# Hamza Abbasi

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## About myself

- Technical Architect with nearly 5 years of experience building intelligent systems in safety-critical and high-reliability environments. Background in autonomous driving, ADAS validation, navigation benchmarking, and production-grade Generative AI systems.
- Experienced in designing end-to-end platforms for scenario generation, perception validation, and multimodal sensor data processing including camera, LiDAR, radar, GPS, and IMU. Recently focused on deploying GenAI solutions such as RAG pipelines, fine-tuning with LoRA/QLoRA, evaluation frameworks, and scalable backend services.
- Strong ownership mindset with a track record of translating complex requirements into reliable, production-ready systems.

## Work experience

### Principal Technical Architect | Automotive Artificial Intelligence GmbH | 31/07/2021 - Current | Islamabad, Pakistan

- Led the development and validation of multiple self-driving car functionalities for a key Audi GmbH project, ensuring compliance with rigorous automotive industry standards.
- Architected and engineered Advanced Driver Assistance Systems (ADAS) Operational Design Domains (ODDs), optimizing system performance across varied environmental and operational conditions.
- Pioneered the integration of GenAI into automotive applications, deploying cutting-edge techniques such as Retrieval-Augmented Generation (RAG), LoRA, and qLoRA on LLaMA Mixtral and GPT models to enhance company products and other initiatives.
- Managed large-scale datasets, overseeing the end-to-end process from data labeling to model retraining, ensuring high-precision outcomes for Audi GmbH's autonomous driving systems.
- Developed a comprehensive Navigation Benchmarking Platform, enabling the comparative analysis of HERE, TomTom, and Google navigation data within Audi's infotainment systems, driving improvements in route accuracy and user satisfaction.
- Designed and implemented robust CI/CD pipelines using Docker, Jenkins, Kubernetes, and GitHub, significantly accelerating the development and deployment cycles for automotive software.
- Engineered scalable backend systems using FastAPI and MongoDB, delivering high-performance REST APIs critical for real-time data processing in autonomous vehicles.
- Leveraged Apache Airflow to automate complex workflows, optimizing resource allocation and improving the reliability of data processing pipelines.
- Specialized in simulation and visualization, crafting realistic scenarios to test and validate self-driving systems, reducing the reliance on costly physical testing.
- Applied deep learning techniques for real-time segmentation, detection, classification, and tracking, enhancing the perception capabilities of autonomous vehicles.
- Managed and processed spatial data using tools like Mapbox, GeoJSON, GeoPandas, and OpenDrive (ODR), refining the geospatial accuracy of autonomous navigation systems.
- Developed sophisticated algorithms for map-related applications, improving spatial data processing and route optimization for self-driving vehicles.
- Built Python-based data pipelines for 3D perception tasks, integrating computer vision, image odometry, and sensor fusion to create a cohesive perception system.
- Integrated diverse sensor data (CAN, BUS, ECU, LiDAR, Cameras) into unified systems, ensuring seamless data flow and enhancing the decision-making process in autonomous vehicles.
- Developed Key Performance Indicator (KPI) pipelines in C++, providing critical insights into system performance and enabling data-driven optimization of self-driving functionalities.
- Designed the architectural framework for self-driving car systems, encompassing perception, planning, and control, laying the foundation for robust and scalable autonomous vehicle operations.

**AI & Platform Developer** | AutoCanvas Pvt. limited | 08/2021 - 10/2021

- Contributed to cutting-edge self-driving car technology development with expertise in real-time computer vision systems and ROS.
- Specialized in pedestrian, key point, and vehicle detection, segmentation, distance estimation, depth sensors, and image stitching.
- Developed real-time algorithms for object detection and tracking, enhancing self-driving car perception.
- Collaborated with cross-functional teams to integrate computer vision solutions.
- Kept abreast of industry advancements, implementing state-of-the-art methodologies.

**Research Intern** | Computational Biology Research Lab (CBRL) | 12/2020 - 08/2021 | Islamabad, Pakistan

- Developed a comparison report and implemented several machine learning (Logistic Regression, Random Forest, Bagging, Boosting, SVM) and deep learning algorithms (Neural Networks, CNN) to classify pneumonia using chest x-ray images.
- Worked on image stitching techniques to generate datasets from blood/tissue samples from electronic microscopes for breast cancer detection.

**Teacher Assistant** | National University of Computer and Emerging Sciences | 01/2018 - 08/2023 | Islamabad, Pakistan

My responsibilities included grading assignments and tests, organizing discussion groups, offering extra assistance to students, helping with course materials, and collaborating with the teacher.

**Courses:** Embedded Systems, Engineering Management, Engineering Economics, Digital Logic Design, Applied Thermodynamics, Probability & Random Processes, Physics for Engineers, Electrical Network Analysis, Differential Equations.

