

# Awais Asghar

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## Education

Year	Degree/Certificate	Institute/School	CGPA/%
2022-2026	B. Electrical Engineering	National University of Science and Technology (NUST), Islamabad	3.57/4.0
2020-2022	F.Sc. (Pre-Engineering)	City College of Science and Commerce, Multan	96.72%
2018-2020	Matriculation	Ansari Science High School, Multan	96.66%

## Research Interests

RTL Design, Embedded System Design, FPGA, Signal Processing, IoT, AI, Machine Learning, Deep Learning, Computer Vision

## Honors And Achievements

- Achieved **3rd position** in the Board of Intermediate and Secondary Education (BISE), Multan, among **70,000+** students in the F.Sc. annual examination of 2022.
- Awarded a merit-based laptop through the **Prime Minister Youth Initiative** Scheme.
- Selected as one of 4,000 Millennium Fellows worldwide from 60,000+ applicants across 7,500+ campuses (top 4%).
- Co-led a Robotics and AI startup providing student training in AI, where after a successful boot camp our students presented their projects to the Prime Minister of Pakistan.
- Honored with an award for delivering a **Python, AI and Chatbots** bootcamp at **NICAT**, Islamabad.
- It's an honor for me to be included in the Dean's Honor List **three** times.
- Selected for the prestigious **MITACS Globalink Research Internship** (Summer 2026) at the **University of British Columbia, Vancouver**, for a competitive, fully funded international research placement.

## Research 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

### Embedded Systems 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.

### Machine Learning Research Intern:

Supervisor: *Dr. Muhammad Jameel 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.

### Robotics and AI Tutor:

Supervisor: *Dr. Wajahat Hussain, Assistant Professor, Murabbi NUST*

• Aug 2024

- Co-led a Robotics and AI Boot Camp for students, teaching robotics with EV3 Lego kits and AI model training. Mentored students in building competition-winning robots, including Sumo Wrestling, Speedo, and Obstacle Avoiding bots. The students later presented their projects to the Prime Minister of Pakistan.

# 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.

## 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, Jupyter Notebook, Git/GitHub, Real-Time Image Datasets, HDMI Camera Module (for live input), On-chip BRAM/DDR Memory Optimization Techniques.

### 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.

### Automated Waste Classification using Efficient-Net: • Nov 2025

- Developed a deep learning-based waste image classification system using transfer learning with **EfficientNetB0**, achieving **92.9 percent test accuracy** and a macro **F1 score of 0.93** across multiple waste categories.
- **Tools and Technologies:** Python, TensorFlow, Keras, EfficientNetB0, NumPy, Pandas, Matplotlib, OpenCV, Kaggle

### Hybrid Movie Recommender System: • Dec 2025

- Built a content-based, collaborative, and hybrid movie recommender using TMDB and MovieLens data (2015–2025), implementing TF-IDF + cosine similarity and matrix factorization, with a weighted hybrid fusion parameter ( $\alpha$ ).
- Achieved strong performance with **HitRate@10  $\approx$  0.95**, **HitRate@5  $\approx$  0.92**, and **MRR@5  $\approx$  0.90** at optimal  $\alpha$  ( $\approx$ 0.7–0.9), significantly outperforming the collaborative-only (Surprise) baseline.
- **Tools and Technologies:** Python, Pandas, NumPy, Scikit-learn, Surprise, TMDB API, BeautifulSoup, Matplotlib, Kaggle.

### Credit Card Fraud Detection Pipeline: • July 2025

- Developed a machine learning pipeline for fraud detection on highly imbalanced credit card datasets, applying EDA, SMOTE/under sampling, and training **Logistic Regression, Random Forest, and XGBoost models**. Achieved 99.93% test accuracy with high recall, minimizing false negatives and ensuring robust fraud detection.
- **Tools and Technologies:** Python, Scikit-learn, XGBoost, Pandas, NumPy, Matplotlib, Seaborn, Jupyter Notebook, GitHub.

### 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.

### Early Fault Detection for Induction Motor Using ML: • Dec 2024

- Developed an induction motor fault detection system capable of detecting six critical faults: Eccentricity, Motor Overload, Stator Short Circuit, Broken Rotor Bars, Ground/Earth Faults, and Unbalanced Supply Voltage/Current.
- Built MATLAB Simulink models with advanced signal processing (time-frequency and spectral analysis) and trained ML models via Feature Diagnostic Designer, achieving **96% fault classification accuracy** for early detection and reduced downtime.
- **Tools and Technologies:** MATLAB, Simulink, Signal Processing, Feature Diagnostic Designer, Machine Learning, Deep Learning, Power Electronics Add-on, Predictive Maintenance Toolbox, Classification Learner App.

## Crowd Source Air Quality Index Monitoring System:

• Nov 2024

- Designed an IoT-based air quality monitoring system using advanced sensors (PMS5003, MQ7, MQ2, MQ135, DHT22, BME280) to measure key parameters (PM2.5, PM10, CO, temperature, humidity, pressure, elevation), integrated Bluetooth data transmission with a mobile app, and real-time AQI prediction with **99% accuracy** against **US Embassy** standards, tailored for urban and industrial applications.
- Tools and Technologies:** Arduino IDE, Arduino UNO, C/C++, Environmental Sensors.

## Autonomous Car Detection Using YOLO V4 Architecture:

• July 2024

- Implemented YOLOv4 for real-time car detection in video streams, achieving 90% accuracy by leveraging pre-trained weights, image processing (feature extraction, segmentation), non-max suppression, and score thresholding to reduce false negatives and improve efficiency.
- Tools and Technologies:** Python, PyTorch, OpenCV, YOLOv4, Image Processing, Deep Learning, Computer Vision

## ECG for Patient Health Monitoring System:

• Feb 2024

- Developed an integrated healthcare monitoring solution that provides comprehensive patient vital sign tracking including body temperature, **ECG readings**, heart rate, blood oxygen levels, and fall detection, achieving **95% accuracy** in measurements.
- Tools and Technologies:** Arduino IDE, Arduino UNO, C/C++, Git/GitHub, AD8232 ECG Sensor Module, MAX30100 Pulse Oximeter Module, MPU6050 Gyroscope, Temperature Sensor DS18B20, **ECG Signal Processing Algorithms**.

## Fully Automated Egg Incubator Using Atmega328p Microcontroller:

• June 2024

- Designed a fully automated egg incubator using the Atmega328p microcontroller, integrating sensors for precise temperature and humidity control, stepper motors for egg turning, fan, bulb, water unit, and relays. The system maintained 50–64% humidity during incubation and 65–76% during hatching, achieving a **100% pigeon egg hatching rate** in 18 days.
- Tools and Technologies:** Atmega328p Microcontroller, Arduino IDE, Atmel Studio, Proteus, Sensors (DHT11, DS18B20), Stepper Motor, Relays, Fan, Bulb, Water Unit, C/C++, Embedded C, Git/GitHub.

## Relevant Coursework

### **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.

### **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.

## Tools/Frameworks/Skills

**ML & Deep Learning:** Python, TensorFlow, Keras, CNNs, Pandas, Matplotlib, PyTorch, NumPy,

Scikit-learn, SciPy, OpenCV, ANNs, RNNs, LLMs, LSTMs, GANs, Transformers.

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

**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-SoC1 Board, Zybo Z7

**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**

- Selected as one of 4,000 fellows worldwide from 60,000+ applicants across 7,500+ campuses (top 4%). 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.

## Hobbies/Interests

Language learning (currently learning German and Arabic), sports (volleyball, cricket), e-gaming, book reading, and anime.