

# Annus Zulfiqar

Graduate Student and Research Assistant,  
Computer Science and Engineering (CSE),  
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## EDUCATION

### University of Michigan

Ph.D. in Computer Science & Engineering  
Dissertation: Rearchitecting the End Host Network for the Terabit Per Second Era  
Advisor: Muhammad Shahbaz

Ann Arbor, MI  
Sep 2021 - Present

### National University of Sciences and Technology (NUST)

Bachelor of Electrical Engineering  
Thesis: Forest Cover Detection and Change Estimation using Deep Learning  
Advisors: Muhammad Shahzad, Faisal Shafait

Islamabad, PK  
Sep 2015 - May 2019

## HONORS AND AWARDS

- Broadcom Research Award for Celeris, CAL 2025
- Selected as mentor for P4 Language Consortium, Google Summer of Code (GSoC)
- Distinguished Artifact Award for Homunculus, ASPLOS 2023
- Conference travel grants: ASPLOS 2022, SIGCOMM 2022, NSDI 2025, SIGCOMM 2025
- Ross Fellowship at Purdue University
- National P@SHA Information and Communication Technology (ICT) Award Winner, Pakistan
- Travel award for graduate EEcamp at KAIST, South Korea
- One-year internship offered at DFKI, Kaiserslautern, Germany (passed)
- DAAD-funded internship at Technical University of Kaiserslautern (TUK), Germany
- NUST merit scholarship for top academic performance (4.00/4.00 GPA)

## PUBLICATIONS

### Conference Papers

**NSDI.** Murayyiam Parvez\*, *Annus Zulfiqar\**, Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Paper/Code  
Walter Willinger, and Muhammad Shahbaz. SPLIDT: Partitioned Decision Trees for Scalable  
Stateful Inference at Line Rate. 2025. *Acceptance rate: 22.1% (\*co-primary author)*

**MICRO.** Gerasimos Gerogiannis, Charles Block, Dimitrios Merkouriadis, *Annus Zulfiqar*, Paper  
Muhammad Shahbaz, and Josep Torrellas. NETSPARSE: Hardware Acceleration for Distributed  
Sparse Kernels. 2025. *Acceptance rate: 20.7%*

**ASPLOS.** *Annus Zulfiqar*, Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Paper/Code  
Muhammad Shahbaz. GIGAFLOW: Pipeline-Aware Sub-Traversal Caching for Modern  
SmartNICs. 2025. *Acceptance rate: 19%*

**ASPLOS.** Tushar Swamy, *Annus Zulfiqar*, Muhammad Shahbaz, Luigi Nardi, and Kunle Olukotun. Paper/Code  
HOMUNCULUS: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks.  
2023. *Acceptance rate: 20%*  
*Distinguished Artifact Award*

### Journal Articles

**IEEE CAL.** Ertza Warraich, Ali Imran, *Annus Zulfiqar*, Shay Vargaftik, Sonia Fahmy, and Paper  
Muhammad Shahbaz. Reimagining RDMA Through the Lens of ML. 2025  
*Broadcom Research Award*

<b>SIGCOMM CCR.</b> <i>Annus Zulfiqar</i> , Gianni Antichi, Ben Pfaff, William Tu, and Muhammad Shahbaz. The Slow-Path Needs an Accelerator Too! 2023	<u>Paper</u>
<b>Journal of Applied Remote Sensing (JARS).</b> <i>Annus Zulfiqar</i> , Muhammad M. Ghaffar, Muhammad Shahzad, Christian Weis, Muhammad I. Malik, Faisal Shafait, and Norbert Wehn. AI-ForestWatch: Semantic Segmentation Based End-to-End Framework for Forest Estimation and Change Detection using Multi-Spectral Remote Sensing Imagery. 2021	<u>Paper/Code</u>

## Preprints

<b>ARXIV.</b> Ertza Warraich, Ali Imran, <i>Annus Zulfiqar</i> , Shay Vargaftik, Sonia Fahmy, and Muhammad Shahbaz. OPTiNIC: A Resilient and Tail-Optimal RDMA NIC For Distributed ML Workloads. 2025	<u>Paper</u>
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## Conference & Workshop Extended Abstracts

<b>SIGCOMM.</b> <i>Annus Zulfiqar</i> , Ben Pfaff, Gianni Antichi, Arpit Gupta, and Muhammad Shahbaz. KAIRO: Incremental View Maintenance for Scalable Virtual Switch Caching. 2025	<u>Poster</u>
<b>NSDI.</b> Murayyiam Parvez*, <i>Annus Zulfiqar*</i> , Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Walter Willinger, and Muhammad Shahbaz. BRANCHPIPE: Scalable Decision Trees for Stateful Processing at Line Rate. 2025	<u>Poster</u>
<b>NSDI.</b> <i>Annus Zulfiqar</i> , Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. A Smart Cache for a SmartNIC! Rethinking Caching, Locality, & Revalidation for Modern Virtual Switches. 2025	<u>Poster</u>
<b>SRC TECHCON.</b> Marilyn Rego, Murayyiam Parvez, <i>Annus Zulfiqar</i> , Sylee Beltiukov, Shir Landau-Feibish, Arpit Gupta, Walter Willinger, and Muhammad Shahbaz. SPLIDT: Partitioned Decision Trees for Scalable Stateful ML Inference at Line Rate. 2025	
<b>Hot Chips.</b> <i>Annus Zulfiqar</i> , Ali Imran, Venkat Kunaparaju, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. A Smart Cache for a SmartNIC! – Scaling End-host Networking to 400Gbps & Beyond. 2024	<u>Poster</u>
<b>SRC TECHCON.</b> Venkat Kunaparaju, <i>Annus Zulfiqar</i> , Ali Imran, Gianni Antichi, Ben Pfaff, and Muhammad Shahbaz. GigaFlow: A Scalable and Efficient Hardware Fast-Path for Open vSwitch. 2024	