## Education & Training

**Bachelors in Electrical Engineering** | National University of Computer and Emerging Sciences, FAST | 08/2017 - 08/2021 | Islamabad, Pakistan

**Field(s) of study:**Computer System Engineering (Embedded Systems) | **Final grade:** 3.97/4.0 | **Thesis:** 3D Object and Scene Reconstruction using Kinect Fusion (Sensor Fusion)

**A-Levels** | Beaconhouse School System | 08/2015 - 08/2017 | Quetta, Pakistan

## Honours and Awards

**Gold medal for academic excellence in the Engineering program** | National University of Computer & Emerging Sciences, Islamabad | 01/01/2021

**Fully funded bachelor's scholarship** | Maanz AI Private Limited | 01/01/2018

## Projects

**CORA (Compliance & Regulatory Assistant) | GenAI for Homologation Engineers** | 01/01/2025 - Current

- Led the architecture and development of CORA, a GenAI assistant built to help homologation engineers navigate compliance documents and homologate vehicles faster
- Managed and structured a large corpus of regulations and standards from multiple sources including EUR-Lex, ISO, UN Regulations, and KBA
- Designed and implemented LLM services for document understanding, grounded question-answering, and structured compliance guidance
- Built RAG pipelines with strong citation, traceability, and reliability requirements for regulatory and standards-based content
- Developed evaluation-driven workflows to improve accuracy and reduce hallucinations in high-stakes compliance use cases
- Collaborated closely with product owners and domain experts to translate homologation workflows into production-ready AI systems

https://cora.automotive-ai.com/cora/docs/

**OmniLegis | GenAI Legal Rights Platform (Germany)** | 01/03/2025 - 01/08/2025

- Led the end-to-end architecture of OmniLegis, a GenAI-powered platform helping German B2C users

understand their legal rights

- Built production RAG pipelines using LangChain and LangGraph, including vector search (MongoDB vector indexes) and retrieval optimization
- Developed fine-tuning workflows using LoRA and QLoRA to improve domain-specific legal accuracy and response quality
- Implemented online and offline evaluation pipelines using LangSmith, including LLM-as-a-Judge scoring, Precision@K, Recall@K, and regression testing
- Improved customer experience through evaluation-driven iteration across retrieval, prompting, and ranking strategies
- Deployed and scaled the system on GCP and supported launch on the App Store and Google Play Store

https://omnilegis.com/

**Navigation Database Benchmarking - Audi GmbH** | 30/04/2024 - 01/08/2024

- Led the validation and benchmarking of Google, HERE, and TomTom navigation databases against ground truth data, using GPS and video data collected by three vehicles operating 8 hours daily across the US and Europe.
- Developed a platform to streamline the benchmarking process, enabling manual labelers to efficiently analyze and compare data.
- Delivered comprehensive error analysis, route coverage GeoJSONs, and geo-pinned error reports, providing customers with detailed insights into navigation database accuracy and performance.

**ReplicaR Platform** | 30/06/2023 - 31/03/2024

- Contributed to the design and end-to-end integration of ReplicaR, enabling scenario-based validation for automated driving systems
- Defined software architecture and supported ADAS Operational Design Domain (ODD) engineering for safety-critical systems
- Developed critical workflows for generating and executing driving scenarios aligned with ISO 34502 and ISO 34503
- Worked with OpenDRIVE (XODR), OpenSCENARIO (XOSC), and OSI sensor simulation standards for high-fidelity testing
- Built and maintained CI/CD pipelines using Docker, GitHub, Jenkins, and Kubernetes to support efficient development and deployment
- Helped drive key technical decisions and development that led to TÜV SÜD fit-for-purpose certification of the platform
- Built supporting backend and automation services using Python-based pipelines and robust engineering practices

https://www.linkedin.com/feed/update/urn:li:activity:7226482496811528193/

**GoldenAlgo - Audi GmbH** | 11/2021 - 02/2023

- Led the development of three key self-driving car functions: Hazard Detection, Wide Light Assist (Matrix Beam Technology), and Pedestrian Detection, representing Audi in discussions with top stakeholders from Cariad, Magna, and Mobileye.
- Managed the entire process from AI model specifications to raw data onboarding from Camera, Lidar, Radar, and HIL systems, ensuring seamless integration of multi-source data.
- Developed deep learning models and applied computer vision techniques to accurately detect hazards and pedestrians, including advanced sensor fusion techniques such as ground plane estimation for precise distance measurement.
- Simulated Audi’s matrix beam technology, enabling dynamic headlight adjustments based on vehicle detection at night.
- Engineered high-efficiency C++ pipelines to benchmark data, which played a crucial role in CARIAD’s decision to incorporate Mobileye algorithms into their Level 3 and Level 4 autonomous vehicles.

