Muhammad Azam

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Education

University of Missouri — **Columbia, MO, USA**
Ph.D. in Computer Science — *Aug 2022 – 2026*

University of Agriculture, Faisalabad — **Faisalabad, Pakistan**
MS in Software Engineering — *Oct 2021*

Bahauddin Zakariya University — **Multan, Pakistan**
Master in Information Technology — *Sep 2016*

The Islamia University of Bahawalpur — **Bahawalpur, Pakistan**
Bachelor of Science — *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.

Lecturer (Part-time, Computer Science)
Lahore Garrison College Jan 2017 – May 2017

- 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**
  Associate Professor, Electrical Engineering and Computer Science
  University of Missouri – Columbia
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- **Dr. Michael (Olaolu) Arowolo, PhD, OCE, MIEEE**
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