

# Syed Muhammad Hussain

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## EDUCATION

### HABIB UNIVERSITY

Bachelor of Science

Major in Computer Science; Minor in Electrical and Computer Engineering

Relevant Coursework: Deep Learning, Software Engineering; Machine Learning; Algorithms; Data Science

Karachi, Pakistan

Aug 2020 - April 2024

### DJ Science Govt. College

Pre-Engineering

Karachi, Pakistan

Sept 2018 - May 2020

## WORK EXPERIENCE

### BEAM AI

Associate Machine Learning Engineer

Karachi, Pakistan

May 2024 - Present

- Developed AI-driven solutions, including a Retrieval-Augmented Generation (RAG) pipeline for document search, significantly improving the speed and accuracy of information retrieval.
- Designed a scalable MLOps pipeline for seamless model deployment and monitoring, enhancing system reliability and minimizing downtime.
- Created a multimodal AI system for automated document processing, improving data extraction and understanding through Azure AI services and Llama Index libraries.
- Engineered an autonomous AI agent for workflow optimization, boosting operational efficiency through intelligent task automation. Utilized the Langchain framework and agent graphs for multi-agent workflows, leveraging PGVector databases and reasoning prompts.

### Empathic Computing Laboratory, University of South Australia

Machine Learning Research Intern

Remote

Aug2024-Feb 2025

- Detected user preferences using EEG and physiological signals.
- Conducted statistical analyses and data processing.
- Developed machine learning and deep learning models for preference classification, including a custom deep learning model for time series classification from raw data using RNN architectures such as LSTM, GRU, and TCN.
- Gained hands-on experience in EEG experimental design and data analysis.
- Supervised by Kaining (Kai) Zhang, Allison, Theo, and Prof. Mark Billingham.

### Folio3

AI/ML Intern in Engineering dept

Karachi, Pakistan

July 2023 - Sep 2023

- Developed and refined object detection and segmentation models, including YOLO and single-stage detection models, as well as RCNN models.
- Worked with Vision Transformer architectures like ViT to enhance model performance.
- Applied theoretical knowledge to real-world projects in machine learning and computer vision.
- Enhanced practical skills through hands-on experience and data analysis.
- Gained insights into the complexities of the field and created tangible solutions.

### Habib University

Research Project Assistant

Karachi, Pakistan

May 2022 - Aug 2023

- In this role, I focus on researching and developing innovative solutions to detect camouflaged objects in images and videos. Camouflaged objects present challenges in fields like military operations, wildlife conservation, and surveillance, where traditional detection algorithms often fail. My work addresses these limitations to improve accuracy, reduce security risks, and enhance situational awareness.

### Habib Bank

SOC Intern in Cyber Security dept

Karachi, Pakistan

July 2022 - Aug 2022

- As a Security Operations Center (SOC) analyst intern, I focused on leveraging IBM Qradar tools to enhance cybersecurity. My responsibilities included actively working with SIEM and SOAR technologies to strengthen the overall security posture. Through this experience, I gained valuable insights into threat detection and response strategies within a dynamic SOC environment.

## PROJECTS

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### 1. Intelligent Enterprise Search with RAG

Application: AI-driven knowledge discovery for enterprises, enabling instant access to critical information.

- Developed a high-performance Retrieval-Augmented Generation (RAG) pipeline for intelligent document search.
- Engineered a multi-stage indexing system with semantic chunking and vectorized retrieval using Qdrant & PGVector.
- Integrated LangChain, LlamaIndex, and LLMs (OpenAI, Anthropic, Mistral) to enhance domain-specific information retrieval.
- Applied advanced prompt engineering (CoT, Few-Shot Learning), improving search accuracy by 40%.
- Deployed on Azure for scalable, real-time document retrieval with minimal latency.

### 2. Scalable MLOps for AI Model Deployment & Monitoring

Application: Automating AI model deployment and lifecycle management for enterprise solutions.

- Designed an end-to-end MLOps pipeline with Docker & MLflow, ensuring seamless model deployment and version control.
- Built an AI evaluation framework using Guardrails & Geval for real-time assessment of hallucination rates, reasoning accuracy, and robustness.
- Integrated LLMs into production workflows via Azure AI Services, automating data-driven decision-making.
- Improved system reliability and responsiveness through automated monitoring, anomaly detection, and performance optimization.

