

ANNUS ZULFIQAR

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EDUCATION

University of Michigan

Ph.D. in Computer Science Engineering

Area: *Programmable Networks, Domain-Specific Architectures*

Advisor: Muhammad Shahbaz

Ann Arbor, MI

Jan 2025 - Present

Purdue University

Ph.D. in Computer Science

Area: *Programmable Networks, Domain-Specific Architectures*

Advisor: Muhammad Shahbaz

West Lafayette, IN

Sep 2021 - Dec 2024

National University of Sciences and Technology (NUST)

Bachelor of Electrical Engineering (GPA: 3.96/4.00)

Thesis: *End-to-End Forest Cover Detection and Change Estimation*

Advisors: Muhammad Shahzad, Faisal Shafait

Islamabad, PK

Sep 2015 - May 2019

ACADEMIC RESEARCH

Next-Generation Architectures Lab, University of Michigan

Graduate Student Research Assistant

Advisor: Muhammad Shahbaz

Ann Arbor, MI

Jan 2025 - Present

- Building advanced caching mechanisms for modern SmartNICs
Collaborators: Ben Pfaff (Feldera/VMware) and team
- Built an architecture search framework for scalable decision trees in the data plane
Collaborators: Walter Willinger and team

Next-Generation Architectures Lab, Purdue University

Research Assistant

Advisor: Muhammad Shahbaz

West Lafayette, IN

Aug 2021 - Dec 2024

- Explored architectures for the *slow-path* at the control-plane/data-plane interface in SDN
Collaborators: Ben Pfaff (Feldera/VMware) and team
- Built a Neural Architecture Search framework (Homunculus) for emerging ML-capable data planes
Collaborators: Kunle Olukotun (Stanford) and team

Pervasive Parallelism Laboratory, Stanford University

Remote Researcher

Mentor: Muhammad Shahbaz

Stanford, CA

Sep 2020 - Jan 2021

- Designed discrete-event network simulations for data center load balancing algorithms

Technical University of Kaiserslautern (TUK)

Research Intern

Funded by DAAD

Kaiserslautern, DE

Jun - Sep 2018

- Worked on multi-temporal forest cover change detection to analyze the largest afforestation drive in Pakistan using remote sensing imagery and deep learning

TUKL Lab, NUST

Research Intern

Advisors: Faisal Shafait, Muhammad Shahzad

Jun 2017 - May 2019

Islamabad, PK

- Worked on document processing and land cover classification problems using object detection and sequence learning techniques from deep learning

INDUSTRY EXPERIENCE

VMware Research Group (VRG)

Research Intern

Mentor: Ben Pfaff

May - Aug 2022

Palo Alto, CA

- Characterized the Open vSwitch *slow path* performance bottlenecks and proposed to build an accelerator for the *slow path*

Center for Advanced Research in Engineering (CARE)

Design Engineer

Jun 2019 - Jul 2021

Islamabad, PK

- Designed Ethernet/Wi-Fi/LTE-capable PoE-enabled IoT Sensor Networks for industrial machine sensing and telemetry

PUBLICATIONS

1. SpliDT: Partitioned Decision Trees for Scalable Stateful Inference at Line Rate
Murayyiam Parvez*, Annus Zulfiqar*, Sylee Beltiukov, Shir Landau Feibish, Arpit Gupta, Walter Willinger, Muhammad Shahbaz
SIGCOMM 2025 (In Submission)
**Equal Contribution*
2. NetSparse: Hardware Acceleration for Distributed Sparse Kernels
Gerasimos Gerogiannis, Charles Block, Annus Zulfiqar, Muhammad Shahbaz, Josep Torrellas
ISCA 2025 (In Submission)
3. GigafLOW: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs
Annus Zulfiqar, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, Muhammad Shahbaz
ASPLOS 2025
4. A Smart Cache for a SmartNIC! – Scaling End-host Networking to 400Gbps & Beyond
Annus Zulfiqar, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, Muhammad Shahbaz
HotChips 2024
Poster
5. The Slow-Path Needs an Accelerator Too!
Annus Zulfiqar, Gianni Antichi, Ben Pfaff, William Tu, Muhammad Shahbaz
SIGCOMM CCR 2023
Paper
6. Homunculus: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks
Tushar Swamy, Annus Zulfiqar, Muhammad Shahbaz, Luigi Nardi, Kunle Olukotun
ACM ASPLOS 2023
Distinguished Artifact Award
Paper, Artifact
7. AI-ForestWatch: Semantic Segmentation Based End-to-End Framework for Forest Estimation and Change Detection using Multi-Spectral Remote Sensing Imagery
Annus Zulfiqar, Muhammad M. Ghaffar, Muhammad Shahzad, Christian Weis, Muhammad I. Malik, Faisal Shafait, Norbert Wehn
SPIE Journal of Applied Remote Sensing 2021
Paper

TUTORIALS

- Tutorial: In-Network Machine Learning using Taurus
Tushar Swamy, Annus Zulfiqar, Alex Rucker, Muhammad Shahbaz, Kunle Olukotun

TALKS AND DEMOS

- Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs (with Demo) Oct 2024
SRC JUMP 2.0 – Annual Review Meeting
- Gigaflow: Line-Rate, Pipeline-Aware Caching for Modern SmartNICs (with Demo) May 2024
SRC JUMP 2.0 – Spring Meeting
- Homunculus: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks Jul 2023
SRC JUMP 2.0
- The Slow Path Needs an Accelerator Too! Aug 2022
VMware Research Group

TEACHING

- CS 38100 – Introduction to the Analysis of Algorithms (Graduate TA) Fall 2023

CERTIFICATIONS

- Tofino Native Architecture (TNA) & P4 February 2022
Intel Connectivity Academy – Level 1A/B

HONORS AND AWARDS

- Distinguished Artifact Award for Homunculus (ASPLOS 2023)
- Ross Fellowship recipient at Purdue University
- Travel award for ASPLOS (2022), and SIGCOMM (2022)
- National (Pakistan) P@SHA ICT Awards Winner (with *WiserMachines*, IoT spin-off of CARE)
- Travel award for EECamp at KAIST, South Korea
- Funded internship offer for one year at DFKI, Kaiserslautern, Germany (passed)
- DAAD-funded internship at Technical University of Kaiserslautern (TUK), Germany
- NUST merit scholarship recipient from 2015 - 2019

REFERENCES

1. Muhammad Shahbaz (mshahbaz@purdue.edu)
Purdue University
2. Gianni Antichi (gianni.antichi@polimi.it)
Politecnico di Milano
3. Ben Pfaff (blp@cs.stanford.edu)
Feldera