Aayush Shah

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EDUCATION

University of the West of England, Bristol (The British College) **Sept 2024 – May 2027**
BSc (Hons) Computer Science - Artificial Intelligence - ***First-Class Honours***
- **Relevant Coursework:** Artificial Intelligence I, Computer Systems Architecture, Foundations of Computing, Principles of Programming, Web Development and Databases

University of the West of England, Bristol **Oct 2022 – July 2023**
FDCERT International Foundation (Computing) - ***First-Class Honours***
- **Relevant Coursework:** Introduction to Programming, Fundamentals of Multimedia, Internet Technologies, Computer Systems and Architecture, Mathematics for Computing, Fundamentals of Data Science

St. Xavier's College, Maitighar **Sept 2020 – Sept 2022**
School Leaving Certificate - ***GPA: 3.65/4.0*** *Maitighar, Kathmandu*
- **Relevant Subjects:** Mathematics, Physics, Social, Chemistry, English, Nepali

TECHNICAL SKILLS

- **Languages & CS:** Python, JavaScript, TypeScript, C++, Data Structures & Algorithms
- **AI / ML & Data:** LLMs, RAG, OCR Pipelines, Fine-tuning, Anomaly Detection, Neural Networks, NLP, TensorFlow, Scikit-learn, NumPy, Pandas, Matplotlib
- **Backend & Databases:** FastAPI, Django, Node.js, SQLAlchemy, Pydantic, REST, JWT, RBAC, OAuth2, PostgreSQL, MySQL, Redis, ChromaDB
- **Frontend & Mobile:** ReactJS, Next.js, Expo React Native, Tailwind CSS, HTML, CSS
- **Cloud, DevOps & Tools:** AWS S3, Microsoft Azure, Docker, GitHub Actions, Apache Kafka, MQTT, Nginx, Playwright, aiohttp, Git, Jira, Postman, Alembic

EXPERIENCE

Xuno **Dec 2025 – June 2026**
Jr. AI/ML Engineer *Maharajgunj, Kathmandu*
- Architected and led a full rewrite of the legacy Scrappy system into a modular, factory-pattern pipeline scraping live FX data from 13 providers across 3 remittance corridors (USD→NPR, USD→INR, GBP→INR), improving scrape throughput by 300% and cutting provider onboarding time by 60%.
- Built an AI-powered competitor rate analysis layer on top of the scraper; ML models compare live provider rates against mid-market benchmarks and surface the optimal Xuno publish rate — used daily by the FinOps team for data-driven pricing decisions.
- Developed real-time anomaly-detection models to flag suspicious FX rate shifts, consuming live scraper feeds and routing structured alerts to Slack, reducing manual monitoring overhead for the operations team.
- Architected a real-time rate-publication pipeline using **Apache Kafka** (aiokafka, 4 topics) and **Goat/Xonnector OAuth2 REST** to push computed exchange rates to downstream pricing and transaction-ledger services.
- Built an **AWS S3**-backed rate-history export system generating structured ML-ready datasets from competitor and mid-market rate trends, enabling ongoing FX spread forecasting research.

Xuno **Sept 2025 – Dec 2025**
AI/ML Intern *Maharajgunj, Kathmandu*
- Developed high-reliability web scrapers ("Scrappy") for USD→INR and USD→NPR corridors, integrating providers including HDFC, Kotak Remit, SBI California, SBI New York, ICICI, Axis RemitMoney, Western Union, Wise, and Remitly.
- Built scalable, asynchronous scraping pipelines using Python (aiohttp, Playwright, BeautifulSoup) and PostgreSQL, improving rate-fetching throughput by 300%.
- Implemented data-validation, error-handling, and automated Slack alerting, reducing failed scrapes by 40%.
- Assisted in building ML-ready datasets from remittance trends, enabling research on forecasting FX spread changes.

DeepLearning.AI Community **Jan 2024 – May 2025**
Volunteer Tester *Remote*
- Reviewed 50+ video lectures, lecture notebooks, and programming assignments during the testing phase, providing detailed feedback that enhanced course quality.
- Verified the accuracy of 30+ resource citations and ensured all links were functional, contributing to a seamless learning experience.
- Reported 30+ issues using the Git Issue Reporting Tool and suggested 10+ additional resources/labs, directly influencing course content improvements.

Headstarter **Jul 2024 – Aug 2024**
Software Engineering Fellow *Remote*
- Built 5+ AI apps and APIs using NextJS, OpenAI, Pinecone, StripeAPI with 98% accuracy as seen by 1000 users.
- Developed projects from design to deployment leading 4+ engineering fellows using MVC design patterns.
- Coached by Amazon, Bloomberg, and Capital One engineers on Agile, CI/CD, Git and microservice patterns.

