Richard Djarbeng

Email : richarddjarbeng@gmail.com
Alternative Email : rdjarben@andrew.cmu.edu
LinkedIn — Github —Website
Mobile : +250790395123

Personal Statement

As a computer engineer with a passion for building simple and powerful experiences, I possess technical skills in machine learning(ML), computer vision and web development, data analysis, Internet of Things (IoT). My experience in developing backend applications with PHP, NodeJs and front-end applications with ReactJs has given me a solid understanding of software development principles.
I graduated from Carnegie Mellon University with MSc Electrical and Computer Engineering . Currently working on obtaining a Google Professional Machine Learning Engineer (PMLE) certification where I am learning to apply computer vision, generative AI and use ML tools such as BigQuery, VertexAI, AutoML on Google cloud.

Education

- **MSc Electrical Computer Engineering — Carnegie Mellon University** July 2022 - May 2024

  Courses: Introduction to Deep Learning, Computer Vision, Internet of Things, Autonomous Driving, Data Analytics, Data structures and Algorithms, Introduction to Information Security, Cognitive Robotics, Wireless Networks

- **BSc Computer Engineering — University of Ghana** November 2021
  Electives: Software Engineering and Computer Graphics

Experience

- **Research Associate — Carnegie Mellon University** July 2024 - Present
  - **Environmental Sensor Development:** Responsible for the design and development of low-cost sensor nodes for measuring temperature, humidity, wind speed and environmental parameters using innovative AI-driven approaches.
  - **Data Storage and Management:** Collaborate with the project's principal investigators and external researchers to design a data storage and management framework, ensuring the collected environmental data is stored securely and made accessible to project stakeholders.
  - **Sensor Testing and Calibration:** Participate in the testing and calibration of the sensor nodes using machine learning techniques to improve the accuracy and reliability of the low-cost sensors.
  - **Academic Paper Preparation:** Collaborate with the research team to prepare and publish academic papers documenting the project's findings and methodologies.
- **Research Assistant — Carnegie Mellon University** January 2024 - May 2024
  - **Interdisciplinary Research:** Working with the mechanical engineering department to research alternative ways of predicting biomass pollutants in the air using a combination of sensor data from aethalometers.
  - **Air Quality Prediction:** Improving existing low-cost means of predicting black carbon pollutants using RGB pictures of filters to be able to distinguish pollution from wood from fossil fuels.
  - **Data Analysis and Experimentation:** Conducting data analysis with datasets collected for more than 2 years and verifying experiments to measure black carbon pollutants.
- **Teaching Assistant — Carnegie Mellon University** August 2023 - December 2023
  - **Teaching and Mentoring:** Conducting recitations for the Internet of Things (IoT) focused on setting up IoT systems with a web API using JavaScript and NodeJs on the Raspberry Pi.
  - **Academic Support:** Assisting students in understanding concepts in circuit design, programming embedded systems, REST, HTTP, and wireless connectivity (2G, 3G).
- **Graduate Intern — AfriqAir- Kigali Collaborative Research Center** May 2023 – August 2023
  - **System Design:** Designed system specifications and architecture for an IOT wireless data logging unit.
  - **Prototype Development:** Built a prototype IOT system to automate the diagnostic and data collection process from the Thermofisher TEOM™ air quality system. Built with Python and C++ for Raspberry Pi and Arduino.
  - **Web Dashboard Development:** Developed a web dashboard using ReactJs for visualization and interpretation of air quality data.

