Muhammad Arbab Arshad

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EXPERIENCE

- **AI Institute for Resilient Agriculture (AIIRA), Iowa State University** — Iowa, United States of America
  Research Assistant — *Jan 2023 – Present*
  - **Agricultural LLM**: Developed Large Language Model for precise agricultural recommendations using expert-verified data on 90 species. Implemented Retrieval Augmented Generation with 82% recall and 65% precision. Integrated multi-LLM support for enhanced performance. (AgLLMs.github.io)
  - **LLM Evaluation**: Developed 12-task agricultural benchmark to evaluate multimodal LLMs. Established baseline metrics, achieving up to 73.37% F1 score with few-shot learning. (AgLLMs.github.io/AgEval)
  - **3D Modeling**: Evaluated Neural Radiance Fields for detailed 3D plant reconstruction in various environments. Achieved 74.6% accuracy in challenging outdoor scenarios, demonstrating potential for complex modeling. Developed optimization technique reducing training time by 50% with minimal accuracy loss.

- **Kingland Systems** — Iowa, United States of America
  Software Engineering Intern — *May 2023 – Aug 2023*
  - **Cloud Deployment**: Implemented auto-scaling AWS Fargate deployment and developed end-to-end stress testing pipeline using JMeter and Blazemeter, optimizing resource usage and enabling comprehensive load testing
  - **CI/CD Enhancement**: Customized GitLab CI/CD pipeline to seamlessly integrate testing, ensuring uninterrupted development workflow
  - **Recognition**: Received formal recognition in two sprint retrospectives for establishing comprehensive load testing baseline

- **Laboratory for Software Design, Iowa State University** — Iowa, United States of America
  Research Assistant — *Jan 2022 – Aug 2022*
  - **Program Repair**: Executed 5 automated repair tools on GPU clusters for empirical study. Optimized parallel execution, reducing time by 16x across 40 clusters.
  - **Research Impact**: Publication received Distinguished Paper Award at 38th IEEE/ACM Conference on Automated Software Engineering.

- **OpenUAE** — Sharjah, United Arab Emirates
  Machine Learning Engineer — *May 2020 – Dec 2021*
  - **FDIA Detection**: Developed deep learning models (CNN, LSTM) for False Data Injection Attack detection in smart grids. Achieved 94.53% accuracy with attention-based LSTM on IEEE bus systems.
  - **Model Comparison**: Evaluated CNN, LSTM, and hybrid models on row accuracy, computational time, and memory usage. Optimized model architectures through manual grid search for layers and neurons.
  - **Electricity Prediction**: Developed and optimized 12 ML models with 50 million records to predict monthly electricity use in Dubai, achieving 92.5% accuracy.

EDUCATION

- **Iowa State University** — Iowa, United States of America
  Doctor of Philosophy (Ph.D.) in Computer Science; GPA: 3.96 — *Jan 2022 – Present*

- **American University of Sharjah** — Sharjah, United Arab Emirates
  Master of Science (M.S.) in Computer Engineering; GPA: 3.52 — *Aug 2019 – Aug 2021*

- **Lahore University of Management Sciences** — Lahore, Pakistan
  Bachelor of Science (B.S.) in Computer Science — *Aug 2015 – May 2019*

PROJECTS

- **MeditateGPT**: Designed and developed an application for customized guided meditations using GPT-4 API, MERN Stack, Amazon Polly, and AWS S3.
- **Bat Behavior Analysis**: Adapted unsupervised ML image clustering algorithms to audio data for bat behavior analysis, achieving 88.28% accuracy in classifying bats.
- **Emotional Melody**: Developed a text-to-audio generation system for poetry-to-melody using GANs, generating melodies with 68% perceived similarity to real melodies.
- **Intrusion Detection**: Utilized Amazon EI to remotely detect SSH and FTP brute-force attacks, achieving 99% F1 score and 8x speed increase compared to local inference.

Technical Skills

- **Languages**: Python, R, C++, Java, SQL, JavaScript, LaTeX
- **Machine Learning**: Foundation Models, TensorFlow, PyTorch, Scikit-learn, Keras, CUDA, Deep Learning
- **Large Language Models**: Transformers, Hugging Face, LangChain, MLflow
- **Cloud & DevOps**: AWS, Docker, GitLab CI/CD
- **Data Analysis**: Pandas, NumPy, Matplotlib, Seaborn, Jupyter
- **Web Development**: React, Node.js, Express, MongoDB
- **Other**: Git, Linux, Agile, Computer Vision, NLP, Distributed Systems

Selected Research Publications

- **Leveraging Vision Language Models for Specialized Agricultural Tasks**: IEEE/CVF Winter Conference on Applications of Computer Vision (WACV), 2025.
- **Assisted Few-Shot Learning for Vision-Language Models in Agricultural Stress Phenotype Identification**: Advances in Neural Information Processing Systems (NeurIPS), Workshop on Adaptive Foundation Models: Evolving AI for Personalized and Efficient Learning, 2024.
- **Mutation-based Fault Localization of Deep Neural Networks**: 38th IEEE/ACM International Conference on Automated Software Engineering (ASE), 2023.
- **Putting GPT-4o to the Sword: A Comprehensive Evaluation of Language, Vision, Speech, and Multimodal Proficiency**: Applied Sciences, 2024.
- **Comparison of deep learning algorithms for site detection of false data injection attacks in smart grids**: Energy Informatics, 2024.
- **Evaluating Neural Radiance Fields (NeRFs) for 3D Plant Geometry Reconstruction in Field Conditions**: Plant Phenomics, 2024.
- **Forecasting highly fluctuating electricity load using machine learning models based on multimillion observations**: Advanced Engineering Informatics, 2022.