# Abdennour Ben Terki

## Summary

Experienced Research Engineer with over 3 years in Telecommunications and Electronics Engineering, specializing in Machine Learning applications for Optical Networks. Demonstrated expertise in implementing Deep Reinforcement Learning strategies, resulting in a 50% reduction in blocking probability and an 80% increase in network load capacity. Currently pursuing a Ph.D. in Emerging Digital Technologies, focusing on AI-assisted automation, telemetry and prediction and identification of soft failures in multiband optical networks. Awarded the prestigious Marie Skłodowska-Curie Action Fellowship for doctoral research. Seeking a Research Assistant position to leverage expertise in networking, machine learning, and cutting-edge research in telecommunication technologies, with a passion for developing innovative solutions for complex networking challenges.

### Skills

- Programming Languages: Python, MATLAB, Verilog
- Machine Learning: Reinforcement Learning (DRL & MARL), LSTM Neural Networks
- Optical Networking: GNPy, Routing & Spectrum Assignment Algorithms, Quantum QKD
- Telemetry Protocols: gNMI, SNMP, Telegraf
- Hardware: FPGA (Lattice iCE40), Arduino
- Antenna Design: Reflectarray Antennas, MIMO Systems, CST Microwave Studio
- Wireless Communications: 5G, Mobile Network Planning, Performance Analysis
- Tools & Platforms: Git, LaTeX, Linux, Open Air Interface, Yosys, nextpnr, apio

# Work Experience

### **Research Engineer Intern**

Apr 2024 - Oct 2024

Orange, France

- Designed and implemented a testbed using industry-standard optical engineering equipment
- Created streaming telemetry software for data collection using gNMI and SNMP protocols
- Performed extensive data processing and exploratory data analysis, including correlation analysis, feature importance analysis, and PCA
- Developed a three-stage ML algorithm using XGBoost and Random Forest classifiers for:
  - 1. Failure detection
  - 2. Severity assessment
  - 3. Failure localization
- Implemented time-based prediction capabilities for multiple time horizons
- Evaluated model performance using classification reports and confusion matrices

### **Research Engineer Intern**

Infinera, Portugal

- Implemented Deep Reinforcement Learning strategies for optical networks, reducing blocking probability by 50% and increasing network load capacity by 80%
- Implemented RL and DRL-based RSA strategies for multi-band optical networks, achieving 50% reduction in blocking probability and 80% increase in network load capacity
- Applied GNPy tool for GSNR calculations, taking into consideration the physical layer impairments non linearities such as SRS.

Electronics Engineering Technician

Meglab Electronique INC., Canada

Mar 2019 - Sep 2019

Jan 2023 - Apr 2024

- Planned and implemented complex underground mine network using wireless antennas, overcoming challenging environmental conditions, resulting in improved communication and safety measures
- Installed and maintained communication devices, reducing system downtime

#### **Research Lab Assistant**

Télébec Research Laboratory LRTCS, Canada

- Participated in a research study on body-to-body (B2B) communication channels in underground mining environments
- Assisted in conducting RF measurements using 2x2 MIMO antenna systems with circular and linear polarization at 2.4 GHz
- Performed data collection in a challenging underground gold mine environment, characterized by high humidity, low temperature, and dusty conditions
- Contributed to the experimental setup involving Vector Network Analyzer (VNA) measurements in the 2.3 GHz 2.5 GHz frequency band
- Helped execute line-of-sight (LOS) and non-line-of-sight (NLOS) measurement scenarios, involving precise positioning and movement of human subjects wearing miner attire

### Education

	Sant'Anna Scuola Superiore - Italy	Oct 2021 - Current
•	Early Stage Researcher in Machine Learning in Optical Networks	
•	Focus: Automation in multiband optical networks assisted by artificial	intelligence
	University of Quebec - Canada	Sep 2016 - Jul 2018
•	Master of Science in Telecommunications	
•	Thesis: Design of Reflectarray Antenna for 5G Applications	
	École Nationale Polytechnique - Algeria	Sep 2011 - Jul 2016
•	Bachelor Degree in Electronics Engineering	
	Theories Design and Simulation of Dielectric Resonator Antenna	

• Thesis: Design and Simulation of Dielectric Resonator Antenna

# **Key Projects**

# Development of an ML-based Optical Network Simulator (O Link)

- Developed an advanced optical network simulator that mimicked real-world network conditions
- Implemented Deep and Multi-Agent Reinforcement Learning for resource allocation
- Integrated Quantum QKD for secure communication modeling, enhancing network security
- 1:1 path protection to ensure continuous service in case of link failure
- Conducted detailed physical layer impairments integration of fibers and network equipment
- Developed comprehensive performance analysis and data visualization tools
- Designed flexible architecture supporting various network topologies and traffic patterns

### Cellular Network Planning and Performance Analysis (O Link)

- Calculated key network parameters including frequency reuse ratio, cluster size, and capacity
- Optimized network performance by analyzing blocking probability and trunking efficiency
- Improved cell capacity by 77% through implementation of 3-sector directional antennas
- Developed MATLAB script to visualize blocking probability for various traffic loads
- Achieved a spectral efficiency of 0.67 Erlang/MHz/km<sup>2</sup> while maintaining QoS requirements
- Demonstrated proficiency in radio resource management and cellular network planning

### Hands-on Experience with Lattice iCE40 FPGA Board (O Link)

Sep 2016 - Mar 2018

- Utilized open-source tools including Yosys, nextpnr, and apio for FPGA development
- Implemented basic combinational logic circuits using Verilog
- Designed a 4-bit counter with clock division capabilities
- Created Moore and Mealy finite state machines for sequential logic control

## Reflectarray Antenna Design and Simulation for 5G Applications (O Link)

- Conducted research on RA antennas for mm-wave applications in the 26-30 GHz range
- Developed and implemented a MATLAB program to automate the design process of RA antennas, significantly reducing design time and minimizing human error
- Integrated MATLAB code with CST simulator, creating a seamless design workflow
- Designed and simulated two RA antenna configurations(18x18 and 36x36 element array)

# Awards and Achievements

- Awarded the prestigious Marie Skłodowska-Curie Action (MSCA) Early-Stage Researcher Fellowship MENTOR, funded by the EU HORIZON 2020 program, for Ph.D. in Emerging Digital Technologies, Sant'Anna School of Advanced Studies, Pisa, Italy
- Recipient of a full tuition fee exemption scholarship for international students at the University of Quebec Canada, awarded by the Ministry of Education and Higher Education
- Awarded a 2-years full Master's scholarship from the Télébec Underground Communications Research Laboratory at University of Quebec - Canada

# Publications

- "Deep Reinforcement Learning for Resource Allocation in Multi-Band Optical Networks," International Conference on Optical Network Design and Modeling (ONDM), Spain, 2024.
- "Routing and Spectrum Assignment Based on RL in Multi-Band Optical Networks," International Conference on Photonics in Switching and Computing (PSC), Italy, 2023.
- "Routing and Spectrum Assignment Assisted by Reinforcement Learning in Multi-band Optical Networks," European Conf. on Optical Communication (ECOC), Switzerland, 2022.
- "Design of Compact UWB Coplanar Waveguide-Fed Modified Sierpinski Carpet Fractal Antenna," IEEE International Symposium on Antennas and Propagation (APS), USA, 2019.
- "Reflectarray Antenna Design Using Hexagonal Shape Unit Cells for 5G Application," IEEE International Symposium on Antennas and Propagation (APS), USA, 2018.

### Languages

English (Advanced), French (Advanced), Italian (Basic), Arabic (Native)