Sumanth Varambally

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EDUCATION

University of California, San Diego — California, United States
*Ph.D. in Data Science. (**Advisors:** Prof. Rose Yu & Prof. Yian Ma) (GPA: 4/4)* — *Sept. 2022 – Present*

Indian Institute of Technology, Delhi — Delhi, India
Dual Degree (B.Tech + M.Tech) in Mathematics and Computing (CGPA: 9.67/10) — *Jul. 2017 – May 2022*

Technical University of Denmark — Lyngby, Denmark
Exchange Student (GPA: 12/12) — *Aug. 2019 – Dec. 2019*

RESEARCH INTERESTS

Causal Inference, Spatiotemporal Modeling, Time-Series Analysis, Applications of Graph Neural Networks.

PUBLICATIONS

* denotes equal contribution

Conference Publications

- **Sumanth Varambally**, Jiaoyang Li, and Sven Koenig. Which MAPF Model Works Best for Automated Warehousing? In *Proceedings of the International Symposium on Combinatorial Search. Vol. 15. No. 1. 2022.*
- Prashant Pandey, Mrigank Raman*, **Sumanth Varambally***, Prathosh AP. Generalization on unseen domains via inference-time label-preserving target projections. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2021 (pp. 12924-12933)* as an **Oral Presentation**.
- Arindam Bhattacharya, **Sumanth Varambally**, Amitabha Bagchi, Srikanta Bedathur. Fast One-class Classification using Class Boundary-preserving Random Projections, In *Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining (KDD), 2021.*

Preprints

- **Sumanth Varambally**, Yian Ma, Rose Yu. Discovering Mixtures of Structural Causal Models from Time Series Data. *arXiv:2310.06312*

RESEARCH PROJECTS

Primary Research Initiatives

Discovering Multiple Causal Graphs with Mixture Models
***Advisors:** Prof. Rose Yu, Prof. Yian Ma* — *University of California, San Diego*
- Existing literature focuses on causal graph discovery with only one underlying graph - unrealistic in practice.
- Using mixture models, we enable multi-graph causal discovery using likelihood-based deep learning methods.
- We derive identifiability results, prove the theoretical soundness of the proposed method, and empirically evaluate its efficacy. *Under review.*

Patient Zero Identification using Graph Neural Networks
***Advisor:** Prof. Rose Yu* — *University of California, San Diego*
- We use Graph Neural Networks to tackle the problem of patient zero identification in epidemics.
- We quantify the improvement in prediction accuracy and inference time, with over 100x speedup in some cases.
- We evaluate the robustness of the method to edge and node information deletion. *Manuscript under preparation.*

Undergraduate Mentorship Projects

Causality in Large Language Models (LLMs)   **Student Lead:** Hrishikesh Jedhe Deshmukh
***Advisor:** Prof. Rose Yu* — *University of California, San Diego*
- We investigate the causal reasoning abilities of LLMs by designing a synthetic language benchmark.
- We benchmark causal reasoning capabilities like detecting independence relationships, causal directions, common causes, and effects, and detecting directionality of change.

Spatiotemporal Causal Discovery   **Student Lead:** Kun Wang

Advisors: Prof. Rose Yu, Prof. Yian Ma   *University of California, San Diego*

- Many important phenomenon (e.g. climate, road networks) are spatio-temporal. Traditional causal discovery algorithms have low detection power and suffer from high computational complexity.
- We infer a causal graph at a lower-dimensional mode level, and then we utilize deep learning for dimensionality reduction and upscaling between the grid level, providing an end-to-end deep learning-based solution.

MASTER'S THESIS

An Examination of the Kernel Conjugate Gradient Method   **September 2021 – June 2022**

Prof. Sivananthan Sampath, Department of Mathematics   *IIT Delhi*

- Derived convergence rates for the Kernel Conjugate Gradient Method under General Source Conditions.

Received the Best M.Tech Thesis Award by the Department of Mathematics, IIT Delhi.

WORK EXPERIENCE

Machine Learning Intern, Airbus Group | *Bangalore, India*   May 2019 – August 2019

- Developed a novel method of studying the behaviour of black-box systems by replicating their functionality using AI based surrogate models followed by the application of XAI techniques to examine the underlying models. *Resulted in the anonymized submission of a defensive publication.*

TECHNICAL SKILLS

Programming Languages: Java, Python, C, C++, Matlab, Assembly, SQL, LaTeX.
Libraries/Tools: PyTorch, Keras/Tensorflow, `numpy`, `matplotlib`, `pandas`, Docker.

SCHOLASTIC ACHIEVEMENTS

- **Best M.Tech Thesis Award:** Awarded by Department of Mathematics, IIT Delhi.
- **IUSSTF-Viterbi Program, 2021:** Selected amongst the **top 15 students** nation-wide.
- **Quadeye Excellence Scholarship, 2021:** Selected amongst **the top 20 students** in IIT Delhi.
- **Department Rank:** Ranked 3rd in the Dual Degree Program (Mathematics and Computing), IIT Delhi.
- **Merit Prize:** Ranked amongst the **Top 7% students** in the 1st, 2nd, 4th and 9th Semesters at IIT Delhi.
- **Scholarships:** Awarded the **NTSE Scholarship** in 2015 and **KVPY Scholarship** in 2015 and 2016.
- **Indian National Informatics Olympiad, 2016:** Received an Honorable Mention.
- **JEE Main, 2017:** Secured an All-India rank of **361 out of 1.2 million** candidates.
- **Physics, Chemistry & Astronomy Olympiads, 2016:** Qualified in **Top 1%** of students in Karnataka.

TEACHING EXPERIENCE

Provided instructional support, led problem solving tutorial sessions and assisted in student evaluation. Worked as a teaching assistant for the following courses:

- **Semester I, 2020-21:** MTL100 - Calculus
- **Semester II, 2020-21:** MTL106 - Probability and Stochastic Processes
- **Semester I, 2021-22:** MTL104 - Linear Algebra and Applications
- **Semester II, 2021-22:** MTL108 - Introduction to Statistics

VOLUNTEERING EXPERIENCE

- **Stanford Code in Place, 2021:** As a Volunteer Section Leader, provided instructional support and led a weekly discussion section of students in the 5-week introductory online Python course Code in Place.
- **Academic Mentor, 2019:** Volunteered as an academic mentor for the first year course, Calculus.