

EMMANUEL OBENG FRIMPONG

📞 703-589-6592 ✉️ frimpongemmanuelobeng@gmail.com  [linkedin.com/in/emmanuel-obeng-frimpong-70a522166](https://www.linkedin.com/in/emmanuel-obeng-frimpong-70a522166)

 fo-e.github.io

Education

George Mason University

PhD Electrical and Computer Engineering, **GPA: 3.72/4.0**

January 2023 – current

Fairfax, Virginia

Hanbat National University

Master of Science: Intelligent Media Engineering, **GPA: 4.438/4.500**

March 2021 – December 2022

Daejeon, South Korea

Thesis: Physical Layer Security Enhancement for 6G: Deep Learning and Irregular RIS

Kwame Nkrumah University of Science and Technology

Bachelor of Science: Telecommunication Engineering, **GPA: 3.85/4.0 (WES)**

September 2015 – May 2019

Kumasi, Ghana

Relevant Coursework

- Linear Algebra
- Convex Optimization
- Probability and Statistics
- Information Theory
- Advanced Signal Processing
- Learning from Data

Skills

Technical: Wireless Communication, Physical-Layer Security, Machine/Deep Learning, Reconfigurable Intelligent Surfaces

Programming: Python, Matlab, SQL, Latex, C&C++

Frameworks & Libraries: TensorFlow/Keras, Pytorch, Scikit-Learn, Pandas, Numpy, SciPy, Matplotlib, Pandas

Statistics: Power BI, Tableau Software, Microsoft Excel, Trello (Project Management)

Hardware & Design: NI USRP, GNU Radio Companion, Linux Scripting

Competitive Edge: Excellent problem solving abilities, self-motivated and results oriented

Research and Teaching Experience

Department of Electrical and Computer Engineering

Graduate Research Assistant

January 2023 – current

Fairfax, Virginia

- Researched Deep Reinforcement Learning for Irregular Reconfigurable Surfaces
- Currently designing efficient spectrum sensing technique using Deep Neural Networks and Hidden Bivariate Markov model

Intelligent Communications and Information Security Lab

Graduate Research Assistant

March 2021 – December 2022

Daejeon, South Korea

- Researched guaranteeing physical-layer security using reconfigurable intelligent surfaces
- Worked on security vulnerability analysis in LTE networks using USRPs
- Researched deep learning end-to-end wireless communication and physical layer security
- Reviewed relevant research papers and theory
- Reproduced results in highly-ranked research papers, relevant to our project, with *MATLAB* or *Python*
- Mentored undergraduates on developing a deep learning based AI Chatbot, Hayanmind Inc. Project

Faculty of Electrical and Computer Engineering, KNUST

Teaching and Research Assistant

September 2019 – August 2020

Kumasi, Ghana

- Worked as Optical communication lab assistant, assisted undergraduates during lab sections and provided ready access to all experimental data to my supervisor.
- Tutored and graded the following courses: Optical Communications Network, Data Communications Network, Mobile and Satellite Communication Systems.
- Conducted literature reviews, prepared reports and presentations for tutorials and discussions.
- Supervised undergraduate research project.

Npontu Technologies Limited

Machine Learning Intern

June 2018 – August 2018

Accra, Ghana

- Researched on machine learning applications in banking, finance and Insurance sector.
- Worked with supervisor to develop a model that could detect fraudulent banking activities in Ghana.
- Collaborated with product development team to identify opportunities to implement trained models which showed increased efficiency in general performance.

Projects

Learning from Data Project

Sept - Nov 2023

- Designed generative models using Kernel Density Estimation
- Implemented several high accuracy classifiers such as perceptron learning algorithm, logistic regression, support vector machines for linear and nonlinear dataset
- Designed regression models both linear and nonlinear
- Designed ensemble learning methods using trees and other simple algorithms as base models
- Implemented neural network for classification, and regression and CNN for image classification
- Data exploration and analysis, Data cleaning and feature engineering, Hypothesis, Testing, Statistical learning theory

Deep Reinforcement Learning for Irregular Reconfigurable Intelligent Surfaces

September 2023

- Guarantee sum-rate using Irregular Reconfigurable Intelligent Surfaces (IRIS)
- Setup a joint optimization NP-hard problem with high dimension non-linear mixed integer programming optimization
- To solve this problem, we transform the problem to a Markov Decision Problem and implement Deep Deterministic Policy Gradient, a deep reinforcement learning algorithm

Development of Physical Layer Security Technology for 6G Communication Networks

December 2022

- Guarantee physical-layer security using Irregular Reconfigurable Intelligent Surfaces (IRIS)
- Considered an IRIS-aided MISO wiretap system and formulated a secrecy rate maximization problem
- Designed a high-quality sub-optimal algorithm to solve this non-convex problem

Unified Design of Physical-Layer Security and Machine Learning for 5G Wireless Systems

December 2021

- Implemented an end-to-end learning approach for physical layer security in Gaussian Multiple Access Wiretap Channel
- Designed a loss function that controls secrecy, reliability and user-priority
- Proposed training approach that guarantees secrecy performance
- Implemented secrecy by introducing randomness in transmission using coset and a modified kmeans algorithm

Generation of Orbital Angular Momentum Waves using circular slot and patch antennas

April 2019

- Designed an antenna that could exploit a new degree of freedom in transmission other than time, frequency and space.
- Used HFSS software to design two Uniform Circular Array antennas each with 8 antenna elements.
- Calculated and designed patch and slot antennas for the antenna array.

Machine Learning in Banking, Finance and Insurance Sector

June 2018

- Aim was to apply Machine Learning to solve pressing issues in banking and finance sector
- Performed feature engineering on data set to suite the Ghanaian banking chain
- Collaborated with product development team on a machine learning model that detects possible fraudulent activities.
- Analyzed performance improvement for trained model integration.

Relevant Awards/Certifications

Excellent Master's Thesis Award

February 2023

Udemy: Machine Learning, Deep Learning and Bayesian Learning

January 2022

Huawei Certified Network Associate, Routing and Switching

April 2019

Provost's Award for Excellent students (Undergraduate)

Mar.2019, Oct.2018, Oct.2017

Publications

International Journal Papers (*: Corresponding Author)

- **Emmanuel Obeng Frimpong**, Taehoon Kim, Inkyu Bang*, 'Physical-Layer Security with Irregular Reconfigurable Intelligent Surfaces for 6G Networks.' *MDPI Sensors*, 2023
- **Emmanuel Obeng Frimpong**, Taehoon Kim, Inkyu Bang*, 'Deep Learning Approach for Physical-Layer Security in Gaussian Multiple Access Wiretap Channel.' *ICT Express-Elsevier*, 2022

Leadership / Extracurricular

Reviewer, IEEE Vehicular Technology Conference

Spring 2023

Reviewer, AyaPrep Ghana Limited

February 2020 - April, 2020

Career Fair Liaison, Npontu Technologies Limited

March 2020

Member, Ghana Engineering Students' Association Project Committee, KNUST

Sept. 2018 – April 2019

Organizing Secretary, Outreach Committee of Ghana Methodist Students' Union - KNUST

March 2019

Team Lead, Machine Learning in Banking and Finance Project, Npontu Tech.

July 2018 – August 2018