

Blessed Madukoma

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Research Interests

Keeping AI-powered data systems correct as their data, definitions, access rules and tools change, and what that costs. Current focus: LLM data agents and what their traces do not record.

Education

- **Carnegie Mellon University** Aug 2024 – May 2026
MSc Information Technology (Software Engineering, Big Data and Applied ML). GPA: 3.93/4.00 Kigali, Rwanda
 - **Thesis:** Performance anomaly detection in sports using ML models and statistical methods, with a systems engineering application. *Advisor: Prof. Prasenjit Mitra.*
- **Babcock University** Aug 2018 – Jun 2022
BSc Software Engineering, First Class Honours. GPA: 4.55/5.00 Ogun, Nigeria
 - **Final-year project:** Light automation management system: built and evaluated an ESP32-PIR-Firebase classroom-lighting prototype. *Advisor: Dr Oluwatofunmi Adetunji.*

Research Experience

- **Carnegie Mellon University Africa** Kigali, Rwanda
Graduate Research Associate, Spatial and Language Technologies (SaLT) Lab Jun 2026 – Sep 2026
Project: Harness effects and data-reference errors in LLM data agents ([code](#)). *Advisor: Prof. Prasenjit Mitra.*
 - Analysed 283,435 steps of LLM data agents. In DataAgentBench’s logs, the harness caused 21.6% of Python steps to fail with syntax errors shown as the model’s; removing them changes how its six models rank.
 - Built a static checker (Python `ast`) that blocks steps naming files, columns or keys missing from the data, and names what exists. After two fixes, it blocked none of 8,517 working steps on three unseen benchmarks.
 - Ran pre-registered experiments (36,990 runs): blocking these errors raised accuracy only where they were frequent (0.68 points), with no detectable advantage over an error message listing the existing names.
Project: Sports analytics for Rwanda’s Ministry of Sports.
 - Wrote two policy documents for the Ministry, including a feasibility study of sports prediction systems.
Graduate Research Assistant, Spatial and Language Technologies (SaLT) Lab Sep 2025 – May 2026
Project: Performance anomaly detection in athletics. MSc thesis; paper [C1]. *Advisor: Prof. Prasenjit Mitra.*
 - Built an anomaly-detection platform over 1.5M+ athletics performances from 19,000+ competitions (2010–2025), with an investigator dashboard and audit trails to the performance and sanctions records (FastAPI, PostgreSQL, DuckDB, Redis). [Live platform](#).
 - Implemented 8+ statistical, ML and Bayesian detection methods with explainable consensus flagging and elite-filtered thresholds, and compared their flags with Athletics Integrity Unit sanctions records. Using only public data, the system cut the investigators’ review scope by 99.5%.
Volunteer Research Assistant, Remote Sensing and Geospatial Analysis Jan 2025 – Apr 2025
Project: Potato yield estimation from satellite imagery. *Advisor: Prof. Moise Busogi.*
 - Annotated crop types in satellite imagery for the yield estimation project.

Publications

C = CONFERENCE, W = WORKSHOP

- [C1] B. Madukoma and P. Mitra, “Performance Anomaly Detection in Athletics: A Benchmarking System with Visual Analytics,” in *IEEE Swiss Conference on Data Science and AI (SDS)*, Zurich, Switzerland, 2026. Poster presentation. **Honorable Mention – Best Paper Award**. [arXiv:2604.21953](https://arxiv.org/abs/2604.21953).
- [W1] S. Wafula and B. Madukoma, “Unmasking COVID-19 Vulnerability in Nigeria: Mapping Risks Beyond Urban Hotspots,” in *Women in Machine Learning (WiML) Workshop at NeurIPS*, 2025. [OpenReview](#). [arXiv:2509.05398](https://arxiv.org/abs/2509.05398).

Honours and Awards

- **Honorable Mention – Best Paper Award**, IEEE SDS 2026, Zurich, for paper [C1].

