TAWFIK MOHAMMED OSMAN

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SUMMARY

Ph.D. candidate in electrical engineering with two years of research experience in wireless communications and signal processing. Tawfik is seeking a full-time internship in simulation, integration and testing of wireless communication system and machine learning research.

EDUCATION

Electrical Engineering, PhD **Arizona State University** **Tempe, AZ**
Communication Systems and Signal Processing – Advisor: Prof. Ahmed Alkhateeb. May 2024
Research: Machine Learning Aided mmWave MIMO Beam Prediction and Localization.
First Semester | **GPA 4.0**

Master of Science in Engineering, Electrical Engineering **Arizona State University** **Tempe, AZ**
Ira A. Fulton Schools of Engineering | Graduation: May 2021 | ***GPA: 3.68***.

- **Awards**: MasterCard Scholars Foundation Scholarship | Fulton Undergraduate Research Initiative(FURI) Funding | Master's Opportunity for Research in Engineering (MORE) Funding.
- **Relevant Coursework**: Communication Systems, Digital Signal Processing, Detection and Estimation Theory, Digital Circuit Design, Wireless Networks, Communication Networks, Digital Communication, Python for Rapid Eng. Solutions.

Bachelor of Science, Electrical & Electronic Engineering **Ashesi University** **Accra, Ghana**
Graduation: May 2019 | ***GPA: 3.73***.

- **Honors:** First Class Honors |
- **Awards:** MasterCard Foundation Scholar.

TECHNICAL SKILLS

Programming: Python | MATLAB | C&C++ | HTML $ CSS.
Design: Cadence | Simulink | GNU Radio Companion | Linux Scripting
Hardware: NI USRP | Raspberry Pi | Jetson Nano & Xavier | Hardware Prototyping & Testing
Statistics: R-Studio | Tableau Software | Microsoft Excel.
Frameworks & Libraries: PyTorch | TensorFlow | NumPy | OpenCV | SciPy | Scikit-Learn | Matplotlib |Pandas | pyQt5 & tkinter| Sockets.
Certification: Deep Learning Specialization in Coursera by Andrew Ng.

RESEARCH EXPERIENCE

Arizona State University Tempe, AZ
Graduate Research Assistant January 2021 – present
Project: Functional Mapping of sub-GHz channel state information to the mmWave beam vectors, using datasets from a real dual-band Testbed

- Implemented a co-located dual-band Testbed consisting of a mmWave transceiver (Linear Phased Array RF module) and SIMO sub-6GHz transceivers (NI USRPs and microcontrollers).
- Implemented end-to-end mmWave and sub-GHz communication using OFDM-based pilot sequences.
- Developed the digital signal processing blocks in python to capture signals and estimate channel state information and beam vectors.
- Collected, preprocessed, and built datasets of sub-6GHz channels and mmWave received power vectors
- Developed a deep learning model that creates a functional mapping between the channel state information from sub-6GHz signals and mmWave beamforming vectors.

Project: **Evaluating the Prototype of Reconfigurable Intelligent Surface (RIS) using a sub-6GHz transceiver Testbed in the field.**

- Accomplished the control of RIS proof-of-concept prototype with microcontrollers and interfaced it with the sub-6GHz communication setup.
- Lead a month-long field test measurement, to verify the performance of the RIS system.
- Analyzed the received signal power from the RIS, to estimate the pathloss, power gain and coverage in Non-Line of Sight (NLOS) sub-6GHz transmission scenario.
- Integrated a camera system to the testbed, to facilitate RIS-aided sub-GHz channel estimation and terminal user localization.

Project: **Employed Deep Learning and GPS positioning for Vision-Aided mmWave Beam Prediction**.

- Interfaced GPS-RTK Board and Stereo camera to a mmWave Testbed using Python Programming, Socket library and ZED2's SDK.
- Collected, preprocessed, and analyzed the vision data (RGB), position data (Lat/Long) and the mmWave beam power vectors from a Vehicle-to-Infrastructure (V2I) mmWave communication setup.
- Leveraged on pre-trained Res-Net model and Multi-layered neural networks to develop a multi-modal mmWave beam predictor, capable of predicting the optimal beam direction from the preprocessed Vision data, and the GPS position data.

Arizona State University Tempe, AZ
Undergraduate Research Assistant June 2020 – Aug. 2020
Project: **Machine Learning Aided Optimal Beam Prediction**

- Contributed to building the signal processing blocks of a mmWave communication system's prototype.
- Integrated a Marvelmind Indoor Positioning System with the mmWave Testbed.
- Employed Pandas module to pre-process the raw datasets collected Integrated wireless system.
- Developed and tested a novel feed-forward neural network(mmWave Beam Predictor), using python modules from PyTorch framework.

Course Project: **Developed a Multi-Layer Perceptron Classifier (MLPC) Model for classification problem.**

- Built a binary classifier to detect whether there is a mine or rock in the surrounding of a Submarine.
- Employed Principal Component Analysis(PCA) to reduce the Dependent variables to an orthogonal dataset to prevent overfitting.
- The orthogonal dataset was standardized, splitted, trained and tested using modules from Scikit-Learn library.

WORK EXPERIENCES

Arizona State University Tempe, AZ
Graduate Service Assistant *May 2020 - December 2020*

- Facilitated lab activities in coursework of Digital Design Fundamentals, using Intel DE10-Lite FPGA board to implement logic circuits.
- Supported the ASU Sync modality by assisting a faculty member in organizing and controlling the teaching and learning equipment.
- Successfully Held up to 2 hrs./week sessions to help students with their assignments and projects in Python and Machine learning.

Undergraduate Teaching Assistant January 2020 - May 2020

- Coordinated and assisted a faculty member in teaching a Python for Rapid Engineering Solution (EEE591) in a class of 140 students. And 40% of the class had grade A.
- Exploited the Scikit-learn library and utilized its classification algorithms such as Support Vector Machine, KNN, Logistic regression and Perceptron to build an optimized model capable of predicting 98% of counterfeit bills.
- Assisted students to build a CAD Tool Driver Program that utilizes the libraries of Python to generate an inverter-chain Hspice file with an optimized number of inverters and path effort, at a minimum path delay.

PUBLICATIONS AND ACTIVE RESEARCH PROJECTS

1. **T. Osman** and A. Alkhateeb, "Leveraging on Deep Learning to Predict Optimal mmWave Beam Directions Using Sub-6GHz Channels Information from a MIMO Testbed." [*Active project*]
2. G. Chara, **T. Osman**, A. Hredzak, N. Thawdar and A. Alkhaateeb, "Vision-Position Multi-Modal Beam Prediction using Real Millimeter Wave Datasets". Accepted to be presented at IEEE Wireless Communications and Networking Conference (WCNC). Austin TX, United States. 2022.
3. G. C. Trichopoulos, P. Theofanopoulos, K. Bharath, S. Aditya, M. Anuj, **O. Tawfik**, S. Kumar, A. Sengar, A. Chang, and A. Alkhateeb. "Design Evaluation of Reconfigurable Intelligent Surfaces in Real-World Environment," *submitted to IEEE Open Journal of the Communications Society*, 2021. [Online]. Available: https://arxiv.org/pdf/2109.07763.pdf
4. G. Charan, **T. Osman**, and A. Alkhateeb, "Position Error Characterization and Denoising Using Computer Vision and 6G Communication Beams." Expected to be submitted to IEEE WCNC 2022. [*internal review*]