

Richard Djarbeng

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PERSONAL STATEMENT

Software engineer and machine learning engineer with hands-on robotics experience across perception, robot programming, and embedded systems. MSc in Electrical and Computer Engineering from Carnegie Mellon University, with coursework in cognitive robotics, computer vision, and autonomous driving alongside deep learning and data analytics. Work includes deploying ML models in Python and PyTorch, building full-stack web applications in React and Node.js, and designing embedded sensor hardware on Raspberry Pi and Arduino. Comfortable working at every layer, from embedded hardware to trained models to the web interfaces that present the results.

EDUCATION

Carnegie Mellon University

July 2022 – May 2024

MSc Electrical and Computer Engineering

Pittsburgh, PA (and Kigali, Rwanda)

- **Cognitive Robotics (18-799):** Developed robot software with ROS in C++ (packages, topics, publishers, and subscribers), wrote CRAM cognitive-architecture plans in Lisp, and programmed pick-and-place tasks for the PR2 and Lynxmotion AL5D manipulators in Gazebo and Bullet simulators.
- **Computer Vision (16-720):** Completed assignments in image filtering and edge detection, HOG descriptors, Lucas-Kanade optical flow tracking, homographies and image warping, camera models, two-view geometry, structure from motion, CNNs, and photometric stereo.
- **Relevant Coursework:** Autonomous Driving, Internet of Things, AR/VR Systems, Introduction to Deep Learning, Data Analytics, Data Structures and Algorithms, Introduction to Information Security, Wireless Networks

University of Ghana

November 2021

BSc Computer Engineering

Accra, Ghana

- **Relevant Coursework:** Robotics and Computer Vision, Introduction to Artificial Intelligence, Embedded Systems, Computer Architecture, Operating Systems, C/C++ Programming, Object Oriented Programming

TECHNICAL SKILLS

Robotics & Robot Programming: ROS (C++), CRAM Cognitive Architecture, Robot Manipulation and Pick-and-Place, Gazebo and Bullet Simulators, Homogeneous Transforms and Quaternions, A* Pathfinding, Unity3D

Machine Learning & AI: PyTorch, Keras, FastAI, Scikit-learn, XGBoost, CNN Architectures, ResNet, Transfer Learning, Model Deployment, Feature Engineering

Computer Vision: Object Detection (YOLO-World), Image Segmentation (U-Net, ISNet, Silueta), Semantic Segmentation, Deepfake/Face Manipulation Detection, Satellite Image Processing, Roboflow

Software Engineering: React.js, TypeScript, JavaScript (ES6+), Node.js, Python, RESTful APIs, WebSockets, Git, CI/CD, Test-Driven Development

Embedded & IoT: C, C++, Raspberry Pi, Arduino, PCB Design (Fusion360), Sensor Calibration, GSM Modules, Wireless Connectivity (2G, 3G, WebSockets)

Cloud & MLOps: Google Cloud Platform (Vertex AI, AutoML, BigQuery ML, Dataflow), AWS, Hugging Face Spaces

Languages: Python, C, C++, JavaScript (ES6+), Java, C#, SQL, PHP, Ruby, Dart (Flutter)

EXPERIENCE

Carnegie Mellon University

July 2024 – October 2025

Research Associate (IoT & Environmental Sensing)

Kigali, Rwanda

- **Embedded Hardware Design:** Designed and developed low-cost sensor nodes and PCBs for measuring temperature, humidity, wind speed, and environmental parameters.
- **AI-Driven Sensor Calibration:** Applied machine learning techniques to improve the accuracy and reliability of low-cost sensors, benchmarking against high-grade reference instruments.

- **System Design & Data Management:** Built web-accessible dashboards and a data storage framework for the sensor network, with data flowing securely from field hardware to stakeholders.

Research Assistant (Air Quality & Instrumentation)

January 2024 – May 2024

Carnegie Mellon University

Kigali, Rwanda

- **ML Models for Filter Imagery:** Built machine learning models to map image data of particulate matter filters, captured across wavelengths, to PM values, enabling low-cost black carbon estimation without expensive laboratory analysis.
- **Data Analysis:** Conducted extensive analysis on datasets collected over more than 2 years using aethalometer sensor data to predict biomass pollutants.

Carnegie Mellon University

August 2023 – December 2023

Teaching Assistant, Internet of Things

Kigali, Rwanda

- **IoT Curriculum Support:** Conducted recitations focused on building IoT systems with web APIs using JavaScript and Node.js on Raspberry Pi hardware.
- **Technical Mentorship:** Assisted students in circuit design, embedded programming, REST architectures, and configuring wireless modules.

AfriqAir - Kigali Collaborative Research Center

May 2023 – August 2023

Graduate Intern (IoT Systems)

Kigali, Rwanda

- **Hardware Prototyping:** Built a prototype IoT system to automate the diagnostic and data collection process from the Thermofisher TEOM air quality system using Python and C++ on Raspberry Pi and Arduino.
- **System Architecture:** Designed system specifications and architecture for an IoT wireless data logging unit, coordinating requirements across hardware and software teams.
- **Web Dashboard Development:** Developed a production-grade dashboard using React.js and TypeScript for real-time interpretation of sensor data.

