CHRISTOPHER MEJO, Ph.D.

AI Researcher & Theoretical Computer Scientist

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Executive Summary

Theoretical computer scientist and AI researcher bridging quantum computing and production-scale machine learning systems. PhD in Physics from Harvard (completed at age 22) with MIT postdoctoral training under Scott Aaronson in quantum information and complexity theory. Currently holds TS/SCI clearance conducting quantum algorithm research at Sandia National Laboratories through a joint Google Quantum AI initiative, specializing in variational quantum eigensolvers for lattice gauge theory, quantum error correction protocols using surface codes, and tensor network methods for quantum many-body simulation with 50+ qubit systems.

Architect of advanced AI systems spanning multiple domains: developed multi-modal RAG architectures combining dense retrieval (FAISS), graph neural networks (Neo4j), and constitutional AI reasoning for processing 10M+ scientific papers with 40% improvement in relevance metrics. Built production reinforcement learning trading systems using deep Q-networks and transformer models achieving 23% Sharpe ratio improvement while processing 1B+ financial transactions daily with microsecond latency. Created federated learning frameworks across multiple medical institutions for COVID-19 detection (93% accuracy) using EfficientNet-B7 with differential privacy guarantees. Google Summer of Code Fellow (2024-2025) developing meta-learning algorithms for adaptive retrieval and causal inference frameworks, with proven track record deploying mission-critical AI systems in national security, healthcare, fintech, and cybersecurity contexts.

Education

Postdoctoral Fellowship, Theoretical Computer Science
Massachusetts Institute of Technology (2010-2012)
Faculty Advisor: Dr. Scott Aaronson

Ph.D. in Physics
Harvard University (2007-2010)

B.S. in Physics and Computer Science
Harvard University (2004-2007)

Professional Experience

Google Summer of Code 2024 & 2025 Fellowship

AI Scholar Project | R Foundation for Statistical Computing

- Architected a sophisticated multi-modal RAG system combining dense retrieval (FAISS), sparse retrieval (BM25), and graph-based retrieval using Neo4j knowledge graphs for comprehensive scientific literature analysis across 10M+ research papers

- Implemented advanced chain-of-thought reasoning using constitutional AI principles with multi-step verification, enabling the system to break down complex scientific queries into logical reasoning steps with explicit uncertainty quantification

- Developed hierarchical document chunking with sentence-aware boundaries and configurable overlap percentages, preserving semantic coherence while enabling multi-scale retrieval from abstract-level to equation-level granularity

- Created dynamic knowledge graph construction using named entity recognition (spaCy, BERT-NER) and relation extraction (OpenIE, dependency parsing) to automatically build semantic networks connecting research concepts, authors, and methodologies

- Implemented federated learning capabilities allowing distributed training across institutional boundaries while maintaining differential privacy guarantees using techniques like gradient compression and secure aggregation protocols

- Designed multi-agent reasoning architecture with specialized agents for fact-checking, summarization, and research synthesis, coordinated through a central planner using reinforcement learning for optimal agent selection

- Built adaptive retrieval system using meta-learning to personalize search strategies based on user expertise level, research domain, and query complexity, achieving 40% improvement in relevance scores over baseline methods

- Developed uncertainty quantification framework using Monte Carlo dropout, evidential deep learning, and ensemble disagreement to provide calibrated confidence estimates for generated responses

- Implemented real-time collaborative filtering using matrix factorization and deep neural collaborative filtering for personalized paper recommendations, incorporating citation networks and author collaboration graphs

- Created automated hypothesis generation system using variational autoencoders and generative adversarial networks to suggest novel research directions based on literature

gaps and trending topics

- Designed causal reasoning module using Pearl's causal hierarchy and do-calculus to identify causal relationships in scientific literature, enabling counterfactual reasoning about experimental outcomes

- Built comprehensive MLOps pipeline using MLflow, Kubeflow, and Apache Airflow for automated model retraining, A/B testing of retrieval strategies, and continuous deployment with zero-downtime updates

Visiting Research Scientist, Sandia National Laboratories (2020-2024)

Quantum Computing & High Energy Physics | Joint Google Quantum AI Initiative

- Led collaborative research initiative with Google Quantum AI exploring quantum algorithms for high energy physics simulations, developing novel variational quantum eigensolvers for lattice gauge theory calculations
- Implemented quantum resource estimation frameworks for near-term quantum devices, analyzing circuit depth, gate counts, and error correction requirements for physics simulation algorithms using Qiskit and Cirq
- Designed and implemented quantum error correction protocols for fault-tolerant quantum computation, analyzing threshold theorems and developing efficient syndrome decoding algorithms for surface codes
- Implemented distributed quantum computing simulations using cluster computing environments (SLURM) for large-scale quantum many-body system studies with up to 50+ qubit systems
- Contributed to quantum cryptography research for secure communications in national security applications, developing post-quantum cryptographic protocols resistant to both classical and quantum attacks

Senior Data Scientist, Braverock LLC (2021-Ongoing)

- Architected cutting-edge reinforcement learning trading systems using deep Q-networks, policy gradient methods, and actor-critic algorithms for multi-asset portfolio optimization across global markets achieving 23% improvement in Sharpe ratio
- Developed transformer-based market prediction models using attention mechanisms and positional encoding adapted for financial time series, processing 1B+ financial transactions daily with microsecond latency requirements
- Created graph neural network architectures for modeling complex asset relationships and market microstructure, using message passing and graph attention networks for regime detection and risk management
- Implemented meta-learning algorithms for rapid adaptation to new market regimes, using model-agnostic meta-learning (MAML) and few-shot learning techniques for strategy generalization across market conditions

- Built comprehensive MLOps infrastructure using MLflow, Kubeflow, and Apache Airflow for automated model deployment, monitoring, and retraining in production trading environments with real-time streaming analytics

Senior Data Scientist, Cushion AI (2021)

Spearheaded development of advanced machine learning models and CushionNLP (proprietary BERT-based transformer system) to enhance bank fee negotiation capabilities, resulting in 30% increase in successful negotiations and $2M+ in additional customer savings annually. Architected state-of-the-art transaction categorization system using ensemble methods and graph neural networks, achieving 95% accuracy across 80M+ transactions from thousands of financial institutions while reducing processing time by 50%.

Research Data Scientist, RapidRads AI (2019-2022)

Architected state-of-the-art computer vision system for COVID-19 detection from chest X-rays using EfficientNet-B7 backbone, achieving 93% accuracy with federated learning frameworks across multiple medical institutions. Implemented comprehensive ensemble methods combining multiple CNN architectures with Grad-CAM visualization and uncertainty quantification for clinical validation.

Senior Data Scientist & Cybersecurity Researcher, Confiant (2017-2019)

Architected sophisticated threat detection system using ensemble methods combining Isolation Forest, One-Class SVM, and LSTM autoencoders for identifying zero-day malware and advanced persistent threats. Implemented advanced graph neural networks using GraphSAGE for modeling complex ad network relationships and detecting coordinated botnet attacks across 1B+ daily ad requests.

CEO and Lead Architect, Cronode (2011-2017)

Architected and implemented advanced “MoreLikeThis” recommendation engine using TF-IDF vectorization, cosine similarity, and collaborative filtering algorithms, achieving 35% increase in user engagement. Developed sophisticated Apache Solr configuration with custom similarity functions combining BM25 scoring with content-based features and machine learning ranking algorithms.