CYRIL SELASE KWAKU AKAFIA

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RESEARCH INTERESTS

- Neural Encoding and Decoding
- Artificial Intelligence and Machine Learning for Biomedical Applications
- Signal Processing

EDUCATION

Bachelor of Science in Engineering (Biomedical) **August 2018 – August 2022**

University of Ghana Accra, Ghana

Dissertation Title: "Prediction of Anti-inflammatory Compounds for the Treatment of Covid-19 Induced Cytokine Storm Using in-silico Methods"

Relevant courses: Differential Equations, Calculus, Algebra, Cell and Molecular Biology, Human Anatomy, Human Physiology, Biomedical Engineering Systems, Medical Imaging, Numerical Methods

PUBLICATIONS

* denotes equal authorship

- *Palmer, X., ***Akafia, C.**, Woodson, E., Woodson, A., Potter, L. "Organoids, Biocybersecurity, and Cyberbiosecurity—A Light Exploration". Organoids 2024, 3, 83-112. https://doi.org/10.3390/organoids3020007
- *Lin, A., ***Akafia, C.**, Olga Dal Monte, Fan, S., Fagan, N., Putnam, P., Tye, K.M., Chang, S., Ba, D. and AZA Stephen Allsop. (in revision) "An unbiased method to partition diverse neuronal responses into functional ensembles reveals interpretable population dynamics during innate social behavior". Pre-print http://doi.org/10.1101/2024.05.08.593229
- Fry-Nartey, L., Agyenkwa-Mawuli, K., **Akafia, C.**, Nkonu, U., Wilson, M. D., & Kwofie, S. K. (under review) "Machine Learning Models Predict Small Molecules as Potential Biotherapeutics for COVID-19-induced Cytokine Storm."

RELEVANT SKILLS

- **Programming:** Python, bash, HTML, CSS, JavaScript
- **Relevant packages:** PyTorch, Keras, MNE, Matplotlib, Scikit-learn, pandas, NumPy, Flask, Streamlit
- **Software:** Solid Edge (Computer-Aided Design, CAD), SLEAP
- **Data collection:** EEG (emotive, MUSE), heart rate (Fitbit, polarH10), survey/screening (Qualtrics)
- **Other:** Drone Photography

RESEARCH EXPERIENCE

Postgraduate Research Associate **November 2023 - Present**

AZA Lab Supervisor: AZA Stephen Allsop, MD., Ph.D.

Yale School of Medicine, Yale University New Haven, CT, USA

Project FEU

Description: FEU: Functional Encoding Units, a non-parametric and state-space approach to clustering diverse neuronal responses into functional ensembles reveals interpretable population dynamics"

Responsibilities:

- Develop a Python library for analyzing highly complex time series data using the FEU formalism (FEU python library https://github.com/cyrilakafia/feu-pipeline).
- Build and deploy a user-friendly and open-source graphical user interface for clustering time series data with the FEU pipeline using Flask, HTML, CSS, JavaScript, and Celery.
- Benchmark FEU against other popular clustering methods (code and results: https://github.com/al5250/feu).
- Test and develop pipelines for using FEU clustering for electrophysiology, and behavioral data.

Project Rodent behavioral analysis with SLEAP and FEU

Description: An approach to group behavioral data into clusters through the SLEAP pose estimation approach and the FEU clustering method

Responsibilities:

- Utilize SLEAP AI to annotate and track animal movement and behavior through pose estimation.
- Create a pipeline to effectively cluster behavioral data with the FEU clustering formalism.

Project Music Mindfulness Study

Description: Assessing the impact of music and community-based culturally relevant and informed interventions in promoting healing and connectedness through communal music listening and creation by levering near-infrared spectroscopy (FNIRS), electroencephalography (EEG), behavioral, surveys, eye tracking, and physiological monitoring measurement techniques.

Responsibilities:

- Perform analysis on EEG data recorded from human subjects using the MNE python library.
- Collect EEG, heart rate, and survey data from human subjects.
- Assist in analysis of heart rate data and development of a heart rate variability pipeline.

Project MARL approach for behavior analysis

Description: Develop a model using a multi-agent reinforcement learning method to examine social interactions within behavioral experimental frameworks.

Responsibilities:

- Develop research questions based on gaps in literature.
- Contribute to the building and training of reinforcement learning models that mimic animal behavior.

Research Intern **November 2022 – October 2023**

Kwofie Lab Supervisor: Samuel K. Kwofie, Ph.D.

School of Engineering, University of Ghana Accra, Ghana

Project AICpred

Description: Machine learning models predict small molecules as potential biotherapeutics for COVID-19-induced cytokine storm.

Responsibilities:

- Performed rigorous data cleaning, visualizations and both qualitative and statistical analysis.
- Trained up to 45 machine learning models for classification with scikit-learn.
- Developed an AI-based drug discovery web application (link: http://197.255.126.13:8080/) for predicting novel inhibitors against the toll-like receptor 4 (code: https://github.com/cyrilakafia/StormPred).
- Collaborated with other lab members to identify gaps in literature, conduct literature reviews, and write technical reports and manuscripts.

