JOACHIM ASARE

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Portfolio: https://www.joachimasare.com | Github: https://www.github.com/joachimasare

EDUCATION

Harvard University – Cambridge, MA, USA **Aug 2023 - Exp. May 2025**
Master in Design Engineering (MDE), AI/ML Engineering & Human-Centered Design concentration
Honors: Harvard MDE Merit Scholarship, Ghana Presidential Scholar, MIT-Google Product Hackathon 3rd Place Winner
Relevant Coursework: Advanced Data Science II – Deep Learning architectures

Massachusetts Institute of Technology – Cambridge, MA, USA **Sept 2024 - Exp. May 2025**
Cross-registered Graduate Student
Coursework: TinyML & Efficient Deep Learning, Clinical Data Learning and Deployments, AI, Decision Making & Society

Ashesi University – Berekuso, Ghana **Sep 2016 - May 2020**
Major: BSc. Electrical and Electronic Engineering
Honors: Class of 2020 Valedictorian, Dean's List, Mastercard Foundation Scholar

EXPERIENCE

Machine Learning Engineer, Head of AI – Vocadian **May 2024 – Present**
- Developed a generative AI application system using Python and Retrieval-Augmented Generation (RAG) to generate training content from user-uploaded safety training documents, tailored for frontline workers in industries like trucking.
- Built frontend features using Expo Go to run across web, iOS, and Android and deployed via AWS, ensuring seamless integration into Vocadian's apps to enhance safety training and performance tracking for these frontline work industries.

Graduate Teaching & Research Fellow – Harvard School of Engineering and Applied Sciences **Jan 2024 – Present**
- Supervising and leading Machine Learning, Data Engineering and Machine learning projects for graduate students in the 'Collaborative Design Engineering Studio' class at the Harvard School of Engineering and Applied Sciences.
- Assisted students in data science and machine learning techniques, focusing on AI-driven design and interaction, aligning with computational design concepts such as shape grammars for 'ES138 - Computing, Spatial Design and Human Values'.

Machine Learning Engineer - Winter Program – IA Collaborative, Chicago **Dec 2023 – Jan 2024**
- Designed and deployed a generative AI tool for scraping customer insights from Reddit, using Python (Flask) for backend processing and React.js for the frontend, hosted on Microsoft Azure.
- Implemented and optimized large-scale data processing, handling over 100,000 rows per batch for real-time analysis of online conversations.
- Delivered insights using LLM APIs for interactive framework visualization to enhance product design research outputs.

Machine Learning Software Engineer – MIT Sandbox DHIVE Summer Program **May 2024 – July 2024**
- Led a multidisciplinary research team, managing problem and solution development, for a research project concerned with the development of an AI/ML plugin for Electronic Health Records Software to aid in early diagnosis of rare diseases.
- Conducted research and development for healthcare applications involving LLMs, optimizing for bias reduction and model explainability.

Data Science and Machine Learning R&D Engineer – Translight Solar Limited **Aug 2021 - Aug 2023**
- Built LSTM time series machine learning models to analyze energy consumption trends across 100+ building facilities, enhancing analytics and visualization tools that guided solar power system designs.
- Developed and integrated Machine Learning-driven embedded systems for remote control and monitoring of solar power inverters, enhancing customer interaction and increasing conversion rates by 40%.

SSA Machine Learning Engineer Trainee– Google Developers, Remote **Aug 2022 - Dec 2022**
- Selected among top 50 finalists from a pool of 14,000 applicants across sub-Saharan Africa (SSA) for practical project-based training in Machine Learning and Deep Learning Specialization including Natural Language Processing, Convolutional Neural Networks and Recurrent Neural Networks.
- The project achieved top 5% ranking globally in Kaggle's project submission.

Software Research Assistant – Ashesi University **Aug 2020 - Jul 2021**
- Researched on and built user autonomous software frameworks for Big Data handling from Internet of Things Systems.
- Created a user-friendly web interface for real-time data management, empowering users to control audio, image, and temperature data collection autonomously.
- Tutored over 200 students in Power Electronics, Design Thinking, Physics, and Introduction to Engineering, boosting 'Power Electronics' student performance by 34% (2018-2019) with tailored teaching methods.

