RANSFORD OPPONG

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EDUCATIONAL PROFILE

Bachelor of Science in Biomedical Engineering **January 2021 - September 2025**
Kwame Nkrumah University of Science and Technology
Thesis: *Multi-Stage Deep Learning Framework for Thyroid Nodule Segmentation in Low-Resource Ultrasound Imaging*
GPA: 3.61/4.00

RESEARCH EXPERIENCE

Research Intern - Embedded AI (On-Site) **September 2026 - Present**
Lab-STICC, IMT Atlantique, Brest, France, under the France-Ghana Corporation, FEF-AI4SD project (2 million euros grant)
Supervisor: *Professor Derek Asiedu*

- Designed MLPARE-Com, an integrated machine learning framework for joint physical- and link-layer optimization, combining novel transceiver models, hybrid channel estimation algorithms, and Q-learning–driven retransmission policies.
- Developed modular ESP32-S3 firmware integrating embedded neural inference, real-time channel sensing, and adaptive ACK/NACK-based reliability control across a multiple-microcontroller testbed.
- Built an end-to-end evaluation pipeline spanning MIMO channel simulation, model training, embedded deployment, and experimental analysis of communication reliability, latency, and computational performance.

Machine Learning Research Scientist (On-Site) **September 2026 - Present**
Université Paris Saclay, France, under the France-Ghana Corporation, FEF-AI4SD project (2 million euros grant)
Supervisor: *Professor Daniel Adjei*

- Engineered an end-to-end AI model, HALO-nnUAP, an automated hardware- and dataset-aware deep learning framework for (2D,3D and 4D) medical image segmentation and established the experimental framework, including systematic evaluation across multiple datasets, cross-validation, computational complexity analysis, GPU memory profiling, inference latency, and reproducible MLflow-based experiment tracking.
- Developed computational spectroscopy models using frequency-domain analysis, applying FFT and power spectral density methods to characterize and predict wavelength-dependent spectral signatures.

Research Assistant - Ghana National Service Scheme (On-Site) **February 2026 - August 2026**
Quantum Computing and Assistive Technologies Lab, Kwame Nkrumah University of Science and Technology, Ghana
Supervisor: *Professor Jerry John Kponyo*

- Designed a dual-mode GQD–silicon nitride photonic biosensor achieving a simulated limit of detection of 0.02 ng/mL for IL-6 using fluorescence and interferometric sensing.
- Developed quantum simulation models in IBM Qiskit using 3-qubit GQD and Mach–Zehnder interferometer circuits with 2,000 measurement shots per condition.
- Simulated biomarker-dependent responses showing 40–60% fluorescence quenching for PCT (0.5 ng/mL) and 0.1–1.0 nm photonic wavelength shifts across clinical ranges.
- Validated multiplexed detection of PCT, CRP, and IL-6 using spectrally distinct GQDs (530 nm, 570 nm, 610 nm) enabling simultaneous point-of-care biomarker sensing.

Research Assistant - Ghana National Service Scheme (Hybrid) **October 2025 - October 2026**
Quantum Computing and Assistive Technologies Lab, Kwame Nkrumah University of Science and Technology, Ghana
Supervisor: *Professor Jerry John Kponyo*

- Led the development of Deafly Health, an AI-native multimodal engine integrating facial, gestural, and biometric cues for real-time emotion recognition in Ghanaian Sign Language (GSL) communication.
- Designed a multimodal fusion architecture, the Spatio-Temporal Emotion Graph Network (ST-EGN), achieving 84.6% cross-modal emotion detection accuracy on preliminary datasets.

Research Assistant - Ghana National Service Scheme (On-Site) **October 2025 - October 2026**
Responsible AI Lab, Kwame Nkrumah University of Science and Technology, Ghana
Supervisor: *Professor Jerry John Kponyo*

- Contributed to an MRI–CT cross-modality translation framework, synthesizing high-fidelity CT scans from MRI data to support downstream radiological applications in resource-limited settings.
- Implemented and evaluated deep learning–based medical image translation, addressing structural fidelity and modality-specific challenges in generating diagnostically relevant synthetic CT images.

Biomedical Engineering Student Researcher (On-Site) **January 2025 - September 2025**
Bioinstrumentation Lab, Kwame Nkrumah University of Science and Technology
Multi-Stage Deep Learning Framework for Thyroid Nodule Segmentation in Low-Resource Ultrasound Imaging
Supervisor: Dr. Isaac Acquah.

