# ANNUS ZULFIQAR

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## EDUCATION

**Purdue University** — West Lafayette, IN
Ph.D. in Computer Science — Expected 2026
Area: *Programmable Networks, Domain-Specific Architectures*
Advisor: Muhammad Shahbaz

**National University of Sciences and Technology (NUST)** — Islamabad, Pakistan
Bachelor of Electrical Engineering (Batch rank: 3/150) — 2015 - 2019
Thesis: *End-to-End Forest Cover Detection and Change Estimation*
Advisors: Muhammad Shahzad, Faisal Shafait

## ACADEMIC RESEARCH

**Next Generation Architectures Lab (Purdue University)** — Aug 2021 - Present
Graduate Research Assistant — West Lafayette, IN
Advisor: Muhammad Shahbaz

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

**Pervasive Parallelism Laboratory (Stanford University)** — Sep 2020 - Jan 2021
Remote Researcher — Stanford, CA
Mentor: Muhammad Shahbaz (Postdoc)

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

**Technical University of Kaiserslautern (TUK)** — Jun - Sep 2018
Research Intern — Kaiserslautern,
Funded by DAAD — Germany

- 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, Pakistan
Advisors: Faisal Shafait, Muhammad Shahzad

- 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)** — 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*

**Center for Advanced Research in Engineering (CARE)** — Jun 2019 - Jul 2021
Design Engineer — Islamabad, Pakistan

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

## PUBLICATIONS

1. The Slow-Path Needs an Accelerator Too!
   *Annus Zulfiqar*, Gianni Antichi, Ben Pfaff, William Tu, Muhammad Shahbaz
   **ACM SIGCOMM CCR 2023**
   **Paper**
2. 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**
3. 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

- In-Network Machine Learning using Taurus
  Tushar Swamy, *Annus Zulfiqar*, Alex Rucker, Muhammad Shahbaz, Kunle Olukotun
  **ACM SIGCOMM 2022**
  **Webpage**, **Artifact**

## TALKS

- 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**

## HONORS AND AWARDS

- Ross Fellowship recipient at Purdue University
- Distinguished Artifact Award for Homunculus (ASPLOS 2023)
- Travel award for SIGCOMM 2022
- Travel award for ASPLOS 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 (bpfaff@vmware.com)
   **VMware**