Hamza Khaled Mahmoud Ahmed

AI Engineer — Machine Learning Engineer — Data Scientist
hamzakhaledlklk@gmail.com
github.com/h19overflow — Hamza Khaled Linkedin Cyberjaya, Malaysia — +60 122938594

Summary

Highly motivated Computer Science student (expected graduation **May 2026**) specializing in **Data Science**, **Machine Learning**, and **Artificial Intelligence**, with 1.5+ years of hands-on project experience in **predictive analytics**, **deep learning**, **computer vision**, **natural language processing**, and **AI automation systems**. Possesses a robust foundation in **statistics**, **advanced mathematics**, **data analysis**, **algorithm development**, and **predictive modeling**. Proven ability to manage the **end-to-end machine learning lifecycle**:

- **Data engineering**, preprocessing, **feature engineering**, and **data pipeline** development
- **Exploratory data analysis** (EDA), **statistical inference**, and **hypothesis testing**
- **Model development** (classical ML, deep learning, neural networks, LLMs, RAG, AI agents), **training**, and **hyperparameter optimization**
- **Model evaluation**, **performance tuning**, **cross-validation**, and **deployment** strategies

Passionate about applying AI/ML to build intelligent, high-impact solutions. Demonstrated project success in **Federated Learning**, **Advanced RAG Systems**, **AI Inference Optimization**, **Full-Stack AI Development**, and **Computer Vision**. Seeking an entry-level **Machine Learning Engineer**, **AI Engineer**, or **Data Scientist** position to contribute to data-driven projects in **FinTech**, **Healthcare**, or **AI/Tech**.

Education

BSc in Computer Science (Specialization in Data Science) **March 2023 – Present**
Multimedia University, Malaysia
Expected Graduation: May 2026
CGPA: 3.63 / 4.0
Achievements: 4-time Dean's List Award Winner
Relevant Coursework: Statistics, Calculus, Discrete Mathematics, **Machine Learning Algorithms**, Data Analysis, **Deep Learning**, Object-Oriented Programming, Object-Oriented Analysis & Design, Database Management, **Artificial Intelligence**.

Selected Projects

Federated Clinical Trial Matching Platform — Privacy-Preserving AI in Healthcare
Technologies: Python, NVIDIA FLARE, MedGemma, vLLM, MongoDB Atlas, RAG, PyTorch

- **Architecting a novel, privacy-preserving clinical trial matching platform** using **Federated Learning (NVIDIA FLARE)** to identify eligible patients across multiple hospitals without centralizing sensitive data.
- **Designed an efficient two-stage matching pipeline**: a RAG-based candidate retrieval system using hybrid vector/SQL search, followed by a high-accuracy validation stage with a specialized medical LLM (**MedGemma**).
- **Currently implementing advanced inference optimizations with vLLM**, leveraging **Paged Attention** and dynamic batching to dramatically increase throughput and reduce the latency of the MedGemma validation service.
- **Engineered a robust, offline ETL pipeline** to periodically process and embed new clinical data, ensuring the search index remains consistently up-to-date with the latest patient information.

Graph-Powered Agentic RAG System — Advanced AI Research & Development
Technologies: Python, LightRAG, LangGraph, Google Gemini API (Vision Pro & Flash), PostgreSQL, Pydantic, MinerU

- **Architected and built an end-to-end Retrieval-Augmented Generation (LightRAG) system** in a 3-day sprint to solve the "fragmented context" problem inherent in traditional vector search-based RAG.
- **Engineered a multi-stage, multi-modal ETL pipeline** that intelligently processes complex PDFs, using a Vision Language Model (VLM) to analyze images and diagrams, and prepares the data for ingestion into a knowledge graph.

- **Implemented a sophisticated multi-agent system using LangGraph**, where specialized AI agents collaborate to analyze user queries, determine optimal hybrid retrieval strategies (vector + graph), and synthesize fragmented answers into coherent, actionable narratives.
- **Demonstrated a significant leap in AI reasoning capabilities** by enabling the system to understand and traverse the relationships between concepts, moving beyond simple keyword matching to structured, human-like understanding.

LangGraph Agentic Auditing System — AI-Powered Financial Automation
Technologies: LangGraph, Python, LLMs, Pandas, Multi-Agent Systems

- Designed a multi-agent auditing system using **LangGraph** to automate complex financial workflows, including End-of-Service (EOS) calculations and interactive payroll analysis.
- Architected stateful, graph-based workflows to manage data flow and control, enabling both fully automated processing and complex **human-in-the-loop (HITL)** interactions.
- Deployed specialized AI agents for tasks such as data classification and dynamic transformation based on **natural language instructions**, functioning as an auditor's "co-pilot".

Agentic Workbench — Full-Stack AI Document Processing & Analytics Platform
Technologies: LangGraph, LangChain, FastAPI, Google Gemini (LLM), Google Vision (OCR), SQLite, React, TypeScript, Docker, Python

- Engineered a full-stack, AI-powered workbench to automate **structured data extraction** from documents and enable **natural language-based analytics** and visualizations.
- Orchestrated complex, multi-agent workflows using **LangGraph** for an end-to-end document processing pipeline, incorporating OCR, LLM-based extraction, and a **human-in-the-loop (HITL)** review stage.
- Developed a robust backend using **FastAPI** to serve **RESTful APIs** and **WebSockets** for real-time status updates, interfacing with Google Gemini for data structuring and Google Vision for OCR.

