Arindam Chowdhury

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Education

Rice University, Houston TX, USA 2019 - 2024
Ph. D. in Data Science *CPI: 3.96/4.0*
Advised by *Prof. Santiago Segarra*

Indian Institute of Technology, Guwahati, India 2015 - 2017
M. Tech. in Signal Processing *CPI: 9.32/10.0*

National Institute of Technology, Durgapur, India 2010 - 2014
B. Tech. in Electronics and Communications *CPI: 8.70/10.0*

Research Interests

Graph Machine Learning, Graph Neural Networks, Reinforcement Learning, Machine Learning for Wireless, Fraud/Abuse Detection, Distributed Learning, Diffusion models, Information Retrieval.

Technical Skills

Programming: C++, Python, MATLAB, Octave
Cloud Computing: Amazon EC2, Sagemaker, Google Colab
Libraries: OpenCV, Scikit-learn, Tensorflow, PyTorch, NetworkX, PyG, DGL

Professional Experience

Amazon Applied Scientist Intern
San Diego, California Summer 2023
Advised by *Dr. Cecile Levasseur*

- Developed a *heterogeneous temporal graph model* for real-time customer fraud detection on large-scale time-varying user-attribute graphs (*knowledge graphs*) with significant class imbalance.
- Devised efficient inference strategies by leveraging customer *ego-graph*.

Amazon Applied Scientist Intern
San Diego, California Summer 2022
Advised by *Dr. Cecile Levasseur*

- Devised an entity-sampling strategy for efficient training of *heterogeneous graph transformer* models to improve recall of abusive customer detection under significant class imbalance.
- Developed efficient information retrieval methods for large-scale (500M edges) graph construction from tabular user-attribute data.

TCS Innovation Labs Researcher
Gurgaon, India 2017 - 2019
Advised by *Dr. Lovekesh Vig*

- Designed a connectionist architecture combining deep convolutional and sequence models for end-to-end recognition of offline handwritten text [10][a].
- Developed a reasoning-based neural model for information extraction from images of statistical plots for automatic summarizing for the visually impaired [9].
- Developed deep object detection & recognition models for automatic digitization of inspection sheets that contain hand-marked schematics of factory floor [11][b].

Research Projects

Constrained reinforcement learning for episodic resource allocation Fall 2022 -
Developed a deep RL-based framework for sequential resource allocation in wireless ad-hoc networks (WANETs) under instantaneous and episodic constraints[1].

Current work focuses on developing a generalized model for handling multiple episodic-constraint types for QoS optimization in mobile ad-hoc networks (MANETs).

GLASSO-aided denoising diffusion for covariance estimation Fall 2023 -
This work focuses on leveraging GLASSO output for conditional denoising diffusion on graphs for sparse covariance estimation of high-dimensional data.

Graph based efficient resource allocation for wireless Spring 2020 - Fall 2022
Developed a hybrid framework to augment an iterative algorithm (WMMSE) with graph neural network (GNN) based learning modules for fast and efficient power allocation in SISO [7,8] and MIMO [2,6] wireless networks.

Theorized and empirically validated stability bounds on the hybrid algorithm with respect to input perturbations [5].

Application of Neural Tangent Kernels on graphs Fall 2021
Developed an efficient framework to extend Graph-NTK for inductive node-level downstream tasks with skip connections on large graphs [4].

Efficient training of Graph Convolutional Networks Fall 2020
Developed a distributed framework for efficient training of graph convolutional networks (GCN) through partitioning of the hidden layers in case of large graphs [3].

Selected Publications

[1] *Learning Non-myopic Power Allocation in Constrained Scenarios*, **A. Chowdhury**, S. Paternain, G. Verma, A. Swami, S. Segarra. 57th Asilomar Conference on Signals, Systems, and Computers (2023).

