Toufiq Musah

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Summary

A biomedical researcher and engineer working in Machine Learning, Deep Learning, & Computer Vision applications in Medicine, with works in Medical Imaging Analysis, Imaging Biomarkers, & Related Domains.

Education

University of Pennsylvania *Aug 2025 – Present*
Master of Science in Engineering in Data Science

- **Relevant Courses:** Machine Learning for Data Science, Computer Systems Programming, Big Data Analytics

Kwame Nkrumah University of Science and Technology (KNUST) *Jan 2021 – Nov 2024*
BSc. Biomedical Engineering *- First Class Honors*

- **Relevant Courses:** Research Methods, Biomechanics, Medical Imaging, Probability and Statistics, Linear Algebra, Calculus, C/C++, Biomaterials, Bioinstrumentation, Biosignal Processing and Analysis

Professional Experience

Research Assistant, Engineering Research *Kumasi, Ghana* *Oct 2024 – Present*
Kumasi Centre for Collaborative Research in Tropical Medicine (KCCR)

- Conducting interdisciplinary research in Digital Health, Artificial Intelligence, and Machine Learning within the Global Health & Infectious Diseases (GHID) Group.
- Developing and deploying generative AI models and Clinical Decision Support Systems to enhance diagnosis, treatment, and management of infectious and chronic diseases.
- Collaborating on systematic reviews and literature analyses on disease management strategies, particularly focusing on gestational diabetes care in Ghana.

Research Assistant, Machine Learning Intern *Kumasi, Ghana* *Oct 2023 – Feb 2024*
Responsible Artificial Intelligence Lab (RAIL)

- Conducted extensive research across multiple domains of machine learning/deep learning, including Generative Adversarial Networks (GANs) and Machine Learning Applications in Biomedical Engineering.
- Built Generative Models for Computed Tomography (CT) denoising and upscaling (SRGAN), and CT-MRI translation (CycleGAN).

Engineering Intern *Kumasi, Ghana* *Sept 2021 – Nov 2021*
Sesi Technologies Limited

- Built User-Interface components to assist in the digitization of agricultural tools.
- Designed and implemented a custom computer mouse, sourcing components, utilizing CAD & 3D printing.

Research and Academic Work

Conference & Workshop Papers

Automated Segmentation of Ischemic Stroke Lesions in Non-Contrast Computed Tomography Images for Enhanced Treatment and Prognosis - ***Toufiq Musah****, Prince Ebenezer Adjei, Kojo Obed Otoo*
MICCAI Meets Africa Workshop - Oral Presentation [ArXiv] [Springer]

Large Kernel MedNeXt for Breast Tumor Segmentation and Self-Normalizing Network for pCR Classification in Magnetic Resonance Images - ***Toufiq Musah***
MICCAI - 2nd Deep-Breath Workshop [ArXiv]

Poster Presentations, Abstracts, Talks

An Explainable Artificial Intelligence Framework for Clinical Decision Support Systems in Stroke Triaging - ***Toufiq Musah****, Tracy Birago Boamah, Mathew Akakpo, Prince Ebenezer Adjei* - Poster Presentation

Explainable Classification of Ischemic And Hemorrhagic Strokes Using Non-contrast Computed Tomography Scans - ***Toufiq Musah****, Tracy Birago Boamah, Mathew Akakpo, Adjei Prince Ebenezer*

Sleep Apnea Detection Using Machine Learning in Low-Resource Compute Devices and SpO_2 Sensors

University of Ghana, School of Engineering Sciences Conference - Abstract, Oral Presentation [Abstract]

Advanced Optimisation Techniques in Machine Learning (Tutorial)
Ghana Data Science Summit, IndabaX-Ghana 2025, Ashesi University, 2025 [Tutorial Materials]

Relevant Projects

Surgical Scene Understanding and Panoptic Segmentation with Scene Graphs
Developed of an end-to-end system for automated surgical room scene understanding. Trained an S^2-Scaled SwinUNETR for panoptic segmentation of 21 classes (personnel, instruments, and tools) enabling robust identification and localization. Fine-tuned MedGemma using QLoRA for scene graph generation and event significance detection, facilitating downstream reasoning and analytics for surgical workflow analysis.

Brain Tumor Segmentation Using Deep Learning
Developed and implemented advanced algorithms for segmenting brain tumors from multi-modal MRI scans as part of the Sprint AI Training for African Medical Imaging Knowledge Translation programme. The project focused on addressing the unique challenges facing the Sub-Saharan African region including limited data availability.

Super Resolution and Denoising of Computed Tomography Scans
A generative model for producing high resolution head CT scans from low resolution variants, to minimize effective patient radiation dose in CT diagnosis radiology procedures.

Data Augmentation via Deep Convolutional GAN
Implemented a deep convolutional generative adversarial network (DCGAN) to synthetically generate additional medical image data for self-supervised pre-training, enabling effective data augmentation and facilitating robust fine-tuning of computer vision models.

Awards and Acknowledgments

- Best Oral Presentation Award - MICCAI Meets Africa Workshop, 2024
- Best Poster Presentation Award - Ghana Data Science Summit, IndabaX, 2024
- Academic Excellence Award – Provost List 2021, 2022, 2023
- MasterCard Healthcare Entrepreneurship Grant
- MICCAI Education Challenge Finalist, 2024
- MICCAI Travel Award, 2024, 2025

Volunteering

Course Facilitator, Women in Engineering - SheCodes Club Teaching Python programming and introductory machine learning classes for the Women in Engineering Society, creating an inclusive learning environment to help members gain tech skills and build their confidence in STEM.

Student Lead, ARM(E3)NGAGE Club Spearheading the ARM student club focused on microcontroller programming, IoT, and embedded machine learning. Guided teams in developing innovative hands-on projects while organizing outreach workshops.

Volunteer, IndabaX, Ghana Data Science Summit Contributing to the organization of IndabaX GDSS by curating engaging content that raised awareness and sparked interest in the transformative potential of data science.

Blog Posts, Tutorials

Introduction to TorchIO for 3D MRI Processing: - Preprocessing (Part 1) - Augmentation & Dataloaders (Part 2)

End-to-End Deep Learning Tutorial for Image Classification: Pneumonia Detection - Colab Notebook

How to Make an Image Classification Model: Is it a Pie? - Blog Post

Skills

Languages: C/C++, Python, LaTeX, MATLAB

Libraries: PyTorch, TensorFlow, Keras, Scikit-Learn, Pandas, LangChain

Software: Solidworks, Fusion 360, ANSYS FEA, Unity Game Engine, KiCAD, Electronics Prototyping