Firas Fredj

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EXPERIENCE

Wireless Researcher January 2021 - August 2023
WICONS Research Group - University of Manitoba *Winnipeg, MB, Canada*

- Worked on modeling of the Reconfigurable Intelligent Surfaces (RIS) aided cellular wireless SIMO communication systems.
- Mathematically derived a **Bayesian Inference** based estimation method for channel estimation for passive RIS-aided communication systems.
- Introduced an **unsupervised Machine Learning** (ML) based scheme for estimation using Neural Networks combined with Variational Inference.
- Developed a new feature for an ML-based framework for practical scenarios with high mobile users to estimate the second moment of mmWave channels.
- Developed a **signal processing algorithm** for maximizing the average data rate by efficiently utilizing the long-term CSI for passive beamforming.
- Implemented the proposed algorithm in **Python (Tensorflow)** using **Object-Oriented** approach and **Matlab**.
- Performed extensive **(L1/PHY)** simulations to assess the performance of the RIS and the designed algorithms against **5G-NR (3GPP spec)** under different mmWave channel conditions and parameters.
- Authored a full-length peer-reviewed IEEE Conference (ICC 2023) and a submitted journal in IEEE Journal (TWC) papers.

Machine Learning Research Intern February 2020 - June 2020
WICONS Research Group - University of Manitoba *Winnipeg, MB, Canada*

- Designed a **Deep Reinforcement Learning** (DRL) based solution to predict the uplink beamforming of Cell-Free networks by maximizing the achievable rate under inter-user interference and pilot contamination.
- Implemented a low-complexity **distributed version** of the DRL model to reduce the computational tasks of the central unit.
- Performed extensive (L1/PHY) simulations using **Python (Tensorflow/Keras, multiprocessing libraries)** and **Matlab** to assert the performance of the proposed DRL based algorithms and compared them with the state-of-the-art **signal processing** algorithms.
- Authored a full-length peer-reviewed IEEE Journal (TCCN 2022) paper.

Embedded Systems Intern June 2019 - August 2019
CodinTek *Ariana, Tunisia*

- Developed an end-to-end IoT solution for monitoring cattle behaviour in real-time for heat detection. Wrote codes in **Embedded C** on STM32 and **Python** on Raspberry Pi using Bluetooth low Energy and MQTT IoT protocols.
- Participated in debugger implementation by developing a CAN bus messages decoder of messages received from drones implemented on STM32 with **Embedded C** [Code].

EDUCATION

University of Manitoba January 2021 - August 2023
Master of Science - Electrical and Computer Engineering *Winnipeg, MB, Canada*
GPA: 4.13/4.5

Ecole Polytechnique de Tunisie September 2017 - June 2020
Multidisciplinary Engineering Degree *La Marsa, Tunis, Tunisia*
Graduation Mark: Excellent

Institut Préparatoire aux Etudes d'Ingénieurs de Tunis September 2015 - June 2017
Mathematics - Physics *Tunis, Tunisia*
Ranking in National Exam: 64 out of 1400

TECHNICAL & LANGUAGE SKILLS

- **Programming languages**: Python, C/C++, Matlab
- **Frameworks & Tools**: Tensorflow/Keras, Numpy, Scikit-Learn, MPI, OpenMP, Cuda, OpenCL, SQL, Git, Linux, VS Code, Eclipse, Latex
- **Computer Science**: Object Oriented, Linear Data Structures, Trees, Dynamic Programming
- **Languages**: Fluent English (IELTS 6.5/9), Fluent French (DELF B2); Native Arabic

PUBLICATIONS

IEE Journals/Conferences (Peer Reviewed, Submitted)

- **F. Fredj**, A. Feriani, A. Mezghani, E. Hossain "Channel Estimation in RIS-Enabled mmWave Wireless Systems: A Variational Inference Approach" *Submitted* to *IEEE Transactions on Wireless Communications* (2023).
- **F. Fredj**, A. Feriani, A. Mezghani, E. Hossain "Variational Inference-Based Channel Estimation for Reconfigurable Intelligent Surface-Aided Wireless Systems" *In-Press* in *IEEE International Conference on Communications* (2023).
- **F. Fredj**, Y. Al-Eryani, S. Maghsudi, M. Akrout, E. Hossain "Distributed Beamforming Techniques for Cell-Free Wireless Networks Using Deep Reinforcement Learning" *Published* in *IEEE Transactions on Cognitive Communications and Networking* (2022).

PROJECTS AND COMPETITIONS

- **In-Application Programming (IAP)**: Developed a new IAP driver for STM32 cards that upgrades wirelessly the Flash Memory via Bluetooth interface in **Embedded C** [**Code**].
- **Competitive Programming**: Participated in the competitive programming contest ACM ACPC 2019 as being among the top in the national contest ACM TCPC 2019 in **C++**.

SCHOLARSHIPS AND FELLOWSHIP

- Fellowship of graduate studies from NSERC (2021).
- Fellowship of research internship from NSERC (2020).
- Excellence scholarship from the Ecole Polytechnique de Tunisie (2017).

EXTRA-CURRICULAR ACTIVITIES SECTION

- Vice-President at American Chamber (AmCham) EPT Junior Chapter (2018-2019).
- Assisted in hosting NASA Space APPS Challenge 2018 event at Ecole Polytechnique de Tunisie, as sponsoring manager and logistic manager.
- Volunteer at Association des Jeunes Polytechniciens (AJP)
- **Interests**: Psychology, Finance, One Piece manga.