

RESEARCH INTERESTS

Devising methods that make machine learning models robust to distributional shifts.

This involves designing methods that detect when data distributions have changed, and how machine learning models need to adapt in an efficient manner to address these changes.

EDUCATION

Georgia Institute of Technology, Atlanta, GA

PhD. in Electrical and Computer Engineering

Expected Aug 2023

Thesis: Change detection in Machine Learning

Masters in Electrical and Computer Engineering

May 2018

Concentration: Signal Processing and Machine Learning

National University of Sciences and Technology, Islamabad, Pakistan

Bachelors in Electrical Engineering

May 2014

WORK EXPERIENCE

Georgia Institute of Technology, Atlanta, GA

Graduate Research Assistant

Aug 2018 - Present

- Devised new improved robust change detection methods for real-world noisy settings
- Devised new methods for representation learning and sequence classification

NEC Laboratories America, Princeton, NJ

Research Intern in Machine Learning

May 2021 - Aug 2021

- Devised new methods for data efficient ordinal classification using self-supervised learning
- These methods reduce training time by 60 % for ordinal classification
- Developed Signal to Noise ratio classification methods that achieve an accuracy of 95 % for real world optical network data
- Explored how soft-labels are better suited for classifying noisy ordinal data

xFlow Research, Islamabad, Pakistan

Software Engineer

Sep 2014 – June 2016

- Developed a Python benchmarking suite for quantifying cloud computing infrastructure performance
- Developed C++ applications for Network functions virtualization that could accelerate routing performance by 70%
- Tested newly developed Network functions virtualization installation packages on cloud infrastructure for deployment

PROJECTS

Semi-supervised sequence classification through change point detection

- Devised a method to use detected unsupervised change points for obtaining similar dissimilar pairs
- These pairs provide weak supervision that can be used to learn neural network representations in a label efficient manner

WiSAT: An activity recognition system for wheelchair users

- Devised an interpretable classifier for characterizing in-seat movement for paraplegic wheelchair users
- Assisted in embedding this classifier in iOS/Android applications for end users
- Assisted in devising data collection protocols
- This tracking system is deployed in clinical trials

Sparse Metric Learning for change point detection

- Devised a new method that uses available change points to improve change point performance
- This method obtained triplet pairs from available change points for learning a metric for Wasserstein distances
- Demonstrated improved change detection performance on human activity, sleep and neuroscience datasets

Collaborative Filtering for Recommender Systems using categorical Matrix Completion

- Devised a recommendation system that obtained user movie ratings by setting up an ordinal matrix completion problem
- Demonstrated that decomposing a categorical matrix completion problem into 1 bit low-rank matrix completion problems can help improve movie recommendation performance by upto 5 %

Domain Adaptation for Time Series classification

- Identified scenarios where it is useful to learning invariant feature representations between source and target domains
- Explored appropriate distance metrics in representation space to mine similar class samples across domains

Self-supervision and active learning for learning temporal representations

- Explored methods for learning self-supervised representations for time series datasets that do not require augmentations
- Devised active label sampling schemes suited for temporal neural network representations for instance classification tasks

TEACHING AND LEADERSHIP EXPERIENCE

Georgia Institute of Technology

Graduate Teaching Assistant

Aug 2020 - May 2021

Conducted office hours. Assisted designing and grading homework problems for the following graduate level courses

- ECE 6270: Convex Optimization
- ECE 6258: Digital Image Processing

Research mentorship of the following graduate and undergraduate students at Georgia Tech

Aug 2019 - May 2020

- Aditya Retnanto
- Christopher Ray
- Yifen Shen
- Austin J. Little
- Andrew Shutzberg
- Victor Zhu

PUBLICATIONS

Journal Publications and Preprints

1. **N.Ahad**, S. Sonenbum, M. Davenport, S. Sprigle, “ Validating a Wheelchair In-Seat Activity Tracker”, *Assistive Technology*, 2021.
2. **N.Ahad**, M. Davenport, Y. Xie, “ Data Adaptive Symmetrical CUSUM ”, *In revision, Sequential Analysis. Preprint*
3. **N. Ahad**, E. Dyer, K. Hengen, Y. Xie, M. Davenport, “Learning Sinkhorn divergences for supervised change point detection”, *In revision, IEEE Transactions on Signal Processing. Preprint arXiv:2202.04000*
4. **N. Ahad**, J. Qadir, and N. Ahsan, “ Neural networks in wireless networks: Techniques, applications and guidelines ”, *Journal of Network and Computer applications*, 2016
5. J. Qadir, N.Ahmed, **N. Ahad**, “ Building Programmable Wireless Networks”, *EURASIP Journal on Wireless Communications and Networks*, 2014

Conference Publications

1. C. Uzray*, **N.Ahad***, M. Abazou, E. Dyer, ”Detecting change points in neural population activity with contrastive metric learning”, *IEEE Conf. on Neural Engineering (IEEE NER)* , 2023
2. **N. Ahad**, M. Davenport, “ Semi-supervised Sequence Classification through Change Point Detection ”, *AAAI*, 2021 (acceptance rate of **21 %**)
3. F. Zhu, A. Sedler, H. Grier, **N. Ahad**, M. Davenport, M. Kaufman, A. Giovannucci, C. Pandarinath “ Deep inference of latent dynamics with spatio-temporal super-resolution using selective backpropagation through time ”, *NeurIPS*, 2021
4. J. Quesada, L. Sathidevi, R. Liu, **N. Ahad**, J. M. Jackson, M. Azabou, J. Xiao, C. Liding, M. J., C. Urzay, W. Gray-Roncal, E. C. Johnson, E. L. Dyer “ MTNeuro: A Benchmark for Evaluating Representations of Brain Structure Across Multiple Levels of Abstraction ”, *NeurIPS Datasets and Benchmarks Track*, 2022
5. A.D. McRae, A. Xu, J. Jin, N. Nadagouda, **N. Ahad**, P. Guan, S. Karnik, M. Davenport “ Delta distancing: A Lifting Approach to localizing items from user comparisons”, *ICASSP*, 2022
6. J. Qadir, **N. Ahad**, E. Mushtaq, M. Bilal, “SDNs, Clouds, and Big Data”, *Futures of Information Technology*, 2014

PRESENTATIONS

- Semi-supervised Sequence classification through Change point detection, conference on AAAI, Vancouver, BC. (Virtual)
- Ordinal classification through Neural Network Decomposition, NEC Research Labs, Princeton, NJ. (Virtual)
- Symmetrical Change statistics for detecting multiple change points in a sequential manner, COTN meeting, Atlanta, GA.

SERVICE and OUTREACH

Reviewer for the following machine learning conferences

- International Conference on Machine Learning (ICML), 2023
- International Conference on Machine Learning (ICML), 2022
- Neural Information Processing Systems (NeurIPS), 2022
- ML4Health Workshop @ Neural Information Processing Systems (NeurIPS), 2019.

AWARDS

Mentor for best presentation award - opportunity research scholars program at Georgia Tech, 2018
Fulbright Foreign Scholarship for pursuing Masters at Georgia Tech, 2016
Third Place, National Engineering Robotics Competition (NERC), 2013
Academic Scholarship and Dean's List at National University of Sciences and Technology, 2012-2014

SKILLS

Programming/Scripting languages: Python, C/C++, MATLAB, Bash

Machine Learning/Data Science tools: Pytorch, TensorFlow, Keras, Sci-kit learn, SQL

DevOPS tools: Docker Containers, Ansible, Git, Jenkins, Linux, OpenStack

High Performance Computing: OpenMPI