

# Awais Asghar

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## Education

**National University of Sciences & Technology (NUST)**

Islamabad, Pakistan

Bachelor of Engineering in Electrical Engineering

Sept 2022 – June 2026

CGPA: 3.57/4.0 | Specialization GPA: 3.89/4.0 | **Merit Scholarship:** 2024-2026

**Senior Design Thesis:** ML based Hardware Accelerator for Real Time Image Segmentation on FPGA

## Research Interests

AI Accelerators, FPGA and RTL Design, Embedded AI Systems, Machine Learning, Deep Learning, Computer Vision Acceleration

## Research Experience

### Embedded Systems Design Research Intern:

Supervisor: Dr. Usman Zabir, HoD and Associate Professor, ESDAC Lab, NUST

• May 2024 – Aug 2024

- Developed and deployed Embedded Linux solutions on FPGA and DE-SoC boards, focusing on hardware-software integration and system optimization.
- Gained hands-on experience with bootloaders, Linux kernel configurations, configured GPIOs, optimized memory management for efficient data handling, and real-time processing for embedded systems.
- Technologies:** RealVNC, FileZilla, Intel Quartus, Verilog, FPGA Hardware, Linux Kernel, DE1-SoC Board.

### Deep Learning Research Intern:

Supervisor: Dr. Jameel Nawaz Malik, Assistant Professor, Deep Learning Lab SINES, NUST

• June 2024 – Sept 2024

- During my internship, I gained hands-on experience with AI, Machine Learning, Deep Learning Neural Networks, Convolutional Neural Networks, and Image Processing.
- I utilized CUDA, a computer architecture for GPU programming to train and implement a machine learning model on given data and verified the model's performance using PyTorch.
- Technologies:** Python, PyTorch, Matplotlib, TensorFlow, Scikit-learn, Google Colab, CUDA, and image processing.

### Machine Learning Research Intern:

Supervisor: Dr. Nazia Perwaiz, Assistant Professor, HamsanTech, NSTP

• June 2024 – Aug 2024

- Developed multiple dashboards to extract valuable insights from real-life industry data.
- Built a machine learning pipeline for [Skin Cancer Detection using a multi-model](#) approach, achieving **91% accuracy** and an **AUC of 0.963** for accurately labeling skin cancer with a single RGB image.
- Technologies:** Python, Scikit-learn, Pandas, Matplotlib, PyTorch and TensorFlow to streamline the machine learning process from data preparation, feature extraction, and model ensembling incorporating models such as XGBoost, AdaBoost, LGBM Classifier, SVM, and Logistic Regression.

## Corporate Experience

### Chip Design Trainee Engineer:

Supervisor: Dr. Hammad M. Cheema, Project Director, NUST Chip Design Centre (NCDC)

• Feb 2025 – Present

- Worked on FPGA-based digital chip design projects involving RTL design, simulation, and hardware implementation in System Verilog, gaining hands-on experience with **C programming, Linux, Digital System Design, RISC-V and computer architecture, and processor design.**
- Implemented a [5 Stage Pipelined Single-Cycle RISC-V Processor](#) using System-Verilog on FPGA. Project includes complete datapath and control logic with instruction memory, data memory, ALU, immediate generator, and branch comparator. It supports the complete RV32I instruction set (R, I, S, B, U, J types) and optimized for hardware-software co-design learning.
- Designed and implemented an [FPGA-based smart anti-theft car security system](#) in Verilog HDL on the DE1-SoC, featuring a reprogrammable FSM, sensor debouncing, siren generation, and a fuel-pump safety interlock to prevent unauthorized access.

**Tools and Technologies:** RTL Design, Digital System Design, Computer Architecture, RISC-V, Vivado, Quartus, Verilog HDL, System Verilog, FPGA, Linux Kernel, DE1-SoC, Zybo Z7

## Projects

### ML based Hardware Accelerator for Real Time Image Segmentation on FPGA:

• Inprogress FYP

- Designing an FPGA-based hardware accelerator to perform real-time image segmentation using an encoder-decoder architecture.
- Leveraging parallel processing on FPGA for low-latency, high-accuracy segmentation.
- Benchmarking FPGA performance against CPU/GPU implementations for speed, accuracy, and efficiency.
- Target applications include [autonomous driving](#) and [medical diagnostics](#).
- Tools and Technologies:** Zybo Z7 FPGA Board, Xilinx Vivado Design, Vitis HLS, Verilog/SystemVerilog, Python, Pytorch/TensorFlow/Keras (Model Training), PYNQ Framework.

## Autonomous Driving Scene Segmentation with U-Net:

• Dec 2025

- Implemented a U-Net architecture for pixel-wise semantic segmentation on CARLA self-driving car simulator image dataset.
- Designed a **novel lightweight U-Net architecture** by compressing the U-Net model from **8.7 million to 0.53 million parameters** while preserving the encoder-decoder structure with skip connections.
- Achieved strong segmentation results with **high 72% IoU, 80% F1 score and 96% Model Test Accuracy.**
- **Tools and Technologies:** Python, Pytorch/TensorFlow/Keras, NumPy, Pandas, Matplotlib, OpenCV, Scikit-learn, Google Colab/Jupyter Notebook/Kaggle, Machine Learning, Deep Learning, Computer Vision.