Full Stack Software Engineer – Freelance **Jan 2017 – Aug 2021**
- Built over 40 web applications independently and collaboratively using languages and frameworks such as React.js, Next.js, Node.js, HTML,JavaScript, Flask, CSS, SQL and MongoDB. View sample websites at **https://linktr.ee/joachimasare.**

PROJECTS & RESEARCH

Retrieval-Augmented StreamingLLM **Ongoing**

- Working on extending StreamingLLM to overcome limitations in retaining long-term context by integrating it with the Retrieval-Augmented Generation (RAG) framework, such as LlamaIndex.
- Designed to allow the model to intelligently retrieve evicted tokens and reintroduce them into the current attention window, effectively mitigating memory lapses.
- The goal is to create an LLM capable of producing coherent text over extended interactions, with the ability to access and incorporate relevant past information from databases into its responses.

Responsible Use of Publicly Scraped Big Data to Train and Fine-Tune LLMs **Project Demo Link**

- Developed a framework for responsibly training and fine-tuning large language models (LLMs) using publicly scraped data, specifically focusing on privacy, transparency, and fairness.
- Implemented data anonymization techniques, bias mitigation strategies, and leakage prevention to ensure ethical use of data, utilizing a live project on Google Colab with Reddit-scraped data.
- The project included both anonymized and unanonymized datasets to demonstrate data leakage risks when identifiable information is present, highlighting critical safeguards for deploying LLMs in production.

Interactive Attention Weights Visualization Tool for LLM Models **Project Link**

- Created as an educational and debugging software tool, by integrating Hugging Face's Transformers library with Flask for real-time extraction and analysis of attention weights aiding in model understanding and refinement.
- Translates the attention weight distribution mechanisms into an intuitive interface for fellow researchers and developers.

Investigating LLM-Induced Language Bias in Clinical Decision Support Systems **Ongoing**

- Working on language-induced biases in LLMs (e.g., mBERT, XML-R) for MedQA tasks in non-English and low-resource languages, focusing on semantic consistency and diagnostic accuracy.
- Leveraging a 15+ language medical dataset, implementing metrics like BERTScore and cosine similarity to identify bias and improve LLM performance in multilingual healthcare systems.

AI-Powered Maize Streak Disease (MSD) Control in Farms | Computer Vision, Robotics **Project Link**

- Trained and implemented the custom Convolutional Neural Network (CNN) model on a dataset of over 50,000+ images of infected and healthy maize leaves for early detection of MSD. GitHub Repo Link
- Built an LLM-based robotic control interface where users use natural language via text or speech to control a pattern-based precision movement of a servo-motor controlled, cable-suspended camera surveillance computer vision robotic system, for automated image capture for Maize Streak Disease detection. GitHub Repo Link

Prohibited Items Detection in X-ray Images **Project Link**

- Developed and trained convolutional neural network models using PyTorch on a large dataset of over 1,000,000+ X-ray images (SIXray dataset) to significantly improve the accuracy of detecting prohibited items at security checkpoints.
- Leveraged data science techniques (e.g., data augmentation, t-SNE for dimensionality reduction) and advanced neural network architectures (ResNet, Vision Transformer) and to enhance model performance.

Enlight Web Extension: Generative AI for Enhanced Web Accessibility | LLMOps **Project Link**

- Developed a ChatGPT-4-powered Chrome extension to enhance web browsing for visually impaired users, providing contextual audio-visual summaries and an interactive user experience.
- Won 3rd place at the 2024 MIT Product Hackathon.

Future of Work for the Blind | Data Analysis and Visualization **Project Link**

- Curated a dataset matrix and a cosine similarity-based algorithm to predict employment opportunities for the blind by analyzing job and skill attributes from the US Bureau of Labor Statistics and O*NET Database.
- Built an interactive visualization of occupations using D3.js, highlighting their potential careers based on a skill similarity algorithm. View at **https://nexwork-futures.onrender.com/**

Implementation of User Autonomy for Data Privacy in IoT Software Systems **Project Link**

- Designed and built a proof-of-concept for a privacy-centric IoT platform for user-controlled data collection and transmission, validating the practicality of user-driven privacy in IoT system designs. Capstone Paper Link

SKILLS

- **Programming Languages**: Python, C++, R, Flask, React, Node.js, Typescript, HTML, CSS, SQL, MongoDB, MATLAB.
- **Technical Skills**: Deep Learning, Model Pruning & Optimization, LLM API integrations, Machine Learning, Data Visualization, Web app development, Computer Vision, Data Analysis, IoT System Design, Electronics and Circuit Design, AWS, Microsoft Azure App Services.
- **Machine Learning Toolkits:** TensorFlow, PyTorch, LangChain, OpenCV, Scikit-Learn, Hugging Face
- **Certifications:** Deep Learning Specialization (DeepLearning.AI)