MUYIDEEN ABDULSAMAD

AI Researcher · AI for Scientific Discovery · Materials Informatics · ML Engineering

RESEARCH PROFILE

AI researcher building machine learning systems that accelerate scientific discovery across materials science, engineering simulation, and physical sensing. Research spans materials property prediction, inverse design of materials, acoustic intelligence, and computer vision — each project going from problem definition through model architecture, training, validation, and production deployment. Background in metallurgical and materials engineering provides domain depth across inorganic materials, thermodynamics, solid-state physics, and experimental characterisation — the scientific grounding that makes the AI work meaningful rather than generic. Seven years of production software engineering ensures research outputs become real systems, not just papers.

RESEARCH INTERESTS

AI for materials discovery · Inverse design of functional materials · ML for property prediction · Physics-informed machine learning · Scientific workflow automation · AI-accelerated simulation · Autonomous experimentation · Materials informatics

RESEARCH EXPERIENCE

Materials Inverse Design — AI-Driven Composition Prediction | Independent Research *2024*

- Designed and built an ML inverse design model addressing a fundamental challenge in materials discovery: given a target set of mechanical properties, predict the elemental composition and heat treatment route required to achieve them.
- Framed as a reverse-mapping neural network trained on composition-structure-property datasets curated from peer-reviewed materials science literature; validated predictions against held-out alloy data.
- Directly addresses the AI-for-science problem of reducing the search space in materials discovery — instead of screening thousands of compositions experimentally, the model proposes candidates computationally.
- Stack: Python, TensorFlow, Scikit-learn, NumPy, Pandas, Matplotlib.

ML Prediction of Steel Mechanical Properties — Materials Informatics | B.Eng. Thesis, Ahmadu Bello University *2024*

- Developed an end-to-end ML pipeline predicting tensile strength, yield strength, and hardness of steel from iron-carbon phase diagram data; achieved 90%+ accuracy on held-out test data.
- Scientific contribution: demonstrated that phase diagram composition and microstructure phase fractions, combined with heat treatment parameters, are sufficient features to predict mechanical properties at engineering accuracy — removing the need for physical testing at the screening stage.
- Pipeline: phase diagram data extraction → feature engineering on composition and heat treatment variables → model training with cross-validation → uncertainty-aware prediction output.
- Stack: Python, TensorFlow, Scikit-learn, MATLAB.

Acoustic Intelligence Research — OPsonic | DataVessel Lab *2024*

- Research question: can a compact deep learning model classify acoustic events reliably enough for production deployment in a real scientific data platform?
- Designed and conducted the full research cycle: audio dataset curation, feature representation study (mel-spectrogram vs MFCC vs raw FFT — mel-spectrogram with log-amplitude scaling outperformed alternatives by 4% F1), CNN+LSTM architecture design, training, evaluation, and production deployment.
- Result: 92% classification accuracy on held-out test data; deployed as a production REST microservice for DataVessel Lab's data pipeline.
- Stack: Python, TensorFlow, Librosa, FastAPI, Docker.

Computer Vision Research — Gesture Classification at the Edge | Independent Research *2024*

- Research question: can a lightweight custom CNN classify sequential human gestures reliably enough for

real-time on-device inference without cloud dependency?

- Built and trained a custom CNN from scratch using PyTorch — dataset curation, augmentation pipeline design, architecture search, training with cross-validation, model quantisation, and mobile deployment.
- Result: real-time gesture classification with under 100ms on-device inference; deployed in FajrGuard mobile application with local inference only, preserving user privacy by design.
- Stack: Python, PyTorch, OpenCV, mobile deployment tooling.

Exploration of ML Applications in Computational Fluid Dynamics | Independent Research *2023 – 2024*

- Conducted research into the application of machine learning to computational fluid dynamics — studied surrogate modelling approaches, ML-CFD integration methods, and the theoretical basis for replacing physics solver runs with neural network approximations.
- Built experimental models to understand how ML can learn the mapping from boundary conditions and geometry to simulation outputs; explored the trade-offs between model accuracy, training data requirements, and inference speed in physics-adjacent ML tasks.
- Informed by COMSOL Multiphysics simulation experience and literature on physics-informed neural networks (PINNs) and neural operators.

Bio-Neuron Chip Design — Collaborative Research | UC San Diego, Dept. of Bioengineering *2023 – 2024*

- Collaborated with a doctoral researcher at UC San Diego Bioengineering to design a bio-neuron chip prototype; designed micro-electrode arrays, microfluidic channels, and chip geometry in SolidWorks with geometry constrained by nanoscale fabrication requirements.
- Research context: the chip design is part of a broader bioengineering research programme studying neural signal transduction at the interface of biological and electronic systems.
- Delivered fabrication-ready technical drawings and 3D assemblies for laboratory prototyping.

TECHNICAL SKILLS

ML & Deep Learning: Python (advanced, 7 years), PyTorch, TensorFlow, Scikit-learn, Keras, NumPy, Pandas, SciPy, Matplotlib, Seaborn

Architectures & Methods: CNN, LSTM, Transformer-based models, graph neural networks (reading), physics-informed neural networks, inverse design, active learning, Bayesian optimisation

Scientific Domains: Inorganic materials science, solid-state physics, thermodynamics, phase diagram analysis, acoustic signal processing, computer vision, computational fluid dynamics (ML-adjacent)

Simulation & CAE: ANSYS (FEA, Explicit Dynamics, Granta), COMSOL Multiphysics, SolidWorks, MATLAB

MLOps & Deployment: Docker, Kubernetes, FastAPI, MLflow, CI/CD, Git, Linux/Bash, REST APIs, MongoDB

Languages: Python, Rust, MATLAB, Java, JavaScript, SQL, Bash

PRODUCTION SYSTEMS BUILT ON RESEARCH

- OPsonic — acoustic classification model (92% accuracy) deployed as production REST microservice for DataVessel Lab.
- FajrGuard — real-time computer vision app, custom CNN, under 100ms on-device inference, live on mobile.
- Enterprise management system — FastAPI + React.js, Kubernetes-deployed, serving 100+ users.
- Materials inverse design model — Python, TensorFlow, validated against published alloy datasets.
- SeenTrad — full-stack multi-vendor marketplace, live in production.

EDUCATION

B.Eng. Metallurgical & Materials Engineering *Oct 2024*

Ahmadu Bello University, Zaria · Second Class Upper (Hons)

Thesis: ML simulation and prediction of steel mechanical properties via iron-carbon phase diagram — 90%+ prediction accuracy.

AWARDS

- Computational Materials Engineer Class Award — ABU MME Department, 2024 (ML-driven materials innovation)
- Tech Oracle Award — NUESA Online Quiz Competition, 2024

LANGUAGES

- English (Proficient) · Arabic (Conversational) · Hausa (Fluent) · Yoruba (Fluent) · French (Basic)