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
- **Supervisor:** Makarand S. Kulkarni

Work Experience

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

Postdoctoral Research Fellow
October 2020 - present

- **Graph Neural Networks (GNNs) for Bioinformatics:** utilized raw biological data (RNA-protein binding, multi-omics) to create graphs and applied GNNs for novel ML tasks like transfer learning and link weight prediction.
- Investigated the *effective capacity* and generalization of neural networks through the lens of pruning.
- **Mentoring:** Co-supervised PhD projects on continual learning, GNNs for predicting extreme precipitation, and a Master's thesis on understanding sparse double descent.
- **Teaching:** Delivered introductory lectures and tutorials on GNNs in a PhD course on Neural Networks. Prepared and tutored MBA students for an introductory project on basic machine learning tools.

Purdue University
West Lafayette, IN, USA

Postdoctoral Research Assistant
March 2020 - September 2020

- Develop models at the intersection of network science and machine learning for applications in neuroscience.
- Combined geometric and non-geometric wiring rules to explain topological organization of the connectome.
- Devised a hierarchical generative model that integrates the micro and macro-level structures of networks.

Research Assistant
August 2015 - December 2019

- Devised a generative model that combines various link creation processes to synthesize realistic networks.
- Utilized the action-based framework to design resilient supply chain networks in a centralized fashion.
- Devised a framework for designing individual incentives for agents in strategic network formation games.
- Automated mechanism design to devise player incentives to achieve global network design goals.
- Mentored various undergraduate projects on topics like *identifying patient zero, gradient-based simulation optimization, and various topics in networks 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.

Technical Skills

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

Key Publications

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)

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

Technical Skills

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

Relevant Courses

Industrial Engineering

- Operations Research, Simulation Design, Stochastic Processes, Linear Programming, Introduction to Probability, Real Analysis, Matrix Analysis, Structure and Dynamics of Networks, Simulation Optimization, Bayesian Decision Theory, Inference and Synthesis of Complex Networks, Nature-Inspired Computation

Computer Science

- Stochastic Optimization and Machine Learning, Artificial Intelligence, Algorithm Design and Analysis, Data Structures, Computer Architecture

Extra-Curricular Activities

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 INFORMS Annual meeting

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