- Designed HALO-UNet, a lightweight multistage deep learning framework that achieved a 71% Dice score for thyroid nodule segmentation on real-world ultrasound datasets (TN3K, DDTI).
- Proposed a novel hardware-aware optimization pipeline integrating dynamic preprocessing, pruning, and quantization, resulting in >70% faster inference under low-resource constraints.
- Demonstrated generalization and clinical relevance through multi-dataset validation and architectural ablation studies comparing UNet, DeepLab, and TransUNet variants.
- Deployed HALO-UNet on Hugging Face Inference Endpoints, providing an accessible, open-source platform for real-time testing and reproducible medical AI research.

Build Student Consultant (Remote) **March 2025 - May 2025**
Optimized T cell differentiation protocol using Design of Experiments (DoE), The Build Fellowship

Supervisor: *Claire Wang (Senior Process Engineer)*

- Created a scalable suspension culture process that reduced production costs by 18% compared to static methods, while maintaining >90% cell viability.
- Applied full factorial DoE to identify critical parameters (vessel type, agitation speed, bead-to-cell ratio), reducing batch variability from 25% to 12%.
- Validated the protocol through three GMP-like runs, aligning with FDA CMC guidelines for clinical translation and presented findings to my supervisor, including a Draft Proposal, Process Flow Diagram and Final Report.

WORK EXPERIENCE

Auphanim Technologies and Sciences (Hybrid) **Kumasi, Ghana**
Vice President, Vision Intelligence (Engineering) June *2026 - Present*

- Designed an edge-deployed computer vision system that continuously monitors existing RTSP/HLS camera feeds and autonomously escalates verified threats.

Mentismint (Hybrid) **Accra, Ghana**
Co-Founder & Chief Technology Officer *October 2025 - Present*

- Built and shipped a cross-platform React Native personal finance mobile app with Expo, using Expo Router for navigation and EAS for build/release workflows; delivered full-stack features across a microservice backend, a typed TypeScript client/service layer and an integrated Groq AI layer to support AI-driven capabilities.

Masara Consult (Remote) **Birmingham, United Kingdom**
Lead Software Engineer *April 2024 - April 2025*

- Designed and launched an AI-powered multi-curriculum e-learning platform, reaching 1,000+ users in its first month.
- Implemented secure RESTful web services with Node.js + SQL database for user management, course delivery, and analytics dashboards.

BUILD SCITECH (Hybrid) **Kumasi, Ghana**
Lead Product Engineer *March 2023 - Present*

- Leads the development of products in fintech, healtech, agritech, ecommerce etc. Runs a 3-tier business model; communication platform as a service, business consultancy and technology transfer program.
- Established a techexpo community with 600+ african student developers, founders and employers with a conversion rate of 65% into users and employees.

MENTORSHIP EXPERIENCE

African German Entrepreneurship Academy Startup Class (15,000+ euros Travel Grant) **University of Leipzig, Germany (On-Site)**
Startup Founder, Agropremium '23 and Obstamed '25 September *2023 - September 2025*

- Architected and deployed enterprise-grade AI solutions, including a web-based global trade platform (Agropremium) to optimize fair-trade logistics, and a smart, sensor-integrated assistive mobility cane (ObstaMed) to enhance navigation autonomy for the visually impaired.

Technical Lead, Instrumentation and Measurement Society KNUST Chapter **KNUST, Kumasi, Ghana (On-Site)**
IEEE Instrumentation and Measurement Society *January 2024 - September 2025*

- Led mentorship and innovation programs, organized and guided students through IMPACT 2026, Sensing Solutions and AI 2024 and African Robotics and Intelligent Systems Expo 2025 Conferences. Organized workshops on instrumentation, embedded systems, and intelligent sensing.

The Next Generation of Tech Giants, **Kumasi, Ghana (Hybrid)**
BUILD SCITECH *October 2023 - Present*

- Established Technology Transfer Program and supervised over 10 student-led research in health, climate, biotech and energy innovation. Provided hands-on guidance on creating, building and leading. Facilitated weekend Technical Workshops on Agentic System Development.

LEADERSHIP EXPERIENCE

Vice President, Projects and Innovation (On-Site) **September 2023 - September 2024**
ENACTUS KNUST

- Led the Projects & Innovation Division at ENACTUS KNUST (150+ members, 7 projects), spearheading innovation-driven initiatives integrating AI, IoT, and automation for sustainable development. Oversaw technical design, and community pilot programs while mentoring members and driving partnerships to scale impact.

Head of Trade and Technology (On-Site) **September 2023 - September 2024**
Biomedical Engineering Students' Society, Kwame Nkrumah University of Science and Technology

- Led 10+ technical workshops and innovation programs in AI, IoT, and 3D printing, enhancing hands-on skills for 200+ students and fostering academia–industry collaboration with seminars and club gathering.

