Kwabena Kwayisi KISSIEDU

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PROFILE

A First Class Honors Civil Engineer with advanced capabilities in structural engineering laboratory research, machine learning, physics-based simulation, and 3D digital environments. Seeking to develop and apply AI-driven tools for creating safer and more sustainable infrastructure. Possesses a complete, modern workflow for computational research, from creating 3D digital worlds and generating synthetic data to training the physics-informed AI models needed for analysis.

EDUCATION

Bachelor Of Science in Civil Engineering (First Class Honors), GPA:3.74 **September 2019 – August 2023**
Kwame Nkrumah University of Science and Technology (KNUST) **Kumasi, Ghana**
Relevant Coursework: Reinforced Concrete Design, Steel and Timber Design, Structural Dynamics, Structural Engineering, Computer Programming (Python), Systems Engineering II (Intro to Finite Element Analysis)

RESEARCH INTERESTS

- Physics-Informed & Generative Models for Damage Simulation and Synthetic Data Generation
- Inverse Design of Sustainable Materials (UHPC) and Additive Manufacturing Processes
- AI-Driven Geometric Digital Twins for Lifelong Structural Management
- Computer Vision for Structural Health Monitoring & Construction Site Safety
- Probabilistic AI for Uncertainty Quantification in Engineering Models

RESEARCH / PROJECT EXPERIENCE

Personal Research Projects **March 2024 – Present**

Structural Health Monitoring (SHM) and Digital Twins

- **Visual Damage Detection**: Developed a U-Net model in PyTorch for semantic segmentation of concrete cracks, achieving a Dice Score of 0.93. Enhanced the model with attention mechanisms and calculated class weighting to handle fine cracks and data imbalance. GitHub
- **Synthetic Data Generation**: Built a Variational Autoencoder (VAE) to generate high-fidelity, synthetic concrete crack images, providing a robust solution to data scarcity for training computer vision models. GitHub
- **Unsupervised Anomaly Detection**: Engineered a VAE-based model to detect anomalies in structural time-series sensor data, enabling monitoring without prior examples of failure.
- **Probabilistic Damage Classification**: Implemented a Bayesian Neural Network (BNN) to classify damage while quantifying the model's prediction uncertainty, a critical feature for safety-critical applications. GitHub

Construction Site Safety and Risk Assessment

- Developed a real-time safety monitoring system using YOLOv8 for PPE compliance detection.
- Currently extending the model by incorporating dense captioning to move from simple object detection to intelligent scene understanding and contextual risk assessment. GitHub

Physics-Informed AI and Probabilistic Modeling

- **Physics-Informed Neural Network (PINN):** Built and trained a PINN in PyTorch to solve the Euler-Bernoulli beam equation, enforcing the governing PDE and boundary conditions directly in the loss function. GitHub
- **Uncertainty-Aware Surrogate Modeling:** Implemented and compared Gaussian Process Regressors and Deep Ensembles with Aleatoric Uncertainty to create reliable surrogate models for predicting concrete compressive strength, complete with principled uncertainty bounds. GitHub

Research Assistant **December 2024 – Present**

Fatigue Life Prediction of Locally Manufactured Steel Reinforcement Bars from Scrap Metals Using Artificial Neural Networks and Numerical Simulation

Structural Engineering Lab, Department of Civil Engineering, K.N.U.S.T. **| Supervisor:** Dr. Evans Amponsah

- Developing an Artificial Neural Network-based Fatigue Life prediction model using experimental fatigue test data.
- Optimizing the model for accurate Fatigue Life prediction.
- Comparing model predictions with experimental fatigue test results and numerical simulations to assess model accuracy.
- Performing sensitivity analysis to determine the influence of selected factors on Fatigue Life.

Research Assistant **January 2024 – Present**

Assessment of Fatigue Life of Locally Manufactured Steel Reinforcement Bars for Sustainable Construction in Ghana.

Structural Engineering Lab, Department of Civil Engineering, K.N.U.S.T. **| Supervisor:** Dr. Evans Amponsah

- Developed a physics-based numerical model in ABAQUS to predict the fatigue life of locally manufactured rebars from scrap metals.
- Evaluating the fatigue life of locally manufactured steel reinforcement bars from scrap metals.
- Investigating the factors influencing fatigue resistance in the local manufacturing process.
- Assessing the potential for integrating locally produced bars into sustainable construction practices.

PUBLICATIONS

(Upcoming 2025) - Assessment of Fatigue Life of Locally Manufactured Steel Reinforcement Bars for Sustainable Construction in Ghana.

(Upcoming 2025) - Fatigue Life Prediction of Locally Manufactured Steel Reinforcement Bars from Scrap Metals Using Artificial Neural Networks and Numerical Simulation.