## INVITED TALKS, DEMOS, AND POSTERS

Gigaflow: Pipeline-Aware Sub-Traversal Caching for Modern SmartNICs	
<ul style="list-style-type: none"> <li>Intel Corporation, San Jose</li> <li>Google Networking Summit</li> <li>P4 Workshop Demo At Open Compute Project (OCP) <a href="#">Link</a></li> <li>ACE Center for Evolvable Computing — Demo at Annual Meeting <a href="#">Link</a></li> <li>P4 Developer Days Event <a href="#">Link</a></li> <li>NetSyn Lab, Princeton University</li> <li>IBM Thomas J. Watson Research Center</li> <li>Networked Systems Group (NSG), ETH Zurich</li> <li>ACM ASPLOS Conference</li> <li>Network Operations and Internet Security Lab, University of Chicago</li> <li>Systems Seminar, University of Michigan</li> <li>Politecnico di Milano</li> <li>ACE Center for Evolvable Computing — Demo at Annual Meeting <a href="#">Link</a></li> <li>ACE Center for Evolvable Computing — Demo at Spring Meeting <a href="#">Link</a></li> </ul>	Oct 2025 Oct 2025 Oct 2025 Oct 2025 Jun 2025 Apr 2025 Apr 2025 Apr 2025 Apr 2025 Mar 2025 Mar 2025 Mar 2025 Oct 2024 Mar 2024
Homunculus: Auto-Generating Efficient Data-Plane ML Pipelines for Datacenter Networks	
<ul style="list-style-type: none"> <li>ACE Center for Evolvable Computing (<a href="#">Link</a>)</li> </ul>	Jul 2023

- PurNet Seminar, Purdue University

Sep 2023

The Slow Path Needs an Accelerator Too!

- VMware Research Group (VRG)

Aug 2022

## OPEN SOURCE PROJECTS AND CONTRIBUTIONS

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- **aisuite** [★ 12.8K, 🍏 1.3K] <https://github.com/andrewyng/aisuite>
- **AI-ForestWatch** [★ 31, 🍏 8] <https://github.com/annusgit/ForestCoverChange>
- **Taurus In-Network ML** <https://gitlab.com/dataplane-ai/tutorials/sigcomm22>
- **Gigaflow vSwitch** <https://github.com/gigaflow-vswitch>
- **Homunculus Framework** <https://gitlab.com/dataplane-ai/homunculus/artifact-asplos23>

## 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

Rearchitecting the end host network for the terabits per second era

### VMware Research Group

Palo Alto, CA

Research Intern

May - Aug 2022

Mentor: Ben Pfaff

Characterized the Open vSwitch slow path performance bottlenecks and proposed an accelerator for the SDN 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 in SDN; Built a Neural Architecture Search (NAS) framework, Homunculus, for data plane ML

### 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

Islamabad, PK

Design Engineer

Jun 2019 - Jul 2021

Designed Ethernet/WiFi/LTE/BLE-capable, PoE-enabled, IoT Sensor Networks for industrial machine sensing and telemetry

### Technical University of Kaiserslautern

Kaiserslautern, DE

Research Intern

Jun - Sep 2018

Advisors: Norbert Wehn, Christian Weis

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

### TUKL Lab, NUST

Islamabad, PK

Research Intern

Jun 2017 - May 2019

Advisors: Faisal Shafait, Muhammad Shahzad

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

## PROFESSIONAL SERVICE

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- Volunteer Reviewer – Ph.D. Admissions Committee, University of Michigan Dec 2025
- Program Committee (PC) Member – SIGCOMM 2025 Artifact Evaluation Aug 2025
- Program Committee (PC) Member – NSDI 2026 Artifact Evaluation Jul 2025
- Mentor – P4 Language Consortium, Google Summer of Code (GSoC) Jan 2025
- Volunteer Reviewer – Ph.D. Admissions Committee, University of Michigan Dec 2024

## MENTORING EXPERIENCE

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- Advay Singh, undergrad at University of Michigan – Cloud Infrastructure 2025 - Present
- Murayyiam Parvez, Ph.D. student at Purdue University – ML for Systems 2024 - Present
- Ali Imran, Ph.D. student at University of Michigan – SmartNICs, ML Systems 2024 - Present
- Venkat Kunaparaju, undergrad at Purdue University – Cloud Infrastructure 2023 - 2024

## TEACHING EXPERIENCE

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**SIGCOMM.** Tushar Swamy, *Annus Zulfiqar*, Alex Rucker, Muhammad Shahbaz, Kunle Olukotun. [Link/Code](#)  
In-Network Machine Learning using Taurus. 2022

**Purdue University.** CS 38100 – Introduction to the Analysis of Algorithms (GTA). Fall 2023

## CERTIFICATIONS

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**Intel Connectivity Academy – Level 1A/B:** Tofino Native Architecture (TNA) & P4 [Link](#)

## REFERENCES

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