**Real-time 3D Reconstruction using KinectFusion (Final Year Project)** | 08/2020 - 07/2021

- Implemented a C++ code on visual studio using Microsoft’s Kinectv2 sensor that can reconstruct the real-world scene into a 3D Model. This Model can be printed through a 3D printer.Executed an advanced C++ coding project within Visual Studio, leveraging Microsoft's Kinectv2 sensor.

- Integration of 6 DoF MPU-6050 Gyro and Accelerometer with the Kinect Sensor, to improve the accuracy and precision of the model.
- Developed a real-time 3D reconstruction system based on the principles of KinectFusion, inspired by the groundbreaking research paper.
- Achieved dynamic and interactive 3D scene modeling, allowing real-world scenes to be reconstructed into detailed 3D models.
- Ensured compatibility for 3D printing, enabling the physical realization of these 3D models.
- Demonstrated the practical application of KinectFusion technology for real-time 3D modeling and 3D printing in an innovative final year project.

### Smart Automated Irrigation System with Atmega32 and Raspberry Pi Integration | 11/2020

- Designed and constructed a hardware-based automated irrigation system, integrating Atmega32 and Raspberry Pi controllers.
- Implemented soil moisture sensing technology to monitor land conditions in real-time.
- Enabled wireless communication via Xbee Module to relay land status updates to the system owner.
- Automated the irrigation process by seamlessly integrating the system with a water pump controller.
- Achieved efficient and precise land irrigation based on real-time moisture data analysis.

### Enhancing STEM Education Access in Underprivileged Pakistani Schools | 11/2020

- Conducted a comprehensive review and critical analysis of existing literature on addressing STEM education disparities in underprivileged schools.
- Contributed to the research through structured interviews and surveys to gather valuable data insights.
- Crafted innovative solutions tailored to the unique socio-economic and cultural context of Pakistan.
- Utilized interdisciplinary approaches to bridge STEM education gaps and promote inclusivity in underprivileged communities.

### Autonomous Line-Following and Obstacle-Avoidance Robot System | 04/2018

- Engineered an autonomous robot using Arduino Mega, ultrasonic, and IR sensors.
- Enabled precise line following and obstacle avoidance through advanced algorithms.
- Demonstrated efficient navigation along complex paths.
- Utilized real-time data analysis for intelligent decision-making.

### Brain Tumor Detection and Classification via Image Processing in MATLAB | 09/2019

- Employed sophisticated image processing techniques in MATLAB to analyze MRI brain images.
- Executed Fourier Transform analysis on MRI data to identify and classify brain tumors.
- Developed a robust codebase capable of detecting the presence of tumors and categorizing their types accurately.
- Implemented a comprehensive algorithmic approach for precise and efficient tumor identification and classification.

## Volunteering

### President | 30/11/2019 - 30/11/2020 | National University Engineering Society

As a dedicated volunteer, I successfully led a team of **35 individuals** to initiate various engineering events during the **pandemic**. Despite the challenges, I ensured that university students remained engaged in **engineering activities** by organizing 15 different events including **Robotics Bootcamps**, **System on Chip Seminars**, **IoT workshops**, **Cloud Computing Series Seminars**, and **Personal Development Trainings**. Through my leadership, the team was able to provide students with valuable opportunities to learn and grow in their fields of interest.

### General Secretary | 30/11/2018 - 30/11/2019 | FAST Adventure Society

As a passionate volunteer, I led a team of **20 individuals** with the aim of promoting **physical, mental, and emotional wellness** among university students through **adventure trips**. I organized various outdoor activities including **hiking, camping, rafting, sailing, gliding, and rock climbing**. To further my vision, I **initiated** a new concept of an**adventure gala**, a three-day event on campus for students who were unable to participate in the trips. The adventure gala featured exciting activities like zip lining and rope climbing and has since become a yearly

legacy, celebrated by students for its unique blend of adventure and personal development.

### Head Electrical Engineering | 30/11/2018 - 30/11/2019 | NaSCon

As the Lead of the Electrical Engineering Department, I successfully managed a team of 40 individuals in representing our department at the **National Solutions Convention** 2019. My responsibilities included overseeing 10 events, including Robowars, Roborace, Robomaze, and Speed Wiring, as well as introducing new events such as **Autoshows** (To create awareness of **Automotive Engineering**), **Aerowars** (Drones and RC planes fighting/maneuvering in the sky), and Engineering Debates. My vision was to promote engineering activities and provide a platform for **nationwide teams** to participate by hosting the event at our university. This experience honed my **leadership and project management skills** while showcasing my passion for the field.

## Certifications

### Huawei Certified ICT Associate Artificial Intelligence

### Deeplearning Specialization – Deeplearning.AI

### TensorFlow Developer Specialization