RELEVANT PROJECTS

Gyanavriksha | FastAPI, PostgreSQL, ChromaDB, React, Redis, MQTT, Docker, Gemini **2026**

- Sole backend architect for an **AI-powered** 7-service microservices platform targeting Nepal's secondary education system — where graded assignments take days or weeks to return; designed 25-table PostgreSQL schema across 8 functional domains and all FastAPI modules from scratch.
- Built an OCR-to-LLM grading pipeline (Google Cloud Vision + Gemini) that digitises handwritten assignments and delivers structured, step-by-step feedback within **minutes** — replacing a manual process that left students without context by the time feedback arrived.
- Implemented a RAG chatbot grounded in instructor-uploaded curriculum via ChromaDB + Gemini, eliminating hallucination and ensuring responses stay syllabus-aligned — filling the gap where personalised tutoring is unaffordable for most Nepali families.
- Integrated ESP32 IoT smart desk telemetry over **MQTT** (per-device light, distance, status topics) with real-time exam integrity monitoring, device-level API key auth, and topic isolation to block spoofed submissions.
- Engineered defence-in-depth security: JWT 15-min expiry with Redis-backed refresh rotation, TOTP 2FA, QR login, SlowAPI rate limiting, and RBAC enforced at the API level .

Learning Prime Number Structure with Machine Learning | Decision Tree, Neural Networks **2026**

- Constructed a **5M-integer dataset** (up to 5×10^8) using a novel Prime-Margin sampling strategy, engineering 177 features across modular, positional, and analytic representations to probe decision boundaries that uniform sampling would obscure.
- Demonstrated that XGBoost rediscovers the Sieve of Eratosthenes from data alone — achieving **100% recall but only 33% precision**, with a flat Precision-Recall curve confirming pseudo-primes are statistically indistinguishable from true primes without explicit factorization.
- Established the **Identifiability Limit** for twin prime detection (precision ceiling ≈11% across all architectures) and the **Structural Ceiling** for factor count prediction (Macro-F1 ≈0.38), empirically validating Hardy–Littlewood independence heuristics and cryptographic hardness assumptions underlying RSA.

Mental Health & Medical AI Chatbot | Mistral 7B, Transformers, Ngrok, Hugging Face **2025**

- Fine-tuned Mistral 7B Instruct v1 model on specialized mental health and medical datasets (MentalChat16k and MeQuAD) using Google Colab Pro, achieving enhanced empathetic responses and medical accuracy for healthcare support applications.
- Deployed the fine-tuned model as a responsive web application using Ngrok tunneling, creating an accessible mental health and medical chatbot that provides empathetic, contextual responses for users seeking psychological and medical guidance.
- Integrated advanced NLP techniques with custom training pipelines, optimizing model performance for sensitive healthcare conversations while maintaining user privacy and data security.
- Documented complete model training process and implementation in Google Colab, providing reproducible research methodology for fine-tuning large language models on healthcare datasets.

PUBLICATIONS

1. **Shah, Aayush, Mahato, Prabhat, & Bhagat, Aadarsh.** (2023). *Enhancing Post-Quantum Cryptography: Exploring Mathematical Foundations and Comparative Analysis of Different Cryptographic Algorithms. International Journal for Research in Applied Science and Engineering Technology*, 11, 1626–1642. DOI: **10.22214/ijraset.2023.55341**
2. **Shah, Aayush.** (2023). *How ChatGPT (AI) is Likely to Become a Potential Threat (or Not) to Human Imagination and Creativity?. International Journal for Research in Applied Science and Engineering Technology*, 11, 379–383. DOI: **10.22214/ijraset.2023.55070**
3. **Mahato, Prabhat & Shah, Aayush.** (2023). *A Review of Prime Numbers, Squaring Prime Pattern, Different Types of Primes and Prime Factorization Analysis. International Journal for Research in Applied Science and Engineering Technology*, 11, 2036–2043. DOI: **10.22214/ijraset.2023.54904**

AWARDS & CERTIFICATIONS

- **Bronze Honour** for exceptional performance in the final round of the **International Youth Math Challenge (2023)**.
- **CS50AI: Introduction to Artificial Intelligence with Python (2024)** – Completed Harvard University's CS50AI course, covering AI fundamentals, including search algorithms, knowledge representation, machine learning, and natural language processing.
- **CS50P: Introduction to Programming with Python (2023)** – Completed Harvard University's CS50P course, covering Python basics, including data types, control structures, functions, and object-oriented programming.
- **DeepLearning.AI Mathematics for Machine Learning and Data Science Specialization (2024)**: Completed a comprehensive specialization covering the mathematical foundations essential for data science and machine learning.