SKILLS AND TOOLS

Programming & Systems Engineering: Python, Modern C++ (C++14/17/20), C, TypeScript, JavaScript, CMake, Async I/O, RAII
Computer Vision & Medical AI: OpenCV, MONAI, SimpleITK, NiBabel, MedT, nnUNet, YOLOv26 Ultralytics
Embedded Systems & Firmware: ESP32, ESP-IDF, FreeRTOS, Raspberry Pi, NVIDIA Jetson, ARM, Arduino, Embedded C/C++, HALs, ISRs
Signal Processing & Intelligent Sensing: FFT, power spectral density, frequency-domain analysis
Edge AI & Neural Network Optimization: PyTorch, TensorFlow, ONNX, ONNX Runtime, NVIDIA TensorRT, ExecuTorch, TensorFlow Lite
Hardware Acceleration & Heterogeneous Computing: NVIDIA CUDA, cuDNN, GPU Profiling, CPU–GPU Workload Partitioning, ARM NEON SIMD, Tensor Cores, ONNX Graph Optimization
Software Engineering: React/Next.js, React Native, Node.js, FastAPI, CI/CD, Docker, Unix/Linux, Git, Vim/Emac/Nano, OOP, Microservices
Mathematical Computing & Numerical Algorithms: Probability and Statistical Inference, Bayesian Estimation, Computational Complexity Analysis, Time and Space Complexity, Error Propagation, Sensitivity Analysis.

PROJECTS

MLPARE-Com, a learned communication protocol for PHY and LINK layers
Python, C++, Embedded C, CMake, Assembly Language, ESP-IDF/NOW/SDR, ESP32S3/C5 **(Proprietary)**

- Developed an integrated machine learning framework to optimize the physical and link layers of wireless communication systems through combining variational autoencoder-based transceiver models, ML-based channel estimation, and reinforcement learning-based retransmission policies.

HALO-nnUAP, an automated, hardware-aware medical image segmentation
Python, PyTorch, nnU-Net, MLflow, CUDA, NVIDIA RTX 3500 Ada GPU, Medical Segmentation Decathlon **(Proprietary)**

- Developing **HALO-nnUNAP**, a hardware-aware medical segmentation framework spanning a family of models including HALO-UNet, HALO-Former, and HALO-Temporal; pilot HALO-UNet results across four CT/MRI datasets show up to 26.5% lower inference latency than nnU-Net.

Somax iQ-T1, Mobile AI Ultrasound Device for Point-of-Care Thyroid Diagnostics
Butterfly iQ+, HALO-UNET, TensorRT, FastAPI, Azure ML,React Native **Slides** | **Visit site**

- Developed a smart device on a custom built model HALO-UNET. Won a pre-seed grant ($8000) and awarded Mansa-to-Mansa NVIDIA Jetson Orin Nano project challenge ultimate prize ($300) worth of embedded system.

peerbooking, on-campus marketplace for peer support **Visit site**
RestAPI, NextJS, Tailwind CSS , Convex Database, Node JS, PWA

- Built a role-based peer learning marketplace with booking, scheduling, and chat flows using Next.js, Clerk auth, and Convex real-time backend, supporting student/tutor onboarding and session management. Currently has 1K+ active users in beta testing (4 weeks) across just one campus.

Strata, a better alternative to middleware **GitHub** | **Visit site**
Typescript, tsup (CJS/ESM + d.ts builds), Vitest, Supertest; strict TS, open-source

- Built a type-safe typescript request open-source pipeline package modeling execution as a dependency graph, with a topological scheduler enabling parallel execution, circular dependency detection, and Next.js integration.

CONFERENCE PRESENTATIONS AND PREPRINTS

Accepted and presented

Oppong, R., Dotse, K., Adjei, A. A., Arthur, J., Kasore, V., Kponyo, A. B., Agyemang, J., Kponyo, J. J. Emotion-Aware Embedding Fusion in Large Language Models for Intelligent Response Generation in Mental Health Counselling. *KONVENS 2026*, Hamburg, Germany. Poster presentation. https://www.korpuslab.uni-hamburg.de/en/konvens2026/34.pdf

Oppong, R., Adjei G. S., Obstamed: Smart Obstacle Detection Mobility Aid for the Visually Impaired. *iN4iN 2025*, Leipzig, Germany. Oral presentation [Manuscript]

Oppong, R., Anokye, A. J., Acquah, I. HALO-UNet: A Lightweight Multi-Stage Deep Learning Framework for Thyroid Nodule Segmentation in Low-Resource Ultrasound Imaging. *TWEEK 2025*, Kumasi, Ghana. Oral and Poster presentation. [Manuscript]

Preprints

Oppong R. “Certified Tool Execution Framework for MCP-Based AI Agents: Provably Secure Defense Against Tool Poisoning and Credential Theft” https://doi.org/10.20944/preprints202610.2580.v1

LANGUAGE SKILLS

English (Advanced)

REFERENCES

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