Industry Experience

- **Sedge** [[sedge.app](#)]

Co-founder

- Designed and deployed the Go backend and data pipelines (PostgreSQL, Redis) of a data platform.
- Building safe execution for LLM-generated SQL: a read-only login check, read-only transactions with a time limit and row cap, and a parser allow-list (pg_query_go, TiDB parser).

- **Ministry of Infrastructure (MININFRA)**

Data Engineering and Analytics Engineer (Contract)

Kigali, Rwanda

May 2025 – Sep 2025

- Architected an [infrastructure intelligence platform](#) that consolidates siloed construction-permit and land-use datasets into one system for evidence-based urban planning.
- Built end-to-end pipelines for permit and land-use records, and defined 12+ urban-development indicators, including permit throughput and capital-allocation trends.

- **Huza HR**

Software Engineer (MSc Internship)

Kigali, Rwanda

Jun 2025 – Sep 2025

- Built an email-notification system with multi-stage recruitment templates for candidates, recruiters and internal teams, which enabled the company's first fully digital applicant-tracking workflow.
- Implemented core recruitment workflows (Next.js, Node.js) and reviewed 5+ peer pull requests; the first deployment onboarded 50+ job seekers and 10+ recruiters.

- **The UPANZI Network**

Software Engineer

Kigali, Rwanda

Sep 2024 – Dec 2024

- Migrated the front end of an African [dataset-hosting platform](#) to Tailwind CSS; bundle size fell by 30%.

- **Platnova**

Golang Backend Engineer

Remote

Mar 2024 – Aug 2024

- Implemented cron-driven vault-settlement automation in Go, which cut payment processing time by 20%.
- Rebuilt the transaction-receipt system and shipped the lifestyle-stays package for the payments platform.

- **21st Century Technologies**

Software Architect (National Youth Service)

Lagos, Nigeria

Dec 2022 – Nov 2023

- Co-led the architecture and delivery of large-scale applications, from system design to implementation, and built data pipelines and reporting dashboards for management.
- Built CI/CD pipelines that cut release time by 40%; supported DNS failover in Tier III/IV data centres.

Selected Graduate Coursework

- **Machine Learning in Production** (Christian Kästner); **Engineering Data-Intensive Scalable Systems** (Paulo Merson): microservices, Kafka messaging, sagas, CQRS, event sourcing, circuit breakers and observability.

Leadership and Service

- **Chairman**, Academic Innovation Sub-Committee, Research Committee, CMU Africa, 2024–2026.
- **Executive President**, Computer Club, Babcock University, 2022.
- **Participant**, Digital Humanism Summer School, CMU Africa, 2025. **Volunteer**, Google DevFest Kigali, Dec 2024.

Technical Skills & Certifications

- **Languages & Core:** Go, Python, TypeScript, JavaScript, SQL
- **Backend & Data Systems:** FastAPI, Node/Express, PostgreSQL, Redis, ETL, Data Modeling
- **ML & Analytics:** Scikit-learn, Time Series Analysis, Statistical Modeling
- **Cloud & DevOps:** AWS, Docker, Git/GitHub, Bitbucket, CI/CD (GitHub Actions)
- **Architecture:** Distributed Systems, Microservices, Event-Driven Architecture
- **Frontend:** Vue.js, Nuxt
- **Certifications:** [Data Engineering Essentials](#), [Data Engineering Introduction](#), [Docker](#), [Agile with Jira](#)

References

- **Prof. Prasenjit Mitra**, Bob Dykes Chair Professor in Advanced Artificial Intelligence, Victoria University of Wellington, New Zealand. Formerly Research Professor, Carnegie Mellon University Africa; my MSc thesis and research advisor, 2025–2026.
- **Prof. Edwin Mugume**, Assistant Teaching Professor, Carnegie Mellon University Africa; my course instructor.
- **Prof. Sunday Idowu**, Babcock University; Dean, School of Computing and Engineering Sciences, during my BSc.