Sorphise GH Ltd

July 2020 – January 2021

Intern

Ghana

- Developed and deployed web applications using JavaScript, PHP, React (GatsbyJS), and Netlify, configuring DNS and CI/CD for custom-hosted sites.

Inlaks GH Ltd

June 2018 – August 2018

Intern

Accra, Ghana

- Assisted engineers with maintenance and installation of applications on ATMs; tested hardware modules and troubleshooted faulty sensors and keypads.

PROJECTS

Interactive Face Animation (Virtual Robot)

2023

Frontend Developer

roboface.netlify.app

- Built a virtual robot inspired by a Human-Robot Interaction course at Carnegie Mellon University that tracks the user's mouse and expresses emotions based on proximity and interaction, going idle when unstimulated.
- Built it as a hands-on complement to the Human-Robot Interaction course at Carnegie Mellon.
- *Technologies:* React.js, JavaScript, Animation | [GitHub](#)

Mapping Filter Imagery to PM Values

2024

Machine Learning Engineer

- Built machine learning models to map image data of particulate matter filters, captured across wavelengths, to PM values, providing a low-cost alternative to laboratory analysis for black carbon estimation.
- *Technologies:* Python, Machine Learning, Regression Modelling, Spectral Analysis

Detection and Identification of Manipulated Facial Images

September 2023 – December 2023

Deep Learning Engineer

- Developed a deep learning system to detect and identify manipulated facial images, targeting deepfakes, Face Swap, and Face2Face manipulations.
- Used a Block-based CNN and ResNet-34 for classification, and fine-tuned ResNet-50 via transfer learning on facial manipulation datasets.
- *Technologies:* Python, Deep Learning, Computer Vision, ResNet, CNN, PyTorch

YOLO-World Promptable Video Object Detection

2024

Computer Vision Engineer

- Explored YOLO-World models for promptable object detection and segmentation on real-world video footage recorded in Kigali, Rwanda.
- Built a notebook-based demo to visualise detection and segmentation results, evaluating the model family for practical deployment use cases.
- *Technologies: Python, YOLO-World, Computer Vision, Object Detection, Image Segmentation*

E-commerce Purchase Prediction with BigQuery ML

2024

ML Engineer and Data Analyst

Google Cloud

- Built a high-performance classification model (XGBoost and Logistic Regression) within BigQuery ML to predict returning customer purchase intent from Google Analytics datasets.
- Improved model performance from 0.72 to **0.94 ROC AUC** through rigorous feature engineering of checkout progress, traffic sources, and device-specific behavioural data.
- *Technologies: BigQuery ML, XGBoost, SQL, Feature Engineering*

Predicting Loan Risk with AutoML on Vertex AI

2024

Machine Learning Engineer

Google Cloud

- Developed a machine learning model to predict loan default risk using Google Cloud Vertex AI AutoML, optimising training within compute budgets.
- Evaluated the model using precision/recall curves, ROC curves, and Explainable AI for feature importance, then deployed model endpoints.
- *Technologies: Google Cloud Vertex AI, AutoML, Python, Explainable AI*

Background Remover on Hugging Face

August 2024

Machine Learning Engineer

- Deployed a semantic segmentation model for HD background removal via the **rembg** library to a production-ready Gradio interface, supporting multiple segmentation architectures (U-Net, ISNet, Silueta).
- *Technologies: Python, Deep Learning, Computer Vision, Gradio, rembg*

IoT Security System

November 2022 – December 2022

IoT Engineer

- Engineered an IoT security system using Raspberry Pi, sensors, and Node.js for real-time monitoring, implementing a WebSocket-based server for instant alerts and data visualisation.
- *Technologies: Node.js, Raspberry Pi, WebSockets, Real-time Systems*

2D Game: Escape the Covid Maze

2020

Game Developer

- Built a Unity3D 2D maze game in which autonomous villain agents pursue the player using the A* search algorithm for pathfinding, across two levels of increasing difficulty.
- *Technologies: C#, Unity3D, A* Pathfinding*

GSM HTTP Requests

2023

Embedded Systems Engineer

GitHub

- Implemented HTTP GET and POST requests using GSM modules in C++, a core component for remote data transmission from field-deployed sensor nodes.
- *Technologies: C++, Embedded Systems, GSM, IoT*

Transmission Corridor Monitoring using Satellite Imagery

September 2020 – August 2021

Remote Sensing Engineer

- Developed a change detection application for GRIDCo/ECG in Ghana using Google Earth Engine and CNNs on 10m Sentinel-2 satellite imagery, deployed as a Google Cloud web application for engineers to monitor transmission corridors remotely.
- *Technologies: Python, Google Earth Engine, CNN, Satellite Image Processing*

CERTIFICATIONS & LEADERSHIP

Certifications: AWS Certified Solutions Architect – Associate (June 2026), Google Cloud Professional Machine Learning Engineer (PMLE) Track (August 2024), Pre-doctoral Research School in Computer Science (CMMRS) (August 2025)

Leadership: Club President, IoT Club CMU Africa (2022 – 2024): Organised technical workshops, mentored student hardware projects (GPS, microcontrollers), and arranged field trips to Zipline, an autonomous drone delivery company, so students could see applied robotics in a real deployment.