- **Intern — Sorphise GH Ltd (Ghana)** July 2020 – January 2021
  - **Web Application Development:** Web application development and deployment using JavaScript, PHP, React (GatsbyJS), Netlify NetlifyCMS
  - **Task Management** Used task management software to track project timelines, define requirements, build mock-ups for client feedback, and communicate with managers about challenges.
  - **Scalable Static Site Architecture:** Implemented a scalable static site architecture by decoupling code from content, utilizing Netlify CMS to manage site content and GitHub repositories for code management. This separation of concerns enabled faster website development with continuous integration (CD), increased project efficiency, and allowed for more projects to be completed within a given timeframe. By keeping code and content separate, we were able to streamline our workflow to use the benefits of static site generation.
  - **Site Deployment and Management:** Deployed sites on Netlify site-hosting, configured the Netlify content management system (CMS), to integrate with site content, fixed DNS errors and checked status; performance and errors, on deployed websites.
  - **DNS Configuration:** Configured DNS settings and domain names/URLs for custom-hosted websites, enabling secure HTTPS connections and ensuring seamless redirects from HTTP to HTTPS.
  - **Cloud-Based CMS Migration:** Pushed for migration of developed websites to a cloud-based Content Management System (CMS) via GitHub enabling seamless continuous deployment (CD) and automated website updates. This integration allowed changes to website content to trigger automatic rebuilds and deployments, eliminating the need for manual intervention by administrators or developers and less manual effort.
  - **Custom CMS Development:** Worked on Content Management System (CMS) for website administrators which separated website content from code. This allowed website administrators to update content such as posts; title, body and images for websites without changing the web application code.
  - **In-House CMS Development:** Made changes to in-house CMS application using PHP, AJAX, JavaScript for websites not using cloud CMS.

Skills

- **Web Development:** React.js, Node.js, PHP Express.js, RESTful APIs, WebSockets, Ruby
- **Cloud & Machine Learning:** Google Cloud (Computer vision, Vertex AI, BigQuery), fastai, pytorch, model deployment (Hugging face)
- **Languages:** JavaScript (ES6+), Python, Java, C++, Dart(Flutter)
- **Tools & Practices:** Git, Test-Driven Development
- **Others:** PWAs, Performance Optimization, IoT (Raspberry Pi), Satellite Image Processing

Leadership Experience

- **Club President** Internet of Things (IoT) club Carnegie Mellon University Africa

Projects

- **Free Background Remover Application Using Semantic segmentation Models** Aug 2024

  -Skills used: Deep learning · Python · Computer vision · Gradio · Rembg

  - Deployed a machine learning model for background removal leveraging the 'rembg' library.

  - Deployed the model into a production-ready Gradio interface, enabling users to upload and process images directly through an intuitive web-based platform.

  - Added more models and allowed users to select different models. - Added image processing features, such as post processing the mask, returning only the images mask correction, optimizing performance and usability for various image types.

- **Air Quality Analysis Dashboard** May 2024

  Skills: React.js · TypeScript · Data Visualization · Air Quality Modeling · Data Analysis

  - Developed an interactive dashboard to analyze $PM_{2.5}$ trends in Kigali, leveraging US Embassy reference data (Airnow.gov) and planetary boundary layer dynamics to identify diurnal pollution patterns.

  - Quantified public health risks by identifying that 57% of readings exceeded WHO "Unhealthy" thresholds, with an average concentration of $43.31 \mu g/m^3$.

  - Engineered multi-city comparative analysis modules and visual context features (visibility degradation) to communicate environmental impacts to stakeholders.

  - Collaborated with academic advisors to validate model-observation evaluations and emission source meteorology.

- **Predicting Loan Risk with AutoML on Google Cloud Vertex AI** May 2024

  Skills: Google Cloud AutoML · Machine Learning · APIs · Google BigQuery

  - Developed a machine learning model to predict loan default risk using Google Cloud Vertex AI's AutoML.

  - Engineered features from tabular data, optimized model training within allocated compute budgets and early stopping to prevent overfitting.

  - Evaluated model using precision/recall curves, ROC curves, and Explainable AI for feature importance.

  - Deployed model endpoints and integrated with Shared ML Service, showcasing end-to-end ML lifecycle management.

