Toufiq Musah

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Summary

A biomedical researcher and engineer with multidisciplinary expertise in technology-driven healthcare solutions and machine learning. Experienced in leading impactful research and projects, with a strong commitment to advancing AI-driven healthcare accessibility.

Education

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)

- Research in Digital Health and Artificial Intelligence in the Global Health & Infectious Diseases (GHID) Group.
- Developing generative AI tools for the assistive management of diseases and Clinical Decision Support Systems.

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 CT denoising and upscaling (SRGAN), and CT-MRI synthesis (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.

Biomedical Engineering Intern *Accra, Ghana* Dec 2022 – Jan 2023
37 Military Hospital

- Assisted in routine maintenance checks on various medical equipment including autoclaves and surgery lightening equipment.
- Supported quality control processes through testing and evaluations, ensuring medical devices met organizational and regulatory standards.

Research and Academic Work

Conference Papers

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

Poster Presentations, Abstracts, Talks

- **An Explainable Artificial Intelligence Framework for Clinical Decision Support Systems in Stroke Triaging**
  Authors: **Toufiq Musah**, Tracy Birago Boamah, Mathew Akakpo, Prince Ebenezer Adjei
  Accepted at: Ghana Digital Innovation Week - Poster Presentation
- **Explainable Classification of Ischemic And Hemorrhagic Strokes Using Non-contrast Computed Tomography Scans**

Authors: **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**
  Authors: Toufiq Musah
  Accepted at: University of Ghana, School of Engineering Sciences Conference - Abstract, Oral Presentation
  Book of Abstracts

Relevant Projects

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.

Ocular Disease Detection using Deep Learning

Developing an open-source suite of efficient CNN models for automated diagnosis of major eye conditions (glaucoma, diabetic retinopathy, AMD, cataracts) using fundus images. Achieved >90% accuracy while optimizing for minimal computational requirements. Incorporated explainable AI techniques to ensure models used the right features in disease detection, enhancing interpretability and trust in the system.

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.

Geospatial Data Visualization Pipeline

Built a pipeline that accepts and augments data from the Ghana Statistical Service StatsBank, to easily create Geospatial and Exploratory Data Analysis (EDA) plots for research and policy purposes.

Remote Patient Monitoring Telemetry System

Engineered an IoT-based health vitals monitoring solution using the MAX30102 sensor and Arduino Nano RP2040. Implemented a cloud dashboard for real-time tracking of vital signs, enhancing remote patient care capabilities.

Awards and Acknowledgments

- Best Oral Presentation Award - MICCAI Meets Africa Workshop, 2024
- Best Poster Presentation Award - Ghana Data Science Summit, IndabaX, 2024
- MICCAI Meets Africa Travel Award, 2024
- Academic Excellence Awardee – Provost List 2021, 2022, 2023
- MasterCard Health Entrepreneurship Grant
- Ghana Statistical Service, Data Science Hackathon – First Runner Up
- Engineering Maker's Fair Competition – First Runner Up

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 Transforms - Blog Post

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

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

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