

# ANNUS ZULFIQAR

[zulfiqaa@umich.edu](mailto:zulfiqaa@umich.edu)  $\diamond$  [linkedin.com/in/annuszulfiqar/](https://www.linkedin.com/in/annuszulfiqar/)

## 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 (*Transferred to the University of Michigan*)

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

## HONORS AND AWARDS

- Distinguished Artifact Award for Homunculus (ASPLOS'23) 2023
- Student travel grants: ASPLOS'22, SIGCOMM'22, NSDI'25 2022 - 2024
- Ross Fellow at Purdue University 2021
- National P@SHA ICT Awards Winner with WiserMachines, IoT spin-off of CARE 2021
- MS EE/ECE acceptances: Stanford, UMichigan, UCLA, Columbia, Duke, NYU, KAIST (passed) 2020
- Travel award for graduate EEcamp at KAIST, South Korea 2018
- Funded internship offer for one year at DFKI, Kaiserslautern, Germany (passed) 2018
- DAAD-funded internship at Technical University of Kaiserslautern (TUK), Germany 2018
- NUST merit scholarship recipient 2015 - 2019

## PUBLICATIONS (\* $\rightarrow$ Equal Contribution)

- NetSparse: Hardware Acceleration for Distributed Sparse Kernels  
Gerasimos Gerogiannis, Charles Block, [Annus Zulfiqar](#), Muhammad Shahbaz, Josep Torrellas  
**Micro 2025** (In Preparation)
- 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)
- Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs  
[Annus Zulfiqar](#), Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, Muhammad Shahbaz  
**ASPLOS 2025** [[Paper](#), [Artifact](#)]
- 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](#)]
- 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** [[Paper](#), [Artifact](#)]  
*Distinguished Artifact Award*
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](#)]

## EXPERIENCE

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### Next-Generation Architectures Lab, University of Michigan

Ann Arbor, MI

Graduate Student Research Assistant

Jan 2025 - Present

Advisor: Muhammad Shahbaz

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

### VMware Research Group

May - Aug 2022

Research Intern

Palo Alto, CA

Mentor: Ben Pfaff

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

### Next-Generation Architectures Lab, Purdue University

West Lafayette, IN

Research Assistant

Aug 2021 - Dec 2024

Advisor: Muhammad Shahbaz

- 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 ML-capable data planes  
**Collaborators:** Kunle Olukotun (Stanford) and team

### Pervasive Parallelism Laboratory, Stanford University

Stanford, CA

Remote Researcher

Sep 2020 - Jan 2021

Mentor: Muhammad Shahbaz

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

### Center for Advanced Research in Engineering

Jun 2019 - Jul 2021

Design Engineer

Islamabad, PK

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

### Technical University of Kaiserslautern

Kaiserslautern, DE

Research Intern

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

Jun 2017 - May 2019

Research Intern

Islamabad, PK

Advisors: Faisal Shafait, Muhammad Shahzad

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

## TUTORIALS

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- Tutorial: In-Network Machine Learning using Taurus  
Tushar Swamy, [Annus Zulfiqar](#), Alex Rucker, Muhammad Shahbaz, Kunle Olukotun  
**ACM SIGCOMM 2022**  
[Webpage](#), [Artifact](#)

## TALKS AND DEMOS

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- Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs Mar 2025  
► Politecnico di Milano, University of Chicago
- Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs (*Demo*) Oct 2024  
**SRC JUMP 2.0** – Annual Review Meeting
- Gigaflow: Line-Rate, Pipeline-Aware Caching for Modern SmartNICs (*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

## PROFESSIONAL SERVICE

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- Mentor — Google Summer of Code (GSoC), P4 Language Consortium Jan 2025
- Volunteer Reviewer — PhD Admissions Committee, University of Michigan Jan 2025

## MENTORING EXPERIENCE

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- Murayyiam Parvez, PhD student at Purdue University — ML for Systems 2024 - Present
- Ali Imran, PhD student at University of Michigan — SmartNICs, ML Systems 2024 - Present
- Venkat Kunaparaju, undergrad at Purdue University — Cloud Infrastructure 2023 - Present

## TEACHING EXPERIENCE

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- CS 38100 – Introduction to the Analysis of Algorithms (Teaching Assistant) Fall 2023

## CERTIFICATIONS

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

## REFERENCES

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1. **Muhammad Shahbaz** [msbaz@umich.edu](mailto:msbaz@umich.edu)  
Assistant Professor of Computer Science, University of Michigan
2. **Gianni Antichi** [gianni.antichi@polimi.it](mailto:gianni.antichi@polimi.it)  
Associate Professor of Computer Science, Politecnico di Milano
3. **Ben Pfaff** [blp@cs.stanford.edu](mailto:blp@cs.stanford.edu)  
Chief Engineer/Co-Founder at Feldera