- **E-commerce Purchase Prediction with BigQuery ML** May 2024

  Skills: SQL · BigQuery ML · XGBoost · Feature Engineering · Marketing Analytics

  - Built a high-performance classification model (XGBoost/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 behavioral data.

  - Delivered actionable business intelligence, identifying that targeting the top 6% of predicted visitors could yield a **9x increase in Marketing ROI**, capturing 50% of all potential conversions.

  - Executed hyperparameter tuning and model selection as part of the Google Cloud Professional ML Engineer certification track.

- **Detection and Identification of Manipulated Facial Images using Deep Learning** Sep 2023 - Dec 2023

  -Skills used: Deep learning · Python · Computer vision

  -Developed a robust system using deep learning techniques to detect and identify manipulated facial images using RESNET-50, focusing on software like Face swap, deepfakes, and Face2Face.

  - Utilized a Block-based Convolutional Neural Network (CNN) and a ResNet34 model to achieve high accuracy in classifying manipulated images extracted from videos.

- **Countdown Progressive Web Application (PWA)** Dec 2021

  Skills: JavaScript · Git/Github · PWAs · User-Centered Design · Continuous Development (CI/CD)

  - Developed a feature-rich countdown PWA using just HTML, CSS and JavaScript with offline support and caching of resources using service workers.

  - Led user-centered design process, prioritizing features based on user feedback (90+ pull requests, many resolved github issues, multiple iterations).

  - Implemented responsive design, dark/light modes, user data persistence, and social media sharing.

- **Transmission Corridor Monitoring using Satellite Imagery** Sep 2020 - Aug 2021

  Skills: Python · Satellite Image Processing · Geospatial Information Systems

  - Developed a web application system for GRIDCo/ECG in Ghana to monitor transmission corridors using satellite imagery and deployed as a Google cloud application.

  - Applied image processing and geospatial analysis to detect and alert on potential hazards or encroachments.

  - Showcased ability to work with big data (satellite imagery) and domain-specific challenges.

- **IoT Security System** Nov 2022 - Dec 2022

  Skills: Node.js · Raspberry Pi · WebSockets · Real-time Systems

  - Engineered an IoT security system using Raspberry Pi, sensors, and Node.js for real-time monitoring.

  - Implemented a WebSocket-based server for instant alerts and data visualization.

  - Demonstrated skills in embedded systems, real-time data processing, and IoT security.

- **Job Search and Career Development Web Application** Oct 2018 - Nov 2018

  Skills: PHP · AJAX · Cascading Style Sheets (CSS)

  - Built a web application using HTML5, CSS, AJAX, and PHP to keep employers informed about students' skills.

  - Implemented messaging functionality for correspondence between employers and job seekers.

  - Developed a cross-platform mobile app for user access from any device.

- Focused on showcasing students' skills to employers before graduation.

- Aimed to bridge the gap between job seekers and employers, providing a platform for skill showcase.

- **University Application Management System built with Java and JavaFx** Apr 2020 - Jun 2020
  Skills: SQL · Java · JavaFx · JDBC

  - Developed a desktop application to simplify the admission process for prospective students.

  - Designed features for user registration, course and residence hall applications, and status tracking.

  - Implemented an admissions dashboard for users and an administrator control panel for application management.

  - Built with Java and JavaFX using OOP principles. Utilized JDBC and SQL for database connectivity.

  - Created a user-friendly interface, making it an excellent tool for managing university admissions.

- **2D game- Escape the Covid Maze**

  Skills used: C · Unity3D · Path-finding

  - 2D game using Unity3D that challenges players to navigate a maze while avoiding Covid-19 blob villains.

  -To keep the game interesting, the villains move through the maze and even climb over barriers and make it harder for players to escape.

  -To build the villains' paths and make them more strategic, I used A* search algorithm to help the villains find the player in the maze. With two levels of increasing difficulty, players must use their keyboard skills to avoid their character being caught by the villains and successfully escape the maze.