TECHNICAL SKILLS

Machine Learning and Data Science

- **Languages & Version Control:** Python, Git
- **Core Frameworks:** Pytorch, Tensorflow, with a specialization in PyTorch
- **Specialized Libraries:** Ultralytics (YOLO), OpenCV, Keras, Scikit-learn, CVZone, Skorch, PIL, Albumentations
- **Data Science and Visualization:** Pandas, Seaborn, Matplotlib
- **ML Operations:** Data Annotation (Label Studio), Data Augmentation (Torch Transforms, Albumentations)

Structural Analysis and Simulation View Structural Engineering Portfolio

- **Numerical Simulation:** ABAQUS
- **Structural Analysis:** ProtaStructure, Midas

Building Design and BIM View Structural Engineering Portfolio

- **Building Information Modeling (BIM):** Autodesk Revit

3D Design and Synthetic Environments

- **3D Modeling:** Blender 3D
- **3D Sculpting:** ZBrush
- **3D Texturing and Rendering:** Substance Painter, Blender3D, Marmoset Toolbag 5
- **Character Creation:** Character Creator
- **3D Environment Building:** Unreal Engine, Unity
- **3D Animation and Photo Editing:** Adobe After Effects, Adobe Photoshop, Adobe Illustrator

WORK EXPERIENCE

Co - Founder
The Anthracite Limited **July 2024 – Present**

- Co-founded a startup with the mission to develop Ghana's first 3D-printed Green Building estate to address national housing challenges.
- Spearheading the technical vision, focusing on the integration of sustainable materials, robotic construction, and AI-driven quality control.

Consultant Engineer
Consulting Steel, Roads and Concrete (SRC) Engineers **November 2023 – September 2024**

- Performed structural design and detailing for a diverse portfolio of large-scale projects, including industrial, residential and medical facilities.
- Served as the representative consultant for “The Ark Phase 2” project, advising on optimum structural solutions and utilizing my ML model to resolve on-site concrete strength issues.
- Spearheaded the adoption of Autodesk Revit for structural detailing, boosting work efficiency and output presentation by about 20%.

Freelance 3D Designer **September 2023 – Present**
Dobiison Ghana Limited

- Creating high-quality 3D characters, assets and immersive VR/AR experiences for a diverse range of clients including Unilever Ghana, MTN and SuCasa Properties.

Freelance Structural Engineer **June 2024 - Present**
Ekodek Engineering and Construction

- Collaborated on the structural design and detailing of numerous residential, commercial and public works projects using Autodesk Revit. Projects include Pineapple Hill Residential Building and Onyx Properties Warehouse.

BIM Content Creator **July 2025 - Present**
Freelance Structural Engineer

- Creating and uploading videos to a YouTube channel dedicated to teaching BIM and 3D modeling concepts.

Engineering Intern
Production Department, Contracta Construction UK **September 2021 – December 2022**

- Supervised construction of retaining walls, pile foundations and composite slabs.
- Performed site surveys to map out road network for road expansion project.
- Performed checks and took stock of vehicles and construction materials.
- Diligently managed skilled and unskilled labour.
- Revised detail drawings for construction of the New Kejetia Market.
- Assisted in management of the company's project database.

TEACHING EXPERIENCE

CE 452 - Computer Applications in Civil Engineering - KNUST **June 2025 – July 2025**

- Invited by Dr. Evans Amponsah to teach BIM using Revit to the final year Civil Engineering class of 300 students.
- Class lasted for a period of 3 weeks, with two sessions per week.
- Prepared a detailed course outline with tasks for each week.
- Tutored students on optimized building modeling techniques for coordination with other engineering disciplines.
- Created a YouTube channel to provide students with access to detailed tutorials on the use of Revit for BIM.

Revit Tutor - SRC Engineers **May 2024**

- Organized in-house training at Consulting Steel, Roads and Concrete Engineers in the use of Autodesk Revit for 3D structural design and detailing.

Revit Tutor - KSTU **February 2024**

- Tutored a group of industry professionals in Revit for 3D building modeling.
- Tutorials span over the course of two weeks.

CE 263 - COMPUTER AIDED DESIGN - KNUST **February 2023**

- Tutored a group of 50 students in the use of Autodesk AutoCAD for structural detailing.

Class Teacher - Victory Bible Church International, Shalom Sanctuary **January 2024 - present**

- Instructor of the Joshua Class.

AWARDS

Best Student in Civil Engineering Design (CED) Project [Structural Engineering] - 2023:
- Final year capstone project that subjects students to a real-life Civil Engineering Design (CED) project.
- Competed with 300 students across KNUST's two campuses for the spot of best student in CED.
- Won the Associated Consultancy award for second- best student in CED (Structures).

COURSERA COURSES

Supervised Machine Learning – Regression and Classification
Stanford Online & DeepLearning.ai
Advanced Learning Algorithms
Stanford Online & DeepLearning.ai
PyTorch Ultimate 2024: From Basics to Cutting-Edge
Packt

VOLUNTARY AND EXTRACURRICULAR ACTIVITIES

VISA Men's Week 2023 & 2022 – Led the planning and execution of VISA Men's Week for two consecutive years, overseeing a team to coordinate week-long events focused on men's development, engagement, and empowerment. Spearheaded the 2023 edition's highlight event: the Men's Dinner, which brought together over 120 members for networking, entertainment and reflection in a formal setting.

VISA KNUST Love Walk and Aerobics (2022) – Organized a walk through parts of KNUST aimed at sensitizing the youth on the importance of regular exercise.

VISA Insight- Organized a help session to educate male students on mental health and the need to seek help when needed.

VISA KNUST Missions 2022 Outreach and Charity – Donated to less-privileged families in the Asokwa community.

VISA KNUST Missions 2021 Outreach and Charity – Donated to less-privileged families in the Ejisu community.

MEMBERSHIPS AND ORGANIZATIONS

National Society of Black Engineers (NSBE)
Engineers Without Borders (EWB)
Ghana Engineering Students' Association (GESA)
Civil Engineering Students' Association (CESA)

Men's President – VISA KNUST (2022-2023)
Men's Vice-President – VISA KNUST (2021-2022)

REFEREES

Available upon request.