Emmanuel Obeng Frimpong

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Education

Hanbat National University **March 2021 – December 2022**

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

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

Advisor: Prof. Inkyu Bang

Kwame Nkrumah University of Science and Technology **September 2015 – May 2019**

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

Relevant Coursework

- Linear Algebra
- Convex Optimization
- Probability and Statistics
- Information Theory
- Signal Processing for Wireless Communications

Skills

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

Programming: Python, Matlab, 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

Intelligent Communications and Information Security Lab **March 2021 – December 2022**

Graduate Research Assistant *Daejeon, South Korea*

- Researched guaranteeing physical-layer security using reconfigurable intelligent surfaces
- Worked on security vulnerability analysis in LTE networks
- 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 **September 2019 – August 2020**

Teaching and Research Assistant *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.

Huawei Authorized Information and Network Academy **November 2019 – June 2020**

Tutor *Kumasi, Ghana*

- Tutored undergraduates in these key computer networking areas: Internet Switching, Routing Architecture, Network Security, Internet Protocols – DHCP, IPV6, FTP, Telnet.

Npontu Technologies Limited **June 2018 – August 2018**

Machine Learning Intern *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.

Work Experience

Npontu Technologies Limited **June 2020 – September 2020**

Internship Coordinator and Liaison *Accra, Ghana*

- Led interns in the data science department to work on implementing sentiment analysis model
- Spent a month on feature engineering to make our model algorithm effective
- Integrated sentiment analysis model in business and commercial platforms and achieve 95% accuracy
- Tutored 50 interns on a certification course titled: Introduction to Project Management Certification

Ghana Broadcasting Corporation **June 2017 – August 2017**

Summer Intern *Accra, Ghana*

- Worked with Engineers to support and enhance live signal transmissions at Uniiq FM.
- Worked with supervisor from the Master Control Room to ensure timed transmission to all GBC television channels.

Projects

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 designed 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

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* [To be submitted]
- **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, 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**