Miracle Olotuche James

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EDUCATION

Master of Science in Engineering Artificial Intelligence (Distinction) 07/2024 – 12/2025
Carnegie Mellon University Kigali, Rwanda

Bachelor of Engineering in Electrical and Electronics Engineering (Dean's List) 01/2017 – 03/2023
Federal University of Technology Minna Niger State, Nigeria

RESEARCH EXPERIENCE

Research Associate 07/2026
Carnegie Mellon University Africa Kigali

- Benchmarked three state of the art OCR models (dots.ocr, PaddleOCR-VL, LightOnOCR) on African scripts, finding character error rates above 200\% on Adlam, N'Ko, Tifinagh and Vai, and developed structured page supervision for Amharic handwriting, composing verified lines from 411 writers into article, two column and table pages with exact layout, reading order and transcription.
- Adapted LightOnOCR through a three stage LoRA curriculum, selecting layout training over an auxiliary loss for Ethiopic consonant families and vowel orders in a controlled ablation, and reduced character error by 85\% against the zero shot model on 150 held out pages (2.08 to 0.31), then extended the method to Ajami manuscripts in Hausa, Wolof and Fulfulde, reaching 0.20 error on held out lines.

Robot Perception Research Intern 06/2026 – 08/2026
Unit Zero Robotics Kigali, Rwanda

- Built a visual question answering (VQA) dataset of 1,397 questions from raw robot logs, covering scene state, task stage, fine substeps, next actions and violation recovery, and fine tuned Molmo2-ER to understand task progress, predict next actions and identify violations, raising task stage F1 from 0.14 to 0.92 and next action F1 from 0.16 to 0.66.
- Built a stage aware reward model across 12 tasks from the ABC130k dataset, defining 10 shared action primitives so a single model could estimate progress on long horizon T-shirt and towel folding 0.77 Spearman with true progress.
- Trained a self supervised relative progress model by resampling demonstrations at varying speeds, repeating frames to simulate stalls and reversing them to simulate regression, reaching 97.3% and 95.0% direction accuracy on held out towel and T-shirt episodes.
- Applied reward aligned behavior cloning to $\pi 0.5$, filtering and weighting action chunks by progress, and deployed it on dual YAM arms with real time chunking and command smoothing, reaching 50 of 50 successful towel folds averaging under two minutes per fold.

Graduate Research Assistant 06/2025 – 05/2026
Carnegie Mellon University Africa Kigali, Rwanda

- Co-developed TSANet, a single image model that detects both physical and digital face attacks, replacing thevideo inputs and separate per attack models used by prior methods. Achieved a 16.93% average classification error rate, outperforming state of the art methods across combinations ofspoofing attacks and remaining robust under severe class imbalance (ICCV Workshops 2025)
- Developing a portable weather station that measures key atmospheric variables for data collection and analysis, enabling the use of locally gathered data to train predictive models for weather forecasting, and serving as a low-cost, energy-efficient alternative to conventional stations.

Teaching Assistant - ML System Design 01/2025 – 05/2025
Carnegie Mellon University Africa Kigali, Rwanda

- Assisted in delivering courses on TinyML, Raspberry Pi, Arduino, and Embedded Systems, guiding students in integrating machine learning with embedded hardware.
- Led the Smart Weather Station project, mentoring students in using Raspberry Pi, Arduino, and sensors for real-time data collection and TinyML-based local data processing.

SELECTED PROJECTS

Robotic Perception for Deformable Object Manipulation 04/2026 – 05/2026
Built an end-to-end robotic perception pipeline spanning deformable object segmentation, visual affordance prediction, and automated failure detection. Used SAM2 with bidirectional mask propagation to recover occluded object masks, a DINOv2-based encoder for grasp-point affordance prediction, and fine-tuned a vision-language model for classifying robot execution failures from video. Key findings included that bidirectional propagation significantly improved segmentation under occlusion, and that structured prompt design alone lifted failure-detection F1 from 0.655 to 0.853 on the same model weights.

