Hassaan Muhammad Khan

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EDUCATION

BE ELECTRICAL ENGINEERING — Karachi, Pakistan
NATIONAL UNIVERSITY OF SCIENCES AND TECHNOLOGY — Nov 2021 - June 2025

- Projects: Voice Controlled Prosthetic Hand (Microprocessor Systems), Auto Cut Off Battery Charger, 5KW generator manufacturing and testing.
- Relevant Coursework: Microprocessor System, Electronic Devices & Circuits, Digital Logic Design, Object Oriented Programming, Linear Circuit Analysis, Artificial Intelligence, Machine Learning, Computer Communication and Networks, Computer Vision, Data Structures and Algorithms.
- Cumulative GPA: 3.89/4.0

BEACONHOUSE COLLEGE (A–Levels)
Physics A* Math A Chemistry A

BEACONHOUSE SCHOOL (O–Levels)
5A* 4A

EXPERIENCE

DOAZ — Seoul, S-Korea| Remote
AI INTERN — June 2025- Present

- Conducted a comparative analysis of RAG, CRAG, and GraphRAG, developing LangChain architectures from scratch.
- Deployed a FastAPI server to serve Hugging Face LLMs using custom ChatCompletion methods for efficient interaction.
- Leveraged open-source Vision language models with VLLMs for scaled deployment for multi-lingual data extraction from pdfs.
- Structured outputs from models using custom Pydantic base-models by integrating the OpenAI client.

MUHAMMAD BIN ZAYED UNIVERSITY OF ARTIFICIAL INTELLIGENCE — Abu Dhabi, UAE| On-Site
UNDERGRADUATE RESEARCH INTERN — May 2024- June 2024

- Selected for a highly competitive program with a 4% acceptance rate globally, being the only Pakistani intern.
- Conducted research under the supervision of Prof. Zhiqiang Shen, focusing on prompt optimization for foundation models.
- Fine-tuned Llama 7B on a curated dataset, leveraging AWS cloud infrastructure.
- Improved model performance, boosting accuracy by ~10% on key benchmarks including MMLU, HellaSwag, and TruthfulQA.

VISITING RESEARCHER (Remote-based) — Aug 2024– Present

- Implemented direct preference optimization on Llama fine-tuned model.
- Developed open-source DRAG framework for evidence-based retrieval through knowledge graph, inspired by Graph Rag from Microsoft.
- Evaluated DRAG framework for knowledge distillation from LLMs to SLMs, improving accuracy on datasets and benchmarks by 10–27%.
- Published the research in ACL 2025, getting accepted for ACL Main conference

ADDITECH-SIM (German-based startup) — Stuttgart, Germany| Remote
COMPUTER SCIENTIST INTERN — July 2023–Aug 2023

- Completed an internship in the domain of machine learning for an industrial project regarding Fugendruck in shaft-hub-connections.
- Deployed regression models from scikit-learn to predict the optimum pressure value using a set of input parameters.
- Optimized the provided data through exploratory data analysis before model training.

MACHINE LEARNING RESEARCHER — Sept 2023– Dec 2024

- Integrated pre-trained model with reinforcement learning custom environment, made with stablebaseline3.
- Achieved a 15% increase in pressure value prediction accuracy over previous baselines.
- Analyzed Mercedes-AMG experimental dataset on vehicle structural analysis.
- Enhanced parameter optimization using genetic algorithms and Variational Autoencoders.

NUST AIRWORKS (Pakistan's First Student UAV Manufacturing Team to Participate Internationally) — Karachi, Pakistan
AUTOMATION LEAD — Aug 2022–June 2024

- Directed a department of 5 members in an integrated team to develop avionic systems and hardware interfaces for UAVs.
- Optimized avionics and circuitry installation for UAVs (hex copters, fixed wings, hybrid VTOL).
- Led end-to-end automation of X VTOL, winning the Performance Award at Teknofest 2023, Turkey.

SENIOR SOFTWARE EXECUTIVE — Dec 2021– June 2024

- Fine-Tuned yolov8 model for the detection of markers for VTOL (Vertical Takeoff and Landing) UAV.
- Deployed model on Jetson Nano using GStreamer and OpenCV for optimized real-time processing.
- Constructed path planning algorithm and Open CV AI for the project of search and rescue mission using a swarm of decentralized drones.

LIBERTY TEXTILE MILLS (one of the leading Textile mills of Pakistan) — Karachi, Pakistan
ELECTRICAL INTERN — July 2023 – Aug 2023

- Implemented PLC programming to operate electrical circuits and control panels, enhancing practical skills in circuit design.
- Gained hands-on experience with variable frequency drives (VFDs) for machinery control and automation.

