MUHAMMAD FAWAD AKBAR KHAN

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SUMMARY

Ph.D. candidate in Computer Science with expertise in LLMs, generative AI, and education-focused ML systems. Developed and deployed a GPT-powered Intelligent Tutoring System serving 300+ students, integrating fine-tuning, RAG, and keystroke analytics for adaptive feedback. Published extensively in IEEE, ACM, and EDM venues on AI in education, fairness frameworks, and scalable ML pipelines. Skilled in translating ML research into robust, production-ready tools that enhance equity, interpretability, and student learning outcomes.

EDUCATION

Utah State University, Logan, UT **Aug 2021 - May 2026**

Ph.D., Computer Science

- **GPA:** 3.87/4.00
- **Thesis:** Advancing Human-Centered Artificial Intelligence: Fairness, Interpretability, and Intelligent Tutoring Systems f or Scalable Learning and Beyond

University of Engineering & Technology, Peshawar **Aug 2018 – Sept 2020**

M.S., Computer Systems Engineering

- **GPA:** 4.00/4.00
- **Thesis:** Cloud-Based Machine Learning Approaches for Remote Sensing: Toward Scalable, Accurate, and Reliable Geo spatial Analytics

University of Engineering & Technology, Peshawar **Aug 2014 – May 2018**

B.S., Computer Systems Engineering

WORK EXPERIENCE

Utah State University **Aug 2021 - Present**

Graduate Research Assistant *Logan, UT*

- Built and deployed a GPT-powered Intelligent Tutoring System using Hugging Face Transformers, LangChain, and GPT APIs; integrated keystroke analytics and agent-based feedback pipelines to support personalized instruction for 300+ CS1 students.
- Integrated Retrieval Augmented Generation (RAG) and fine-tuned LLMs for domain-specific feedback, improving response accuracy and pedagogical relevance in real classroom use.
- Developed FairMatch, a fairness framework for ML classifiers, integrating fairness in AI practices to improve equity utility performance by 16% without sacrificing overall model integrity.
- Applied graph representation learning for grade prediction in MOOCs, achieving a 92% Macro F1 Score. Extended approach toward anomaly detection and security-relevant reliability testing, aligning with adversarial robustness principles.

Freelance Trader — Remote **Oct 2022 – Present**

Researcher

- Independently managed a personal trading portfolio focused on cryptocurrencies, NFTs, and emerging digital assets, achieving over **$10,000** profit on minimal initial capital.
- Designed and tested AI-assisted trading systems leveraging predictive analytics, reinforcement-learning models for dynamic allocation, and sentiment-driven signal generation.
- Experimented with quantitative trading frameworks—time-series modeling, volatility clustering, and statistical arbitrage—to understand model behavior under varying liquidity and market regimes.
- Utilized algorithmic trading bots, data-driven dashboards, and API integrations for real-time execution and analytics.
- Conducted post-trade evaluation using Sharpe ratio, hit-rate, and drawdown metrics to refine strategies and improve decision consistency.
- Explored risk management and behavioral control through automated position sizing, stop-loss calibration, and exposure monitoring.
- Traded across markets and projects such as XRP, Solana, Dogecoin, MOG, Pudgy Penguins, Kemonokaki, Radbro, and Milady, focusing on momentum, mean reversion, and event-driven setups.

National Center of AI **Apr 2019 - May 2021**
Research Associate *UET Peshawar*

- Architected scalable ML pipelines on GCP/AWS using TensorFlow for satellite image analysis, reducing annotation time by 90%. Optimized inference efficiency and robustness in cloud environments, with applications in geospatial security and monitoring.
- Implemented spectral data image object detection with advanced image processing and data fusion techniques, achieving binary classification accuracy of 99.63% and subclassification accuracy of 96.36%.

US-Pakistan Center for Advanced Studies in Energy (USPCASE) **Aug 2017 – March 2018**
Project Engineer *UET Peshawar*

- Developed ML models for health-monitoring of aircraft hydraulic systems, applying anomaly detection techniques to identify faults in safety-critical systems. Extended to wind farm operations, enhancing system reliability in real-world deployment.