## Real-Time Fabric Defect Detection on Jetson Nano:

• Dec 2025

- Built a real-time, purely classical computer vision system for fabric defect detection using multi-method analysis (**GLCM, FFT, Gabor, statistical variance, background subtraction, and edge-Hough**), with **IoU-based bounding box fusion** to robustly localize defects without deep learning.
- Deployed and optimized the pipeline on **Jetson Nano** for live camera input, achieving efficient, interpretable defect detection on a low-power edge device.
- **Tools and Technologies:** Python, OpenCV, NumPy, SciPy, scikit-image, Jetson Nano (Edge AI), USB Camera, Linux.

## FreeRTOS-Based Smart Energy Monitoring and Cloud Integration System:

• Dec 2025

- Built a real-time smart energy monitoring system on **STM32F746** using **FreeRTOS**, where independent tasks handle sensor data acquisition, power and energy computation (Vrms, Irms, kWh), and local display, ensuring responsive operation.
- Implemented an **ESP32-based IoT** interface to upload processed energy data from the FreeRTOS-managed STM32 system to a cloud dashboard, enabling remote monitoring of electrical parameters and energy consumption.
- **Tools and Technologies:** STM32F746, IAR Workbench, ESP32, C/C++, ZMPT101B, ACS712, UART, Linux.

## Honors And Achievements

- **Intermediate Scholarship:** Received 100% fee waiver scholarship based on academic excellence.
- **Position Holder:** Secured 3rd place in BISE Multan Pre-Engineering among 70,000+ students.
- **Prime Minister Youth Laptop Scheme 2025:** Awarded a merit-based laptop for excellent academic performance.
- **Millennium Fellowship:** Selected among top 4 percent globally.
- **MITACS Globalink Research Internship:** Selected for the prestigious internship (Summer 2026) at the **University of British Columbia, Vancouver, Canada** for a competitive, fully funded international research placement.

## Relevant Coursework

### Machine Learning Specialization (3-Course Series)

Deeplearning.ai

Mastering Supervised Machine Learning, Advanced Learning Algorithms, Unsupervised Learning, Reinforcement Learning.

### Deep Learning Specialization (5-Course Series)

Deeplearning.ai

Neural Networks and Deep Learning, Hyperparameter Tuning, Structuring Machine Learning Projects, CNNs, sequence models (RNNs, LSTMs) for natural language processing and time-series analysis.

### Deep Learning Courses Series

MIT 6.S191

Deep Learning, Deep Sequence Modeling, Deep Computer Vision, Deep Generative Modeling, Facial Detection Systems, Deep Reinforcement Learning, Transformers, Large Language Models (LLMs), AI in the Wild, AI for Biology

### Advanced Python Programming

Udemy

Python Programming, from foundational concepts to advanced techniques like OOP concepts and solved the real-world problems.

### Coursework at NUST and NCDC

Embedded System Design, Machine Learning, Computer Vision, Computer Architecture, Digital System Design, Electrical Machines, Communication Systems, Control Systems, Digital Signal Processing, Signals and Systems, Electronic Circuit Design, RISC-V, Linux.

## Tools/Frameworks/Skills

**Microcontrollers:** STM32, ESP 32, Arduino, ATmega 328p, ATmega 16A, Pixhawk.

**ML & DL:** Python, TensorFlow, Pytorch, Keras, Numpy, Scikit-learn, Scipy, Pandas, OpenCV.

**Programming Languages:** C/C++, CUDA, Embedded C, Assembly, Python, Verilog, System Verilog, MATLAB, Simulink

**Tools & Simulations:** Venus, Vitis HLS, Xilinx Vivado, Intel Quartus, ModelSim, LabView, Atmel Studio, RealVNC, FileZilla, NI Multisim, Arduino IDE, Proteus, PSpice, Git & GitHub, VS Code, Jupyter Notebook, Power BI, Tableau, MATLAB, AutoCAD, Linux

**Field-Programmable Gate Array (FPGA):** DE-SoC 1 Board, Zybo Z7-20

**Other skills:** Project Management, Strong Communicator, Teamwork, Complex Problem Solving, **Fast Learner**, Report Writing, Troubleshooting, Communication Skills (verbal/written)

## Leadership Skills

### Millennium Fellowship (Class of 2025): UN Academic Impact & Millennium Campus Network

- Recognized for leadership, and vision to driving social impact through community-focused projects and global collaboration.
- Leading the **BreatheSafe** Initiative, a community-focused project deploying low-cost air quality system to monitor dust, smoke, and harmful gases in real time. The project aims to protect vulnerable populations, raise awareness of pollution's health impact, and advocate for cleaner, healthier environments.