RESEARCH PROJECTS:

- **Reinforcement Learning to improve Finite Element Simulations for Shaft and Hub Connections**: Used stable-baseline 3 to construct custom RL environment that uses supervised regression model for inferences.
  Link: https://github.com/AddiTechSim/RL
- **Prompt optimization and fine-tuning of Llama-7B:** Curated a dataset under VILA-LAB using 26 researched principles and fine-tuned Llama 7B model using Amazon Web services.
  Link: https://github.com/hwaseem04/Evaluating-Prompts
- **DRAG Framework:** A knowledge distillation approach implemented with framework and evaluation using SLMs on benchmark datasets such as MMLU, ARC-Challenge, Open-LLM leaderboard etc. Advancement in RAG approaches for small-scale models.
  Link: https://github.com/VILA-Lab/DRAG
- **Autonomous SLAM – based Interactive Bot:** Working as a final year project with group of 4 students. Implementing SLAM algorithms and ROS2 navigation stack with LLM integration to provide interaction capabilities. Deployment on single board computers (jetson-nano)
  Link: https://github.com/Hassaanmk/Autonomous-SLAM-Based-Assistive-robot
- **Digitain Project**: Analyzed and optimized simulation repositories provided by BMW and Boeing, including large-scale crash data. Applying advanced AI algorithms to derive insights and optimize simulation parameters and results.
  Link: https://github.com/AddiTechSim/DigiTain
- **Facial-Emotion Recognition:** A comparative analysis and implementation of facial emotion detection between CNN and VIT trained on FER-2013 and AffectNet datasets.
  Link: https://github.com/Hassaanmk/Facial-Emotion-recognition
- **RAG Comparative Analysis**: Constructed basic and corrective RAG architectures using LangChain and FAISS vector store. Knowledge graph for GraphRAG was deployed and made through Neo4j for advanced query retrieval through relationship extraction.
  Link: https://github.com/Hassaanmk/RAG-Comparitive-Analysis

RESEARCH PUBLICATIONS

Annual Meeting of the Association for Computational Linguistics (ACL 2025):
Vienna, Austria

- **Paper Acceptance (Main-Conference):** DRAG: Distilling RAG for SLMs from LLMs to Transfer Knowledge and Mitigate Hallucination via Evidence and Graph-based Distillation
  Authors: Jennifer Chen, Aidar Myrzakhan, Yaxin Luo, Hassaan Muhammad Khan, Sondos Mahmoud Bsharat, Zhiqiang Shen
  Link: https://arxiv.org/abs/2506.01954

Stuttgart Conference on Automotive Production 2024
ARENA2036, Stuttgart, Germany

- **Paper Acceptance:** Reinforcement Learning to improve Finite Element Simulations for Shaft and Hub Connections
  Authors: Hassaan Muhammad, Narmeen Sabah, Jan Falter, Markus Wagner, Boris Eisenbart, Matthias Kreimeyer, Muhammad Saeed
  Link: https://link.springer.com/chapter/10.1007/978-3-031-88831-1_26

VOLUNTEER WORK

THE CITIZENS FOUNDATION — Karachi, Pakistan
VOLUNTEER — June 2023

- Taught English and Theatre modules to underprivileged students by engaging in learning aid activities.
- Composed and conducted fun educational activities, different for each day, indulging students of various ages.

IEEE WOMEN IN ENGINEERING — Karachi, Pakistan
SENIOR DESIGN EXECUTIVE — Sept 2021–Present

- Lead organizer of the inter-university event, Teknosquid, was responsible for the timely execution of events through prompt communication with administration.

AWARDS AND CERTIFICATIONS

- **SUPERVISED MACHINE LEARNING: LINEAR REGRESSION AND CLASSIFICATION:** Coursera | July 2023
- **ADVANCED LEARNING ALGORITHMS**: Coursera | Dec 2024
- **IMPROVING DEEP NEURAL NETWORKS: HYPERPARAMETER, REGULARIZATION AND OPTIMIZATION:** Coursera | Jul 2025
- **RECTOR'S HIGH ACHEIVER'S AWARD:** Aug 2022 | Aug 2023| Jan 2024
- **PERFORMANCE AWARD:** International UAV Competition TEKNOFEST | April 2023

SKILLS

- **Programming Languages:** Python, C++, SQL
- **Machine Learning Frameworks**: Pytorch, TensorFlow, Keras, SciKit-Learn, Apache, Hugging-Face
- **Cloud/Server Deployment:** Azure, AWS, Google Cloud, FastAPI, Gradio
- **Data Handling:** JSON, Matplotlib, Seaborn, NumPy, Pydantic models
- **NLP Frameworks and Skills:** Fastchat (Fine-tuning), LM-evaluation-harness, Transformers, LangChain, Neo4j, Outlines, RAG architectures.