

Muhammad Azam

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EDUCATION

University of Missouri

Ph.D. in Computer Science

Columbia, MO, USA

Aug 2022 – 2026

University of Agriculture, Faisalabad

MS in Software Engineering

Faisalabad, Pakistan

Oct 2021

Bahauddin Zakariya University

Master in Information Technology

Multan, Pakistan

Sep 2016

The Islamia University of Bahawalpur

Bachelor of Science

Bahawalpur, Pakistan

Mar 2014

WORK EXPERIENCE

Graduate Research Assistant

University of Missouri — Digital Biology Lab (DBL)

Aug 2022 – 2026

- Conducting research in AI with a focus on LLMs, prompt engineering, and RAG for biomedical and clinical applications.
- Applying Bayesian optimization for prompt tuning in biomedical information extraction.
- Designing pipelines for gene-disease and gene-drug extraction, building knowledge graphs using Gene Ontology and UMLS.
- Developing multimodal systems for knowledge extraction from literature and biological pathway figures.
- Assisting in undergraduate and graduate instruction, research advising, and grading.

Data Analyst

Freelancer (Upwork & Fiverr)

Jun 2020 – Oct 2022

- Delivered data analysis, automation, and predictive modeling to international clients.
- Used network modeling and link prediction for market intelligence and decision support.
- Built automated dashboards and workflows for financial and operational insights.
- **Tools:** Python, Pandas, Matplotlib, SQL, Excel.

Lecturer (Computer Science)

Higher Education Department, Government of Punjab

May 2017 – Jun 2018

- Taught undergraduate courses in computer science and supervised student projects.
- Developed and delivered lectures, labs, and assessments aligned with curriculum standards.
- Managed academic documentation, reporting, and departmental coordination.
- Supported academic initiatives and fostered a collaborative learning environment.

Network Engineer (Intern)

Minhaj University Lahore

Jan 2017 – May 2017

- Assisted with configuration, troubleshooting, and maintenance of campus-wide networks.
- Hands-on with LAN/WAN, IP configuration, routing, and security protocols.

- Taught undergraduate courses in computer science and information technology while completing a concurrent internship.
- Designed and delivered course materials, lectures, and practical sessions in programming and computing fundamentals.
- Supervised student projects and provided guidance in research and technical writing.
- Collaborated with faculty to improve the computer science curriculum and student engagement.

PUBLICATIONS

1. Azam, M., et al. (2025). Applications of Large Language Models and Prompt Optimization for Knowledge Extraction from Biological Pathway Figures. *Journal of Biomedical and Health Informatics*.
2. Azam, M., et al. (2025). Large-Scale Pretrained Language Models. *AI-Driven Drug Design*. Springer Nature. (Accepted, Book chapter)
3. Azam, M., et al. (2025). Optimize Large Language Model Prompts for Text Mining through Bayesian Optimization. *Nature Machine Intelligence*. (Under Review)
4. Azam, M., et al. (2025). Advancing Molecular Biology Analysis with a Retrieval-Augmented Generation Framework for Gene Interactions. Manuscript (Under Review).
5. Azam, M., et al. (2024). Evaluation and Integration of Advanced AI Chatbots for Biological Pathway Curation. *2024 IEEE Intl. Conf. on Bioinformatics and Biomedicine (BIBM)*.
6. Azam, M., et al. (2024). Gene Name Recognition in Gene Pathway Figures Using Siamese Networks. *2024 IEEE MedAI Conference*.
7. Azam, M., et al. (2024). A Comprehensive Evaluation of Large Language Models in Mining Gene Interactions and Pathway Knowledge. *Quantitative Biology*. Wiley.
8. Azam, M., et al. (2023). Recognition of Gene Names from Gene Pathway Figures Using Siamese Network. *WASET International Journal*.
9. Azam, M., et al. (2023). Annotations of Gene Pathways Images in Biomedical Publications Using Siamese Network. *WASET International Journal*.
10. Azam, M., et al. (2023). Evaluations of Similarity-Based Link Prediction Techniques in Social Network. *Journal of Engineering Science and Technology (JESTEC)*, 18(2), 1055–1082.
11. Azam, M., et al. (2023). A Systematic Review of Non-functional Requirements Mapping into Architectural Styles. *Bulletin of Electrical Engineering and Informatics (BEEI)*.
12. Azam, M., et al. (2023). Application of Machine Learning in Estimating On-tree Yield of Citrus Fruit. (Proceedings not specified.)
13. Azam, M., et al. (2022). Comparative Analysis of Machine Learning Technique to Improve Software Defect Prediction. *KIET Journal of Computing and Information Sciences (KJCIS)*.
14. Azam, M., et al. (2022). Evaluation of Image Support Resolution Deep Learning Technique Based on PSNR Value. *Journal of Computing and Information Sciences*. KIET.
15. Azam, M., et al. (2022). Suicidal Behavior Prediction and Socioeconomic Suicide Indicators. *EAI Endorsed Transactions on Pervasive Health and Technology*.
16. Azam, M., et al. (2022). A Systematic Review of Blockchain Technology in the Current Epoch: Applications, Adoption Challenges, and Opportunities. *Bulletin of Electrical Engineering and Informatics*

(BEEI).

17. Azam, M., et al. (2021). Secure Digital Transactions in The Education Sector Using Blockchain. *EAI Endorsed Transactions on Scalable Information Systems*.
18. Azam, M., et al. (2021). The Role of Laboratory Technicians and the Client Public–Private Collaboration Against COVID-19. *Academia Letters*.
19. Azam, M., et al. (2021). Structural Importance-based Link Prediction Techniques in Social Network. *EAI Endorsed Transactions on Industrial Networks and Intelligent Systems (INIS)*.

