Francisco Backend chapters.

2Apr - Jul 2021

• Invited Speaker and Panelist at Women Who Code Statistics in Data Science Workshop Series

Feb – Mar 2021 Jun – Jul 2021

Organizer of Women in Network Science Networks 2021 Conference
Invited student speaker of APS Conference for Undergraduate Women in Physics, 2017.

Jan 2017