[2] *Deep Graph Unfolding for Beamforming in MU-MIMO Interference Networks*, **A. Chowdhury**, G. Verma, A. Swami, S. Segarra. IEEE Trans. on Wireless Comm (2023).
https://arxiv.org/abs/2304.00446

[3] *GIST: Distributed Training for Large-Scale Graph Convolutional Networks*, C. Wolfe, J. Yang, F. Liao, **A. Chowdhury**, C. Dun, A. Bayer, S. Segarra, A. Kyrillidis. Journal of App. and Comp. Topology (2023).
https://link.springer.com/article/10.1007/s41468-023-00127-8

[4] *Label Propagation across Graphs: Node Classification using Graph Neural Tangent Kernels*, A. Bayer, **A. Chowdhury**, S. Segarra. IEEE ICASSP 2022.
https://ieeexplore.ieee.org/abstract/document/9746838

[5] *Stability Analysis of Unfolded WMMSE for Power Allocation*, **A. Chowdhury**, F. Gama, S. Segarra. IEEE ICASSP 2022.
https://ieeexplore.ieee.org/abstract/document/9747310

[6] *ML-aided power allocation for Tactical MIMO*, **A. Chowdhury**, G. Verma, C. Rao, A. Swami, S. Segarra. IEEE MILCOM 2021.
https://ieeexplore.ieee.org/abstract/document/9652974

[7] *Unfolding wmmse using graph neural networks for efficient power allocation*, **A. Chowdhury**, G. Verma, C. Rao, A. Swami, S. Segarra. IEEE Trans. on Wireless Comm (2021).
https://ieeexplore.ieee.org/abstract/document/9403959

[8] *Efficient power allocation using graph neural networks and deep algorithm unfolding*, **A. Chowdhury**, G. Verma, C. Rao, A. Swami, S. Segarra. IEEE ICASSP 2021.
https://ieeexplore.ieee.org/abstract/document/9415106,

[9] *ChartNet: Visual Reasoning over Statistical Charts using MAC-Networks*, M. Sharma, S. Gupta, **A. Chowdhury** and L. Vig. IJCNN 2019
https://ieeexplore.ieee.org/document/8852427

[10] *An Efficient End-to-End Neural Model for Handwritten Text Recognition*, **A. Chowdhury** and L. Vig. BMVC 2018.
http://bmvc2018.org/contents/papers/0606.pdf

[11] *Reading Industrial Inspection Sheets by Inferring Visual Relations*, R. Rahul, **A. Chowdhury**, Animesh, S. Mittal and L. Vig. IWRR ACCV 2018.
https://arxiv.org/pdf/1812.07104.pdf

Accepted Patents

[a] **A. Chowdhury** and L. Vig, *Systems and Methods for End-to-End Handwritten Text Recognition using Neural Networks*, US Patent 10,839,246.

[b] **A. Chowdhury**, Vishw, Rohit, Gunjan, Swati, Monika, L. Vig, G. Shroff, and A. Srinivasan, *Method and System for Information Extraction from Document Images using Conversational Interface and Database Querying*, US Patent 10,936,897.

Relevant Course Work

Linear Algebra & Optimization	Random Processes
Statistical Signal Processing	Computer Vision
Pattern Recognition & Machine Learning	Information Theory
Signal Processing Algorithms & Architectures	Network Science and Analytics
Optimization: Algorithms, Complexity & Approximation	Multi-Agent Dynamic Systems

Academic Activities

Reviewer Spring 2020 - Present
IEEE Journals: TSP, TWC, TSIP, OJCOMS, TNNLS, J-SAC
IEEE Conferences: ISIT, ICASSP, ASILOMAR, VTC

Rice University Teaching Assistant

Signals, Systems, and Transforms (Prof. Santiago Segarra, ELEC 242, ∼50 students)	Spring 2021, Spring 2022, Spring 2023
Network Science and Analytics (Prof. Santiago Segarra, ELEC 573, ∼25 students)	Fall 2020
Data and Dynamical Systems (Prof. Athanasios Antoulas, ELEC 519, ∼25 students)	Fall 2019

Awards

IEEE SPS Travel Grant - ICASSP 2022

Referees

Dr. Santiago Segarra
Assistant Professor,
Rice University, Houston Tx, USA.
Email: segarra@rice.edu

Dr. Ananthram Swami
Senior Research Scientist,
US Army Research Laboratory (ARL), Maryland, USA.
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Dr. Santiago Paternain
Assistant Professor,
Rensselaer Polytechnic Institute, Troy NY, USA.
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Dr. Cecile Levasseur
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Dr. Lovekesh Vig
Chief Scientist and Research Area Head,
Deep Learning & Artificial Intelligence
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