### 3. AI-Driven Document Intelligence & Visual Reasoning

Application: Automating document processing and analysis for legal, financial, and research industries.

- Developed a multimodal AI system for intelligent extraction and interpretation of structured and unstructured documents.
- Automated parsing and semantic analysis of PDFs, CSVs, DOCX, and PPTs using Azure & AWS AI services.
- Implemented Visual Question Answering (VQA) to enable contextual document navigation and reasoning.
- Strengthened document understanding and interpretation using customized models architectures in PyTorch, TensorFlow, and Keras.

### 4. Autonomous AI Agent for Workflow Optimization

Application: Intelligent task automation for enterprise operations and decision-making.

- Engineered an AI agent capable of autonomous task planning, execution, and adaptive decision-making.
- Designed a multi-agent system leveraging LangChain & LlamaIndex for contextual awareness and long-term memory.
- Applied structured reasoning (CoT & ToT prompting) to optimize multi-step workflows.
- Integrated OpenAI, Anthropic, and Mistral APIs, enhancing adaptability to dynamic task requirements.
- Minimized the need for manual oversight by automating complex workflows, improving operational efficiency.

## PUBLICATIONS

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- **S.M. Hussain**, Syed Muhammad Daniyal Murtaza Zaidi, Ahmed Atif, Laiba Ahmed, Dr. Qasim Pasta, Dr. Basit Memon. 2024 50th IEEE Industrial Electronics Conference (IECON). Chicago, USA. Paper Title: **Navigating the Maze Environment in ROS-2: An Experimental Comparison of Global and Local Planners for Dynamic Trajectory Planning in Mobile Robots.** ([Acceptance Letter](#))
- **S.M. Hussain**, Afsah Hyder, Samiya Ali Zaidi, S.M. Ali Rizvi, and Dr. Muhammad Farhan. 2024 6th International Conference on Advances in Computer Vision, Image and Virtualization. Paper Title: **Advancing Real-Time Camouflaged Object Detection with YOLOv8.** Sanya, China. ([Acceptance Letter](#))

- **S.M. Hussain**, Afsah Hyder, Samiya Ali Zaidi, S.M. Ali Rizvi, and Dr. Muhammad Farhan. 20th International Bhurban Conference on Applied Sciences and Technology IBCAST 23. Paper Title: **Enhanced Camouflaged Object Detection for Agricultural Pest Management: Insights from Unified Benchmark Dataset Analysis**. ([paper link](#))
- **S.M.Hussain**, Azeem Haider, Affan Habib, and Dr. M.Farhan. 20th International Bhurban Conference on Applied Sciences and Technology IBCAST 23. Paper Title: **In Automated Video Summarization for Suspicious Event Detection in Surveillance Systems: A Pipeline Approach**. Islamabad, Pakistan ([paper link](#)).
- **S.M. Hussain**, Samiya Ali Zaidi, Afsah Hyder, and Dr. M.Mobeen Movania. 25th International Multitopic Conference INMIC 23. Paper Title: **Integrated Ensemble Learning into Remote Health Monitoring for accurate prediction of oral diseases**. Lahore, Pakistan ([Paper link](#)).
- **S.M. Hussain**, Muhammad Najeeb Jilani, Munim Ul Haq, and Dr. Muhammad Shahid Shaikh. 5th International Conference on Advancements in Computational Sciences. Paper Title: **A Machine Learning Approach to Arabic Phoneme Classification through Ensemble Techniques**. Lahore, Pakistan ([Paper link](#)).

## **ADDITIONAL**

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**Technical Skills:** Pytorch, TensorFlow, Keras, Pandas, NumPy, Data Science, Machine Learning, Deep Learning, Natural Language Processing (NLP), Retrieval-Augmented Generation (RAG), AI Agents, Computer Vision, MLOps, Cloud Computing, Prompt Engineering, Model Evaluation, Data Engineering, Algorithms & Design, SQL, DevOps.

**Honors & Awards:** Awarded a fully funded 4-year scholarship through the Habib University TOPS program.

Selected as a Research Intern at the Empathic Computing Lab, a leading AI research lab in ML and HCI, as the only research intern from my Pakistan region.