TECHNICAL PROJECTS

AI-Driven Intelligent Tutoring System for Python Programming (GitHub):

- Developed and deployed an AI-driven Intelligent Tutoring System (ITS) for CS1 Python programming, featuring 11,700 exercises across 78 subtopics. System includes GPT-based feedback, keystroke and behavioral data tracking, and instructor dashboards. Implemented fine-tuning and RAG pipelines for adaptive feedback. Deployed on Dockerized infrastructure with secure multi-user access.

Reinforcement Learning for Quadcopter Control (GitHub):

- Implemented a modified Advantage Actor-Critic (A2C) algorithm with entropy regularization and parallelized actors, outperforming DQN, DDQN, and baseline A3C by approximately 70%, 41.7%, and 21.4%, respectively, in simulated environments.

Automated Code Generation Analysis with ChatGPT (IEEE)

- Evaluated 131 Human and LLM-generated code samples, identifying key limitations and opportunities for AI in CS education. Developed and open-sourced an AI code detection model achieving 87% accuracy.

Fairness in Probabilistic Classifiers (IEEE)

- Proposed PCIndFair, a fairness assessment framework for probabilistic classifiers addressing threshold sensitivity. Validated across 4 datasets and multiple neural architectures, with applications in bias mitigation for security-critical ML.

SKILLS

Programming & Frameworks: Python, PyTorch, TensorFlow/Keras, Hugging Face Transformers, LangChain, GPT API , Scikit-learn, XGBoost, Docker, Kubernetes, SQL, GCP, AWS, Azure, Node.js/Vue.js
Machine Learning & AI: LLMs (fine-tuning, RAG, prompt engineering), Deep Learning (CNNs, RNNs, Transformers), Reinforcement Learning, Graph Neural Networks, Fairness in AI, Predictive Modeling, Recommender Systems, Model E valuation & Optimization
Specialized Expertise: Education Data Mining, Cognitive Load Analysis, Keystroke & Interaction Data Analytics, Learn ing Trajectory Modeling, Explainable & Responsible AI

PUBLICATIONS (Google Scholar)

- **Human Evaluation of GPT for Scalable Python Programming Exercise Generation. *IEEE* (2024)**
- **Deciphering Student Coding Behavior. *IEEE* (2023)**
- **Assessing the Promise and Pitfalls of ChatGPT for Automated Code Generation.*EDM*(2024)**
- **Enhancing Individual Fairness through Propensity Score Matching *IEEE DSAA* (2022)**
- **A New Framework to Assess the Individual Fairness of Probabilistic Classifiers *IEEE ICMLA* (2023)**
- Enhancing Automated Grade Prediction Using Graph Learning. *IEEE BigData* (2023)
- An Analysis of the Dynamic of Ties on Twitter *IEEE BigData* (2023)
- A fusion of feature-oriented principal components of multispectral data to map granite exposures of Pakistan *Applied S ciences* (2021)
- Lithological mapping of Kohat basin in Pakistan using multispectral remote sensing data: a comparison of support vector machine (SVM) and artificial neural network (ANN) *Applied Science* (2022)
- Mapping allochemical limestone formations in Hazara, Pakistan using google cloud architecture: application of machine

-learning algorithms on multispectral data *ISPRS* (2021)

LEADERSHIP & EXTRACURRICULAR

USUSA Filmmaking Club (USU Page)

Founder

•Lead 100+ member on more than 5 short film projects, training the next generation of storytellers.

Mentor

Directed a team of undergraduate developers in building the Intelligent Tutoring System, bridging research and scalable s oftware deployment.

AWARDS

•**Outstanding Graduate Teaching Assistant Award**: Utah State University (2024)
•**Summa Cum Laude, M.S.**: University of Engineering & Technology (2020)
•Recipient of multiple competitive **fellowships** and **research awards** for **excellence** in ML and AI-driven education