Muhammad Adnan

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EDUCATION

Ph.D., Electrical and Computer Engineering Sept 2026 (Expected)
University of British Columbia, Vancouver, BC, Canada
Research Proposal: Optimizing Recommender Systems - Scaling Memory wall and Communication Collectives
Advisor: Prashant J.Nair

M.A.Sc., Electrical and Computer Engineering Nov 2021
University of British Columbia, Vancouver, BC, Canada
Thesis: Accelerating input dispatching for deep learning recommendation models training

B.E., Electrical Engineering July 2013
National University of Sciences and Technology, Islamabad, Pakistan

RESEARCH

Vision

Artificial intelligence and machine learning is becoming an essential part of any technology - from self driving cars to E-commerce - any technology is using AI and ML in some way. Currently most of the machine learning jobs are done in data centers using state of art CPU's and GPU's which are not targeted towards these kind of jobs.

Recommender systems are becoming one of the most important ML workloads in datacenters, consuming upto 50% of training cycles and 70% of inference cycles. I am interested in investigating novel techniques to optimize the execution of this class of workloads in datacenters. For instance, reusing the concepts of data locality, sparsity/pruning and model-aware collective communications for enabling efficient execution. Also, custom designed accelerators in this domain open new dimensions for performance and power optimizations.

Interests

Recommender Systems, Computer and Systems Architecture, Hardware Accelerators, Machine Learning, High Performance Computing

CONFERENCE Publications

1. "Accelerating Recommendation System Training by Leveraging Popular Choices", *48th International Conference on Very Large Data Bases* **(VLDB'22)**
   Muhammad Adnan, Yassaman Ebrahimzadeh Maboud, Divya Mahajan, Prashant J.Nair

2. "Hotline: An Acceleration Pipeline for Training Recommendation Systems", *In submission at* **(ASPLOS'23)**
   Muhammad Adnan, Yassaman EBrahimzadeh Maboud, Divya Mahajan, Prashant J.Nair

3. "Workload-aware Hardware Architecture Mining", *In submission at* **(HPCA'23)** Muhammad Adnan, Amar Phanishayee, Miguel Castro, Janardhan Kulkarni, Prashant J.Nair, Divya Mahajan

Workshops

1. "Accelerating Recommendation System Training by Leveraging Popular Choices", *presented at Personalized Recommendation Systems and Algorithms Workshops at Fourth Conference on Machine Learning and Systems* **(MLSys'21)** Muhammad Adnan, Yassaman Ebrahimzadeh Maboud, Divya Mahajan, Prashant J.Nair

TALKS

- "Life in Grad school panelist" at Undergrad Architecture Mentoring (uArch) Workshop in conjunction with **ISCA 2021**.
- "IEEE Advanced Embedded Systems Workshop: Commercial Off the Shelf embedded systems", at Lahore University of Management Sciences (LUMS) in Dec. 2017
- "Real Time Systems Workshop: Using Real Time Operating System", at Bahrain Polytechnic in Jan. 2016
- "Embedded Systems for Communications", at Misr International University (MIU) in Nov. 2015
- "Using Real time systems for communication systems", at American University of Sharjah (AUS) in March. 2015

ACADEMIC EXPERIENCE

- **Graduate Research Assistant** 2019-Present
  Systems and Architectures (STAR) Lab.
- **Graduate Teaching Assistant** Fall-2019, Fall-2020
  Introduction to Computer Architecture: Undergraduate-Level
- **Graduate Teaching Assistant** Fall-2020, Summer-2020, Fall 2021
  Digital Systems Design: Undergraduate-Level
- **Graduate Teaching Assistant** Fall-2022
  Introduction to Microcomputers: Undergraduate-Level

INDUSTRIAL EXPERIENCE

- **Microsoft Research** June 2021 - Sep 2021
  Research Intern (ML Systems)
  Responsible for optimizing deep neural network operators and layers to make efficient use of the hardware, optimizing device memory usage and data paths, studying the latest DNN models to map them to the hardware, and contributing back to open source projects.
- **National Instruments (NI)** 2013 - 2019
  Account Manager
  Responsible for providing technical support to the customers in Middle East, preparing demo's for Sales & Marketing and managing the team of applications engineers in Pakistan.

PROJECTS
Graduate

- **Optimizing memory hierarchy for Deep Neural Networks**
  A Real Time Machine Learning project (RTML) with DARPA.
- **Optimizing the search algorithm for finding efficient mappings for DNN accelerators.**
- **Avoiding Cache Pollution from Mis-speculated Loads for efficient Cache Management.**
  Course project for Advanced Computer Architecture.
- **MAC-ECC: An Approach for an Optimized Memory Reliability**
  Course project for Security and Reliability.

HONORS AND AWARDS

- Recipient of **VLDB Endowment Travel SPEND Award** for attending VLDB 2022 conference
- Nominated for **Rookie of the year at EMEIA level** at NI Week 2017
- **Certified LabVIEW Developer (CLD)**
- Nominated for **President's gold medal** for best senior year project
- Received **NUST merit based scholarship** for 4 years for academic achievements during undergraduate
- Received **Commandant's plaque of Excellence Award** being high achiever
- Finalist of **Lipton Talent Hunt (LTH)** in 2013

LEADERSHIP

- President of **Pakistani Students Association in Canada** for helping present and future Pakistani students studying in Canada.
- Lead for **Planet NI STEM Program** for promoting STEM Education in Pakistan
- Event lead for **EME Olympiad 2011 & 2012**

SKILLS

C, C++, Python, Pytorch, Bash scripting, Cadence Virtuoso, Architecture Simulators, Deep Neural Network Performance Simulators

REFEREES

Prof. Prashant J.Nair
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