Viplove Arora

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Education

Purdue University
West Lafayette, IN, USA

PHD, SCHOOL OF INDUSTRIAL ENGINEERING
August 2014 - December 2019

- **PhD Thesis:** A Generalized Framework for Representing Complex Networks
- **Advisory Committee:** Mario Ventresca (supervisor), Joaquín Goñi, Jennifer Neville, Shreyas Sundaram
- **Concentration:** Computational Science and Engineering

Indian Institute of Technology, Delhi
New Delhi, India

B. TECH, PRODUCTION AND INDUSTRIAL ENGINEERING
July 2010 - May 2014

- **Bachelors Thesis:** Development of multi-agent system for maintenance planning of production equipment
- **Minor:** Computer Science (Data Structures, Algorithm Design and Analysis, Artificial Intelligence)

Work Experience

International School for Advanced Studies (SISSA)
Trieste, TS, Italy

POSTDOCTORAL RESEARCH FELLOW IN DATA SCIENCE
October 2020 - present

- **Graph Neural Networks (GNNs) in Bioinformatics:** Applied GNNs to raw biological data (RNA-protein binding, multi-omics) creating graphs for novel Graph ML tasks like transfer learning and link weight prediction.
- **Neural Network Generalization via Pruning:** Explored effective capacity and generalization of neural networks through the lens of pruning, with implications for both traditional and large language models (LLMs).
- **Mentoring Leadership:** Co-supervised projects spanning continual learning, GNNs for extreme precipitation prediction, and sparse double descent analysis.
- **Educational Impact:** Delivered advanced lectures and tutorials on GNNs for Neural Networks PhD course and facilitated introductory machine learning project for MBA students.

Purdue University
West Lafayette, IN, USA

POSTDOCTORAL RESEARCH ASSISTANT
March 2020 - September 2020

- Developed models at the intersection of network science and machine learning for applications in neuroscience.
- Devised a hierarchical generative model that integrates the micro and macro-level structures of networks.

RESEARCH ASSISTANT
August 2015 - December 2019

- Devised a *generative probabilistic model* for graphs that learns from a mixture of distinct link creation processes.
- Transformed the challenge of parameterizing the generative model into a non-linear inverse problem.
- Applied the generative framework to engineer resilient supply chain networks in a centralized fashion.
- Employed automated mechanism design techniques to create individual incentives in a game-theoretic setup.
- Demonstrated mentorship prowess through guiding undergraduate endeavors spanning *identifying patient zero, gradient-based simulation optimization, and various topics in network science and machine learning.*

Manufacturing System Insights
Chennai, India

SUMMER INTERN
May 2013 - July 2013

- Developed a **web-based user interface** to simulate and stream large amounts of machine event data.
- Received Letter of Appreciation from the CTO for showing exceptional technical and project management skills.

Relevant Courses

INDUSTRIAL ENGINEERING

- Operations Research, Simulation Design, Stochastic Processes, Linear Programming, Introduction to Probability, Real Analysis, Structure and Dynamics of Networks, Simulation Optimization, Nature-Inspired Computation.

Computer Science

- Artificial Intelligence, Inference and Synthesis of Complex Networks, Stochastic Optimization and Machine Learning, Bayesian Decision Theory, Matrix Analysis, Algorithm Design and Analysis, Data Structures.

Technical Skills

- **(Programming)** R, Python, MATLAB, C++, Java | **(Machine Learning)** PyTorch, PyG, DGL, TensorFlow
- **(Writing)** Latex | **(Optimization)** Gurobi

Key Publications and Presentations

Conference Papers

- **V. Arora**, D. Irto, S. Goldt, G. Sanguinetti, *Quantifying lottery tickets under label noise: accuracy, calibration, and complexity*, UAI, 2023
- J. MaGee, **V. Arora**, M. Ventresca, *Identifying the source of an epidemic using particle swarm optimization*, GECCO, 2022
- **V. Arora**, M. Ventresca, *A Multi-objective Optimization Approach for Generating Complex Networks*, GECCO, 2016

Journal Publications

- A. Ray, **V. Arora**, K. Maass, M. Ventresca, *Optimal resource allocation to minimize errors when detecting human trafficking*, IISE Transactions (2023)
- **V. Arora**, G. Sanguinetti, *De novo prediction of RNA-protein interactions with Graph Neural Networks*, RNA (2022)
- **V. Arora**, E. Amico, J. Goni, M. Ventresca, *Investigating cognitive ability using action-based models of structural brain networks*, Journal of Complex Networks (2022)
- **V. Arora**, G. Sanguinetti, *Challenges for machine learning in RNA-protein interaction prediction*, Statistical Applications in Genetics and Molecular Biology (2021)
- **V. Arora**, D. Guo, K. D. Dunbar, M. Ventresca, *Quantifying the Variability in Network Populations and its role in Generative Models*, Network Science (2020)
- S. R. Hunter, E. A. Applegate, **V. Arora**, B. Chong, K. Cooper, O. Rincon-Guevara, C. Vivas-Valencia, *An Introduction to Multi-Objective Simulation Optimization*, ACM Transactions on Modeling and Computer Simulation (2019)
- **V. Arora**, M. Ventresca, *Modeling topologically resilient supply chain networks*, Applied Network Science (2018)
- **V. Arora**, M. Ventresca, *Action-based Modeling of Complex Networks*, Scientific Reports (2017)

Invited Talks

- *Quantifying lottery tickets under label noise: accuracy, calibration, and complexity*, PRIMO Seminar, 2023
- *De novo prediction of RNA–protein interactions with graph neural networks*, AMALEA workshop, 2023
- *Challenges for machine learning in RNA-protein interaction prediction*, ICBEB, 2022 (**Best oral presentation**)
- *A Generalized Framework for Representing Complex Networks*, CIGP Symposium, 2019
- *Action-based Modeling of Complex Networks*, Complex Systems @ Purdue, 2019

Extra-Curricular Activities

Reviewer   *January 2019 - Present*

Transactions on Evolutionary Computation, Journal of Combinatorial Optimization, Network Science, Computational and Structural Biotechnology, Information Sciences, European Journal of Operational Research

President, INFORMS Chapter Purdue   *August 2017 - April 2018*

- Lead a team of 8 members to organize different events including research talks, social events, and industry tours
- Successfully invited speakers from Industries and received funding from Graduate Student Association
- The chapter got a Cum-laude award in the INFORMS Annual meeting at Phoenix 2018.

Long distance Running   *July 2012 - Present*

- Completed the Chicago full marathon and 8 half-marathons in India, US, and Italy.

Robotics, IIT Delhi   *July 2010 - May 2013*

- Represented IIT Delhi at Robocon 2011 and 2012, annual national robotics competition
- Awarded first position in an image processing robotics competition at TRYST 2013, IIT Delhi
- Made a Bluetooth-controlled image processing robot for Techfest 2013, IIT Bombay, and received Pearls Award