

# Abdelrhman Ahmed Ezzat

AI Engineer | ML & Deep Learning | GenAI & RAG | Full-Stack AI Systems

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**Portfolio:** <https://abdelrhman941.github.io/MyPortfolio/>

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## SUMMARY

AI Engineering student at Menoufia University (B.Sc. in Artificial Intelligence & Data Science, graduating 2026) with 2+ years of hands-on experience building end-to-end AI systems, from data pipelines and model training to full-stack deployment. Built 5+ production-grade projects spanning Machine Learning, Deep Learning, Computer Vision, NLP, Reinforcement Learning, and Conversational AI. Specializes in Generative AI, LLMs, and RAG pipelines. Writes clean, modular, and maintainable Python code with a strong focus on real-world applicability. Seeking AI Engineer or ML Engineer internship/junior roles.

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## EXPERIENCE

### **Generative AI Trainee | Digital Egypt Pioneers Initiative (DEPI)**

*June 2025 – Dec 2025*

- Contributed to a national initiative on advanced AI and Data Science technologies, focusing on Generative AI and Large Language Models.
- Trained in GenAI, LLMs, RAG pipelines, and prompt engineering techniques — with hands-on application to scalable AI prototypes.
- Developed ML applications leveraging LLMs and Generative AI models with focus on production readiness and deployment.
- Collaborated with peers on team-based prompt engineering workflows, simulating real-world AI development cycles.

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## PROJECTS

### **VirtAI — Real-Time AI Avatar Teacher (Graduation Project)**

*Jan 2025 – Present*

- Built a full end-to-end conversational AI pipeline: ASR -> RAG -> LLM -> TTS -> 3D Avatar, with real-time WebSocket streaming.
- Architected FastAPI backend using Clean Architecture (domain / application / infrastructure / presentation layers) for scalability and testability.
- Developed React + Three.js frontend with ReadyPlayerMe GLB avatar supporting ARKit blend shapes, Oculus visemes, and eye-blink animations.

**Tools:** Python, FastAPI, React, Three.js, TypeScript, Zustand, WebSockets, Groq API, Docker

### **Traffic Sign Detection & Classification (GTSRB)**

*Nov 2025*

- Built an end-to-end AI traffic sign detection system covering 43 categories using the GTSRB benchmark dataset.
- Designed and optimized a custom CNN in PyTorch, achieving over 95% test accuracy with GPU/CUDA acceleration for fast inference.
- Engineered robust data pipelines with augmentation (lighting, rotation, weather) and modular preprocessing using Otsu, Adaptive, and Cheng-Jin-Kuo algorithms.
- Deployed a full-stack web app with FastAPI backend and HTML/CSS/JS frontend, supporting both CLI and browser-based inference.

**Tools:** Python, PyTorch, FastAPI, OpenCV, HTML/CSS/JS

### **Vehicle Detection & Tracking**

*Dec 2023*

- Built a production-ready web app for real-time vehicle detection, lane-based counting, and traffic classification (heavy/smooth) using YOLOv8.
- Designed an async FastAPI backend with live WebSocket streaming to frontend; supports large batch video uploads and high-res inputs.

- Engineered dynamic polygonal ROI/mask extraction for flexible multi-camera deployment with annotated output video and statistical overlays.

**Tools:** Python, YOLOv8, FastAPI, OpenCV, WebSockets, HTML/CSS/JS

### Auto-Correct System using NLP & Transformers

*May 2025*

- Developed a spelling and grammar correction system combining edit distance, probabilistic N-gram models, and transformer-based contextual embeddings.
- Achieved 92% correction accuracy across benchmark datasets with a 50,000+ word vocabulary, handling both isolated tokens and full sentences.
- Built an interactive Gradio GUI and batch-processing NLP pipeline with before/after comparison and vectorized outputs for potential seq2seq training.

**Tools:** Python, NLTK, PySpellChecker, Gramformer, spaCy, Transformers, Gradio

### DQN Agent for 2048 Game — Reinforcement Learning

*May 2025*

- Developed a Deep Q-Network agent from scratch using custom NumPy/TensorFlow implementations, trained for 10,000+ episodes on GPU.
- Engineered replay buffer, target network architecture, and epsilon-greedy exploration strategy with full training convergence.
- Built an interactive Flask web app for live play, benchmarking, and model checkpoint management (manual and AI-controlled modes).
- Created Matplotlib dashboards to monitor score progression, Q-value trends, and exploration decay in real time.

**Tools:** Python, TensorFlow, NumPy, Flask, Matplotlib

## **SKILLS**

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**ML & Deep Learning:** Scikit-learn, PyTorch, TensorFlow, Neural Networks, Classical ML Models, Feature Engineering, Feature Selection, Model Evaluation, Model Deployment, Hyperparameter Tuning, Reinforcement Learning.

**Generative AI & LLMs:** RAG Pipelines, Prompt Engineering, LangChain, Fine-tuning, Embeddings, Vector Databases.

**NLP & Computer Vision:** Transformers, NLTK, spaCy, HuggingFace, OpenCV, YOLOv8.

**Full-Stack & Deployment:** FastAPI, React, TypeScript, JavaScript, HTML/CSS, WebSockets, REST APIs, API Development, Docker, Streamlit, MLOps.

**Data & Databases:** Pandas, NumPy, Dask, SQL, PostgreSQL, Data Preprocessing, Data Pipelines, Data Visualization (Matplotlib, Seaborn, Power BI).

**Time Series:** ARIMA, SARIMA, Prophet

**Tools & Workflow:** Git, GitHub, Conda, Linux, VS Code, Jupyter Notebooks, OOP, Clean Architecture.

**Soft Skills:** Problem-Solving, Analytical Thinking, Team Collaboration, Technical Writing, Adaptability.

## **EDUCATION**

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**Menoufia University** — B.Sc. in Artificial Intelligence & Data Science.

*Oct 2022 – Expected Jul 2026*

**Relevant Coursework:** Machine Learning, Deep Learning, NLP, Computer Vision, Data Structures & Algorithms, Statistics & Probability, Linear Algebra, Database Systems.

**Senior Project:** Real-Time AI Avatar Teacher — Interactive conversational AI using ASR, RAG, LLMs, TTS, and 3D avatar rendering (FastAPI + React + Three.js).

**GPA:** 3.3/4