Intelligent Customer Service Assistant with Hybrid ML/LLM Architecture
Technologies: Python, LangChain (LangGraph), Scikit-learn (Random Forest), ONNX, MongoDB Atlas, Redis

- Engineered a **cost-effective hybrid architecture** by developing a custom Random Forest intent classifier (**99% accuracy**), optimized with **ONNX Runtime** for sub-millisecond inference, reducing reliance on expensive LLM calls.
- Architected an advanced agentic system using **LangGraph**, featuring custom subgraphs for reliable structured output and a novel "pre-hook context fetching" mechanism to minimize token consumption.
- Implemented an **autonomous memory management system** using **MongoDB Atlas** to store and retrieve user history, enabling the agent to personalize conversations and adapt its communication style.

Pneumonia Detection using Hypertuned ResNet50V2 and Simulated Federated Learning
Technologies: TensorFlow, Keras (ResNet50V2), Flower (flwr), Deep Learning

- Engineered a **deep learning model** for pneumonia detection from X-ray images, leveraging a fine-tuned **ResNet50V2** network to achieve **95% accuracy** and **0.90 F1-score**.
- Optimized model performance through comprehensive **hyperparameter tuning** and robust **data augmentation** strategies for improved **generalization**.
- Designed a simulated **Federated Learning** environment using the Flower framework, demonstrating **privacy-preserving model training** principles.

AI-Powered Flashcard Generator with RAG and Web Interface
Technologies: Google Gemini API, RAG, Flask, React, FAISS, LangChain, Python, Pandas, NumPy, Vector Databases

- Built an automated content generation system to create study materials from PDF documents, enhancing learning efficiency through automated **document understanding**.
- Implemented a robust **Retrieval-Augmented Generation (RAG)** architecture leveraging **Google's Gemini LLM** and a FAISS **vector database** for intelligent **semantic search** and accurate content generation.

Fraud Detection Model (Blockchain Transactions) — Machine Learning Classification
Technologies: XGBoost, Random Forest, Scikit-learn, Pandas, SMOTE, Ensemble Methods

- Developed and evaluated multiple models for detecting fraudulent blockchain transactions, achieving **95.67% test accuracy** with an optimized Random Forest model.
- Implemented **SMOTE** to effectively address significant **class imbalance**, enhancing model robustness for **anomaly detection**.

Skills

Technical Skills

- **Programming & Data Manipulation:**
  - **Languages: Python** (intermediate), **SQL** (intermediate: PostgreSQL, MySQL, SQLite), Java (Intermediate), Kotlin (Intermediate)
  - **Data Analysis & Visualization: Pandas**, **NumPy**, **SciPy**, **Matplotlib**, **Seaborn**, Tableau, **Exploratory Data Analysis (EDA)**
- **Machine Learning & AI:**
  - **Core Concepts:** Regression, **Classification**, Clustering, **Ensemble Methods**, **Feature Engineering**, **Hyperparameter Optimization**, **Model Evaluation**, Anomaly Detection
  - **Deep Learning Frameworks: TensorFlow**, **Keras**, **PyTorch**, **Scikit-learn**, **XGBoost**, **Hugging Face Transformers**, **ONNX**
  - **Natural Language Processing (NLP): LLMs** (Gemini, MedGemma), **Advanced RAG**, **Knowledge Graphs**, **Structured Data Extraction**, **Text Embeddings**, **Prompt Engineering**, **AI Agent Systems** (**LangChain**, **LangGraph**, **LightRAG**, CrewAI)
  - **Computer Vision:** OpenCV, **YOLO**, MediaPipe, Object Detection, Image Classification, **Optical Character Recognition (OCR)**
  - **Federated Learning:** Flower, **NVIDIA FLARE**, Privacy-Preserving ML, Distributed Training
  - **Inference Optimization: vLLM**, Paged Attention, Model Quantization (Conceptual), Latency/Throughput Tuning
- **MLOps & Cloud Platforms:**
  - **Cloud Platforms: Google Cloud Platform (GCP)**, **Vertex AI** (Gemini Models)
  - **Orchestration & Monitoring: Prefect** (Intermediate), **Weights and Biases** (Intermediate)
  - **DevOps & Tools: Docker**, **Git**, **GitHub**, Jupyter Notebooks, CI/CD (Conceptual)
- **Databases & Data Management:**
  - **Databases: SQL** (PostgreSQL, MySQL), **NoSQL** (**MongoDB Atlas**), **Vector Databases** (FAISS), **Redis**
  - **Data Concepts: Knowledge Graphs**, Data Modeling, Data Warehousing (Conceptual)
- **Web Development & API Integration:**
  - **Backend: Flask**, **FastAPI**, **RESTful APIs**
  - **Frontend: React**, **TypeScript**
- **Foundations:**
  - **Statistical & Mathematical: Statistical Modeling**, **Hypothesis Testing**, Linear Algebra, Calculus, Probability & Statistics, Optimization

Professional Competencies

- **Core Strengths: Fast Learning** (Expert), **AI Utilization** (Expert), **Analytical Problem-Solving**, **Critical Thinking**
- **Collaboration:** Technical Communication, Team Collaboration, Project Leadership
- **Mindset: Data-driven Decision Making**, Adaptability, Continuous Learner

Languages

English: Fluent
Arabic: Native