Research Intern **December 2022 – March 2023**

ReachSci Mini Ph.D. Programme Supervisors: Elsie E. Kaufmann, Ph.D., Mari A. Chama, Ph.D.

Project: The Influence of Interferences on the Accuracy of 3 Commonly Used Glucometers in Ghana

Responsibilities:

- Performed laboratory experiments involving blood drawing, preparing interference solution, taking and glucometer readings.
- Carry out statistical analysis and designed figures with Microsoft Excel and Inkscape.

ADVANCED COURSES

Computational Neuroscience **July 2024 – July 2024**

Neuromatch Academy Online

Relevant Topics: Modeling, Machine Learning, Dynamical Systems, Stochastic Processes, Causality

Project Title: Investigating cell type and layer-specific processing of novelty in mouse primary visual cortex

Computational Neuroscience **April 2023 – May 2023**

IBRO Simons Computational Neuroscience Imbizo Cape Town, South Africa

Relevant Topics: Machine Learning, Motor Control, Network Dynamics, Neural Recordings, Decision-Making, Higher-Level Function, Biophysics

Capstone Project: “Analysis of Neural Data from Hand-Reaching Experiments in Non-Human Primates: Insights into Motor Control and Rehabilitation Engineering” (code: https://github.com/cyrilakafia/mc-maze-analysis)

WORK EXPERIENCE

Machine Learning Engineer **November 2022 – October 2023**

MinoHealth AI Labs Accra, Ghana

Description: Develop AI tools for scanning, identifying, localizing, and reporting abnormalities in radiology images.

Responsibilities:

- Trained binary classification and object detection models that achieved the highest in-house accuracy in predicting abnormalities in chest X-ray images.
- Curated a diverse dataset of over 500,000 medical images and reports for finetuning large language models.
- Collaborated with team members to finetune the Llama and LLaVA large language models on the medical domain.

- Automated the annotation of malaria parasites in blood smears with an object detection-semi-supervised learning pipeline.

Machine Learning Engineer **November 2022 – October 2023**

KaraAgro AI Accra, Ghana

Description: Building tools and insights that improve yield for farms through aerial data and analytics.

Responsibilities:

- Carry out a rigorous data collection exercise to curate a dataset of over 8,000 plant images with a drone.
- Spearheaded the development of YOLO object detection models for the detection of abnormalities in plant images (preprint: http://arxiv.org/abs/2307.01767).

Clinal Engineering Intern **February 2021 – March 2021**

Greater Accra Regional Hospital Accra, Ghana

Responsibilities:

- Collaborated with a team of engineers to repair and maintain hospital devices: autoclaves, patient monitors, thermometers, and sphygmomanometers.

SERVICE AND LEADERSHIP EXPERIENCE

NeuroAI Workshop **September 2024 – September 2024**

Organizer, Instructor

- Co-organized a full day workshop and coordinated talks from four invited speakers.
- Gave a practical tutorial on understanding the patterns of activities in neural networks.

Deep Learning Indaba (DLI) **December 2023 – Present**

Member of Organizing Team, DLI Mentorship Programme

- Matched young researchers and students with mentors.
- Collaborated with team members to revamp the mentorship program and reach a larger audience.

World Movers Team (WMT)

Member of Writers Committee **August 2023 – Present**

- Plan outreach, donation, and educational events.
- Work with team members to write informative articles on various social topics.

Stanford Code in Place **May 2024 – June 2024**

Section Leader (Mentor)

- Tutor 20 students in Python programming concepts.

PRESENTATIONS

- Fry-Nartey, L., **Akafia, C.**, Nkonu, U. (January 2023), “Machine Learning Models Predict Small Molecules as Potential Biotherapeutics for COVID-19-induced Cytokine Storm”, International Student Conference on Advanced Science and Technology (iCAST), Japan, online.
- Lin, A., ***Akafia, C.**, Olga Dal Monte, Fan, S., Fagan, N., Putnam, P., Tye, K.M., Chang, S., Ba, D., and AZA Stephen Allsop. (June 2024) “An unbiased method to partition diverse neuronal responses into functional ensembles reveals interpretable population dynamics during innate social behavior”, 10th Annual Brain Initiative Conference, Rockville, MD, USA.
- Fry-Nartey, L., **Akafia, C.**, Nkonu, U. (July 2023), “Machine Learning Models Predict Small Molecules as Potential Biotherapeutics for COVID-19-induced Cytokine Storm”, West African Centre for Cell Biology and Infectious Pathogens Research Conference 2023, Accra, Ghana.

HONOURS AND AWARDS

- **Amazon Web Services Scholarship Award** **2023**
  Full funding for Machine Learning Fundamentals online course.
- **ISCNI Scholarship Award** **2023**
  Fully funded tuition and travel to take the computational neuroscience course.
- **Amazon Web Services Scholarship Award** **2022**
  Scholarship award to participate in the Artificial Intelligence with Python online course.
- **African Leadership (ALX) Scholarship Award** **2022**
  Complete tuition to take an online course in Data Analysis.

PROFESSIONAL AFFILIATIONS

- Black in AI
- Deep Learning Indaba