Visual Insect Trait Extraction System 09/2025 – 12/2025
Built an AI-powered pipeline to automatically extract morphological traits, such as body size, wing dimensions, and coloration, from digitized insect images. The system performs automatic scale-bar detection, body-part segmentation, and high-precision measurement, producing FAIR-compliant data compatible with repositories like GRIT. It enables large-scale ecological and evolutionary analysis by reducing manual measurement time from hours to seconds per image, addressing key bottlenecks in biodiversity informatics.

Multilingual ASR and speech-to-translation system for low-resource African languages (Kinyarwanda, Swahili, Luganda) 09/2025 – 12/2025
Designed a multilingual ASR and speech translation system for low-resource African languages using a mix of real and synthetic AfroTTS data. The system incorporates accent variation, noise, and code-switching to improve generalization and aims to surpass baseline performance in recognition and translation quality. It supports more inclusive, accessible speech technology for underrepresented language communities.

Automated Leukemia Detection & Classification Using Microscropic Blood Film Analysis 03/2025 – 05/2025
Designed a two-stage AI system for automated leukemia diagnosis from microscopic blood film images. The first stage detects white blood cells and extracts key morphological attributes, such as nucleus shape, cytoplasmic texture, and chromatin pattern, outperforming the baseline approach. Building on this, the second stage classifies five leukemia subtypes. The system is optimized for varying resource settings, enabling fast and scalable diagnostics in low-infrastructure healthcare environments.

Accessible 3D Teeth Reconstruction from Smartphone Images 02/2025 – 04/2025
Developed an affordable AI system that reconstructs 3D teeth models from smartphone photos by enhancing segmentation with ResNet-50 + DenseASPP (outperforming U-Net in challenging conditions). Achieved 0.89mm precision (18% better than baseline), enabling accessible dental diagnostics for underserved regions.

Audio-Visual Emotion Recognition Project 10/2024 – 12/2024
Collaborated on developing a multimodal machine-learning model combining vocal tone and facial expression analysis to enhance social interaction for individuals with Autism Spectrum Disorder. This project advanced inclusivity by leveraging CNN and LSTM networks for real-time emotion detection, achieving 80% accuracy and fostering innovative problem-solving in a cross-functional academic team.

PUBLICATIONS

TSANet: Unified Face Attack Detection via Triplet Embedding and Soft ACER Loss
International Conference on Computer Vision (ICCV 2025)
Developed an image-based face anti-spoofing system using Soft-ACER loss and contrastive learning to improve detection of physical and digital attacks across benchmark datasets.

Automated and Accessible Leukemia Detection from Microscopic Blood Films Using YOLO and Vision Transformers
IEEE African Council 2025 Conference (AFRICON 2025)
Developed a resource-efficient computer vision pipeline combining YOLO-based detection and Vision Transformers to enable accurate leukemia diagnosis from low-cost microscopic blood films, targeting deployment in under-resourced clinical settings.

Piezoelectric Crystals for Floor Tile Energy Harvesting
International Engineering Conference (IEC 2023)
Designed and constructed a piezoelectric tile that harnesses mechanical energy from footsteps to generate and store electrical power, offering an innovative and sustainable energy solution for public spaces and off-grid communities.

WORK EXPERIENCE

Graduate Research Assistant 01/2025 – 05/2025
Carnegie Mellon University Africa KIgali, Rwanda
- Assisted in delivering courses on TinyML, Raspberry Pi, Arduino, and Embedded Systems, guiding students in integrating machine learning with embedded hardware.
- Led the Smart Weather Station project, mentoring students in using Raspberry Pi, Arduino, and sensors for real-time data collection and TinyML-based local data processing.

Electrical/Electronics Engineer 07/2023 – 06/2024
Calaya Engineering Services Limited Portharcourt, Nigeria
- Optimized decision-making for engineering materials and services by analyzing technical specifications, leading to a 20% reduction in project delays and faster client payment cycles.
- Enhanced project compliance by meticulously preparing technical tenders in line with required specifications, contributing to an increase in successful contract acquisitions

Energy Systems Operations Intern 04/2021 – 09/2021
Transmission Company of NIgeria Abuja, Nigeria
- Monitored high-voltage transmission systems using SCADA tools, proactively identifying and addressing faults to ensure continuous power flow, thus reducing downtime by 5%.
- Generated and analyzed performance reports, identifying outage patterns and informing preventive maintenanceschedules that improved overall system reliability.