MUHAMMAD RAFAY AZHAR

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EDUCATION

Harvard University, Cambridge, MA | *John Harvard Scholar* (top 5% of class)
Bachelor's (A.B.) in Computer Science and Economics (Honors) **Expected Graduation May 2025**
Master's (S.M.) in Computational Science and Engineering **Expected Graduation May 2025**
Relevant Coursework: Machine Learning, Probability Theory, Statistical Inference, Linear Algebra, Algorithms & Data Structures, Group Theory, Systems Programming, OOP, Deep Learning, Parallel and Distributed Computing, Discrete Mathematics, Calculus

Aitchison College, Lahore, Pakistan **High School Diploma (2021)**
Awards and Honors: President of Pakistan's Gold Medal for academic excellence. Pakistan's National Philosophy and Chemistry Teams. Class Valedictorian (5x Top in the World, Pakistan, and Punjab – GCSEs). President of Chess and Debating.

TECHNICAL EXPERIENCE

FINRA (Financial Industry Regulatory Authority), *Quantitative Research Intern* **Boston, MA | Jun – Aug 2024**
- Implemented a Deep Q-network RL agent and order matching engine in Python using TensorFlow Agents to model Nasdaq's Dynamic M-ELO; trained on markout and fill rate metrics, supports varied market conditions for stress testing AI order types
- Developed 'Interrogator', an LLM hallucination detection tool by implementing multi-agent topologies using Microsoft's AutoGen, LangChain, and Streamlit; integrated into RAG workflows, cutting reading times by 80% to support 100k+ rules
- Engineered a customizable rule engine for securities filings with Angular UI & Java backend (AWS Lambda, Spring Boot), automating management of 200+ regulatory rules and enhancing compliance for 3,700 firms, cutting processing time by 15%

Decibel Partners, *AI Analyst and Engineering Intern* **Menlo Park, CA | Nov 2023 – Apr 2024**
- Spearheaded due diligence and product trajectory initiatives for 20 AI startups, forming 50+ partnerships; engineered a Python-based tool to analyze and visualize key financial metrics for 32 portfolio firms, facilitating data-driven investments
- Researched AI trends, creating content for the Latent Space podcast (1M+ views) and building thought leadership in tech VC

NJ/NY Gotham FC, *Statistics Consultant* **Harrison, NJ | Sep – Dec 2023**
- Optimized player trade strategies by leveraging point-spread, Elo, and Glicko-2 ratings on 1,275 player transfers across 9 major soccer leagues to quantify net percentile changes in player performance, helping the club win their maiden NWSL title
- Conducted transfer learning research for the VP of the US Soccer Federation; developed statistical models using Shannon entropy to rank 22 set-piece metrics, validating insights from men's soccer to enhance decision-making in women's soccer

Punjab Information Technology Board, *Machine Learning Intern* **Lahore, Pakistan | May – Aug 2022**
- Implemented and trained an Automatic Number Plate Recognition model using YOLOv8, OpenCV, & Tesseract for Optical Character Recognition on self-curated dataset of 500,000+ vehicles, for security & traffic management in city of 14 million
- Developed a concurrency-based Computer Aided Dispatch system using the MVC model and custom Asterisk REST APIs for efficient dispatch of rescue teams, decreasing emergency response times by 40% by boosting performance to 85k+ QPS

PROJECTS AND RESEARCH

Machine Learning Researcher *(with Professor Melissa Dell, Harvard)* **Cambridge, MA | Aug 2023 – May 2024**
- Performed text and sentiment classification by curating extensive dataset of 5 million+ text samples from newspapers and textbooks from 1920-1989 using Mask RCNN and EffOCR, to train a suite of ~20 BERT and RoBERTa models
- Performed hyperparameter tuning and validation for above models to increase f1 performance by 28%. Currently using results to conduct socio-economic analysis, contributing to the News Déjà vu project (https://newsdejavu.github.io/about/)

Machine Learning Research Lead (MIT Sloan School of Management) **Cambridge, MA | Jan – May 2024**
- Invented a novel metric to quantify performative atypicality to better capture differences in organizational synergies. Using BERT and Sentence Transformers, the metric leverages the PCA, UMAP, LDA, and HDBSCAN algorithms on word embeddings of firms' earnings call reports to identify a firm's behavioral position relative to others in its SIC category
- Applied this method to 9000 calls from 3471 firms in 372 industries, outperforming prior models in predicting stock returns

Dark Matter Simulator **Cambridge, MA | Feb – May 2024**
- Developed a high-performance N-body simulator in C++ for Harvard's top systems group, capturing gravitational interactions of dark matter. Utilized OpenMP, MPI, and SIMD vector operations with 256-bit AVX registers for parallel computations
- Rendered real-time visualizations using CImg and ffmpeg; implemented the DGEMM kernel with CUDA SMEM caching. Engineered an *O(N/p * log(N/p))* algorithm using the Barnes-Hut method and Morton's ordering, achieving an 18x speedup

Senior STEM Tutor (Harvard Academic Resource Center) **Cambridge, MA | Aug 2022 – May 2023**
- Tutored Harvard students in 6 computer science, math, and economics courses; designed probability and algorithmic problem sets, developed concept graphs on Bayesian statistics, and mentored students on study strategies

SKILLS

Coding Languages: Python, C++, C, C#, Java, OCaml, JavaScript, HTML, CSS, SQL, React.js, Angular.js