

Rahul Singh

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EDUCATION

- **Georgia Institute of Technology** Atlanta, GA
PhD in Machine Learning August 2018-present
- **Iowa State University** Ames, IA
Master of Engineering in Electrical Engineering December 2018
- **Indian Institute of Space Science and Technology** Trivandrum, India
Master of Technology in Digital Signal Processing July 2015
- **KIIT University** Bhubaneswar, India
Bachelor of Technology in Electronics and Telecomm. Engineering July 2013

RESEARCH EXPERIENCE

- **Intel AI** San Diego, CA
Intern May 2022 - August 2022
 - Graph Neural Networks (GNNs) for molecular property prediction.
- **Mitsubishi Electric Research Lab (MERL)** Boston, MA
Intern May 2021 - August 2021
 - Reinforcement Learning (RL) for partial differential equation (PDE) control.
 - Design of heating, ventilating, air conditioning (HVAC) control policy based on RL algorithms.
- **Georgia Institute of Technology** Atlanta, GA
Graduate Research Assistant August 2018 - Present
 - Research and publications on (i) generative modeling including probabilistic graphical models (PGMs) and generative adversarial networks (GANs), (ii) learning for graph structured data, (iii) graph neural networks (GNNs).
 - Proposed graph neural networks for signed graphs with positive as well as negative links.
 - Multi-marginal optimal transport (MOMT) approach for development of fast and convergent algorithms for inference from aggregate population-level data generated by a PGM.
 - Proposed convergent algorithms for learning hidden Markov models (HMMs) from aggregate population-level data.
 - Utilized GANs for learning actor-critic algorithms in distributional reinforcement learning (DRL) framework resulting in robust and sample efficient policies.
- **Iowa State University** Ames, IA
Graduate Research Assistant August 2016 - July 2018
 - Research and publications on machine vision assisted electrohydrodynamic printing (E-jet) and manifold learning.
 - Real-time information extraction (diameter and tilt-angle) from the images of the filament in the air.
- **Indian Institute of Space Science And Technology** Trivandrum, India
Senior Project Fellow August 2015 - July 2016
 - Research and publications on signal processing over complex networks.
 - Redefined Graph Fourier Transform (GFT) by utilizing the eigendecomposition of the directed Laplacian of a graph.
 - Proposed a new centrality measure (GFT-C) for complex networks using frequency analysis of signals defined on graphs.

AWARDS & RECOGNITION

- Teaching excellence award, Iowa State University, Ames, IA. (May 2018)
- Best paper award, International Conference on Signal Processing and Communications. (2016)
- Graduate study scholarship from Department of Space, Government of India. (August 2013 - June 2016)

RELEVANT COURSES

- Statistical Machine Learning, Convex Optimization, Digital Signal Processing, Image Processing, Computer Vision, Statistical Inference, Deep Learning, Data Science, Information Theory, Reinforcement Learning.

SKILLS

Python, MATLAB, TensorFlow, PyTorch, Git

SELECTED PUBLICATIONS

- **Book**

- B. S. Manoj, A. Chakraborty, and **Rahul Singh**, “Complex Networks: A Networking and Signal Processing Perspective,” *Prentice Hall PTR, New Jersey, USA*, 2018. (<https://complexnetworksbook.github.io/>)

- **Journals**

- **Rahul Singh** and Yongxin Chen, “Signed Graph Neural Netowrks: A Frequency Perspective,” *Transactions on Machine Learning Research*, 2022. (sumbitted)
- **Rahul Singh** and Yongxin Chen, “Learning Gaussian Hidden Markov Models From Aggregate Data,” *IEEE Control Systems Letters*, 2023.
- **Rahul Singh**, Isabel Hassler, Qinsheng Zhang, Johan Karlsson, and Yongxin Chen, “Inference with Aggregate Data in Probabilistic Graphical Models: An Optimal Transport Approach,” *IEEE Transaction on Automatic Control*, 2022.
- **Rahul Singh**, Qinsheng Zhang, and Yongxin Chen, “Filtering for Aggregate Hidden Markov Models with Continuous Observations,” *IEEE Control Systems Letters*, 2022.
- **Rahul Singh**, Qinsheng Zhang, and Yongxin Chen, “Learning Hidden Markov Models from Aggregate Observations,” *Automatica*, 2022.
- **Rahul Singh**, Isabel Hassler, Qinsheng Zhang, Johan Karlsson, and Yongxin Chen, “Multi-marginal Optimal Transport and Probabilistic Graphical Models,” *IEEE Transaction on Information Theory*, 2021.
- **Rahul Singh**, Isabel Haasler, Qinsheng Zhang, Johan Karlsson, Yongxin Chen, “Incremental Inference of Collective Graphical Models,” *IEEE Control Systems Letters*, 2021.
- **Rahul Singh**, A. Chakraborty, and B. S. Manoj, “GFT Centrality: A New Node Importance Measure for Complex Networks,” *Physica A: Statistical Mechanics and its Applications*, 2017.

- **Conferences**

- **Rahul Singh**, Keuntaek Lee, and Yongxin Chen, “Sample-based Distributional Policy Gradient,” *4th Conference on Learning for Dynamics and Control (L4DC)*, 2022.
- **Rahul Singh** and Yongxin Chen, “Inference of Collective Gaussian Hidden Markov Models,” *IEEE Conference on Decision and Control (CDC)*, 2021.
- **Rahul Singh**, Qinsheng Zhang, and Yongxin Chen, “Improving Robustness via Risk Averse Distributional Reinforcement Learning,” *2nd Conference on Learning for Dynamics and Control (L4DC)*, 2020.
- Songtao Lu, **Rahul Singh**, Xiangyi Chen, Yongxin Chen, and Mingyi Hong, “Alternating Gradient Descent Ascent for Nonconvex Min-Max Problems in Robust Learning and GANs,” *53rd Asilomar Conference on Signals, Systems, and Computers*, 2019.
- **Rahul Singh**, A. Chakraborty, and B. S. Manoj, “Graph Fourier Transform based on Directed Laplacian,” *11th International Conference on Signal Processing and Communications (SPCOM)*, 2016. [**BEST paper award**]