PROFESSIONAL SERVICES

Reviewer for International Journals and Conferences

- EAI Transactions on Industrial Networks and Intelligent Systems
- EAI Transactions on Scalable Information Systems
- EAI Transactions on Pervasive Health and Technology
- EAI Transactions on Context-Aware Systems and Applications
- IEEE Access
- International Journal of Artificial Intelligence and Robotics Research

CONFERENCE PRESENTATIONS & INVITED TALKS

- Automated Prompt Injection Optimization for Large Language Models in Biomedical Text Mining
Invited Research Talk — Bond Life Sciences Center (LSC), University of Missouri, 2025
- Applications of Large Language Models and Prompt Optimization for Knowledge Extraction from Biological Pathway Figures
Invited Research Talk — Bond Life Sciences Center (LSC), University of Missouri, 2025
- Optimize ChatGPT Prompts for Text Mining of Gene Relationships through Genetic Algorithm
AI Showcase Presentation — AMIA 2024 Annual Symposium, San Francisco
- Evaluation and Integration of Advanced AI Chatbots for Biological Pathway Curation
Oral Presentation — 2024 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)
- Extracting Gene Pathways from Figures Using Pool-Less Active Learning
Poster Presentation — AMIA 2023 Annual Symposium, New Orleans
- Recognition of Gene Names from Gene Pathway Figures Using Siamese Network
Oral Presentation — International Conference on Bioengineering & Life Sciences (WASET 2022)

PROJECTS

- Social Network Link Prediction Model (SNLPM) Developed a link prediction model using similarity-based metrics (normalized and unnormalized) to identify potential future connections in social networks for applications in social media, academic collaboration, and professional networking.
- Software Defect Prediction Model (SDPM) Built a machine learning model to predict software defects prior to testing by analyzing code complexity, version changes, historical defects, and additional quality metrics.

- **Gene Name Recognition from Pathway Figures (GNRPF)** Implemented a Siamese-network-based deep learning system for automatic extraction of gene names from biological pathway figures to accelerate pathway curation.
- **Case Management System** Developed a C-based case management application for lawyers to efficiently manage legal case workflows.
- **Stock Management System** Designed a C and SQL database system to track and manage raw material inventory and stock operations.
- **Secure Digital Transactions in Education (Blockchain)** Proposed a decentralized blockchain-based system for secure digital transactions in the education sector using MetaMask, IPFS, and Ganache.

RESEARCH MENTOR

Undergraduate & Master's Research

- Provide mentorship to undergraduate and master's students engaged in biomedical AI research at the University of Missouri.
- Supervise student-led projects involving large language models (LLMs), deep learning, and automated extraction of biological pathway knowledge from literature and pathway figures.
- Guide students in formulating research methodologies and implementing computational workflows.
- Support students in preparing scientific manuscripts and conference presentations.
- Mentor students in developing domain-specific knowledge graphs using Gene Ontology, UMLS, and structured biological relations.

SKILLS

- **Technical & Research Skills:** Prompt engineering and optimization, Retrieval-Augmented Generation (RAG), Large Language Models (LLMs), Bayesian optimization, Biomedical text & figure mining, Bioinformatics & computational biology, Ontology mapping (Gene Ontology, UMLS), Gene-disease & gene-drug relationship mining, Pathway figure-to-text information extraction, Scientific data mining and extraction, Knowledge graph construction, Deep learning.
- **Programming & Tools:** Python, PyTorch, TensorFlow, NumPy, Pandas, Scikit-learn, LangChain, OpenAI API, Hugging Face Transformers, Docker, REST APIs, SQL, Neo4j (graph databases), R, SPSS, Weka, C, C++, C#, LaTeX, Git, Jupyter Notebooks, Visual Studio, MS Office / Office 365.
- **Machine Learning & NLP:** Deep learning, Transfer learning, Natural Language Processing (NLP), Text classification & clustering, Named Entity Recognition (NER), Semantic search, Embedding models (SBERT, SimCSE), Transformer models (BERT, BioBERT, GPT, T5, LLaMA, Mistral), Few-shot & zero-shot learning, Computer vision, Image processing, Representation learning.

AWARDS AND HONORS

- **Travel Award**, Department of Electrical Engineering & Computer Science, University of Missouri 2023
- **Prime Minister's Laptop Scheme**, Bahauddin Zakariya University / Higher Education Commission, Pakistan 2017
- **Academic Achievement Honor**, PM Fee Reimbursement Initiative, Government of Pakistan / Higher Education Commission 2016

HOBBIES AND INTERESTS

- **Exploring AI & LLMs**, staying current with advances in generative AI, biomedical informatics, and cutting-edge machine learning research.
- **Reading Scientific Literature**, including AI, computational biology, and innovation-focused non-fiction to broaden interdisciplinary understanding.
- **Ethical Hacking**, participating in cybersecurity challenges to strengthen system security awareness and technical problem-solving skills.
- **Sports & Physical Well-being**, actively involved in cricket, pickleball, and outdoor team activities to support health, focus, and teamwork.
- **AI Hackathons & Competitions**, engaging in AI hackathons, Kaggle challenges, and collaborative ML projects to apply and expand technical expertise.
- **Mentorship & Technical Writing**, mentoring junior researchers and contributing writing on NLP, LLMs, and prompt engineering to support accessible research communication.

REFERENCES

- **Dr. Dong Xu**

Curators' Distinguished Professor, Paul K. and Diane Shumaker
University of Missouri – Columbia
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- **Dr. Toni Kazic**

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University of Missouri – Columbia
Office: 143A Naka Hall
Email: kazict@missouri.edu
Phone: 573-882-1946
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- **Dr. Michael (Olaolu) Arowolo, PhD, OCE, MIEEE**

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New Orleans, Louisiana, United States
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