Fabrizio Carpi

⌂ New York, NY | 📱 +1 (347) 248-4142 | ✉ fabrizio.carpi@nyu.edu | 🌐 fabriziocarpi.github.io | in fabricarpi

Education

New York University
PhD in Electrical Engineering   Brooklyn, NY
                                                                                            Expected graduation: Summer 2024

- Advisors: Prof. Elza Erkip and Prof. Siddharth Garg.
- Research focus: communication and information theory, wireless communications, semantic/task-aware compression, applied AI/ML.

University of Parma
MS in Communication Engineering   Parma, Italy
                                                                                                                    10/2018

- Thesis: **Exploring Machine Learning Algorithms for Decoding Linear Block Codes**, in collaboration with Duke University.

BS in Information Engineering   *12/2015*

Industrial Experience

Samsung Research America — Standards and Mobility Innovation
Research Intern   Plano, TX
                                                                                                        06/2023 - 09/2023

- Project: **AI-based Pulse Shaping Design** (Python, Pytorch).
    - Implemented simulations and proposed ML-based optimization with custom loss function and domain-knowledge modeling.
    - Submitted one conference paper for publication and one patent.

Nokia Bell Labs — Radio Systems Research
Communication Systems Summer Intern   Murray Hill, NJ
                                                                                                        06/2022 - 08/2022

- Project: **Channel state information (CSI) feedback: a semantic communications perspective** (Python, Pytorch).
    - Developed autoencoder-based CSI feedback optimizing the tradeoff between system performance and feedback overhead.
    - Presented project updates to higher management and different divisions within the company.
    - Received the Outstanding Innovation Award within the global student program (top 7%) and presented a paper at ICC 2023 [C5].

Intel — Next Generation and Standards
Wireless Standards Research Intern   Remote, USA
                                                                                                        05/2021 - 08/2021

- Project: **AI-assisted channel state information (CSI) feedback for MIMO systems** (Python, Pytorch, MATLAB).
    - Implemented autoencoder-based simulations for beyond-5G use cases and generated channel data using MATLAB 5G toolbox.
    - Analyzed system performance and robustness in wireless scenarios specified by 3GPP models.
    - Evaluated performance-complexity tradeoffs based on neural network pruning and quantization.
    - Regularly presented progress to a broader audience and discussed areas of ML-wireless integration with the AI-related group.

Academic Experience

New York University — Tandon School of Engineering — NYU Wireless
Graduate Research Assistant   Brooklyn, NY
                                                                                                        09/2019 - Present

- Project: **Precoding-oriented CSI Feedback in Multi-Cell MIMO Systems** (Python, Pytorch).
    - Extended single-cell CSI feedback framework to multi-cell MIMO system for interference managment.
    - Considered several scenarios to understand fundamentals of different setups (e.g., ideal/limited backhaul).
- Project: **Task-aware compression with constrained nodes** (Python, Pytorch).
    - Investigated scalar quantization schemes for binary hypothesis testing.
    - Proposed a compressor scheme based on greedy optimization and analyzed rate-accuracy tradeoffs.
    - Presented a paper at IEEE SPAWC 2021 and IEEE CTW 2021 [C4] — received best student paper and best poster awards.
- Received the Dante Youla Award in recognition of research excellence and knowledge dissemination.

Teaching Assistant — ECE 2233, Introduction to Probability   *09/2020 - 12/2020*

- Lead exercise sessions, held office hours, and prepared video tutorials for students.
- Received the Chang Education Award in recognition of excellence in teaching activities for undergraduate students.

University of Parma — Internet of Things (IoT) Lab
Research Associate

Parma, Italy
11/2018 - 08/2019

- Project: **Mitigation of NLOS effects in indoor/outdoor localization** (MATLAB).
    - Developed methods to detect non-line-of-sight (NLoS) transmissions based on statistical features of the RSSI.
    - Investigated pre-processing of RSSI data in order to mitigate distance estimation errors due to NLOS conditions.
    - Analyzed performance improvement due to the "NLOS detection + pre-processing" in *agnostic* localization algorithms.
    - Published one conference paper [C2] and one journal paper [J1].

Duke University
Visiting Student for MS thesis

Durham, NC
03/2018 - 08/2018

- Project: **Optimization of LDPC decoding with supervised learning** (Python, Tensorflow).
    - Optimized belief propagation decoding with supervised learning using a simple parameterization based on weight sharing.
    - Investigated the impact of different loss functions and proposed a new loss for channel coding problems.
- Project: **Reinforcement learning for bit-flipping decoding** (Python, Tensorflow).
    - Proposed a new reinforcement learning-based approach for the decoding of linear block codes.
    - Developed a curriculum learning approach to accelerate convergence by modifying the exploration strategy.
- Published a conference paper at IEEE ISIT 2019 [C1] and presented a conference paper at Allerton 2019 [C3].

Awards

2023	**NSF Student Travel Grant**, Conference travel support for IEEE ICC 2023.
2022	**Outstanding Innovation Award**, Global Student Internship Program 2022 at Nokia.
2022	**Dante Youla Award**, Graduate Research Excellence in Electrical Engineering at NYU Tandon.
2021	**Best Student Paper Award (2nd place)**, IEEE Intl. Workshop on Signal Processing Advances in Wireless Comms (SPAWC).
2021	**Best Poster Award (1st place)**, IEEE Communication Theory Workshop (CTW).
2021	**Chang Education Award**, Excellence in Teaching Assistantship in the ECE department at NYU Tandon.

Skills

Languages: Italian (native), Portuguese (fluent).
Programming: Matlab (5+ years), Python (5+ years), Tensorflow (2 years), Pytorch (3+ years), Git, LaTeX.

Leadership

- **MyPhDMentor**, *Mentor* for junior PhD students, organized by the Italian Committee for the PhD Enhancement. — *06/2023 - Present*
- **ECE PhD Students Organization at NYU Tandon**, *Lead organizer* for peer-support and networking events. — *09/2021 - Present*
- **NYU Tandon Graduate Admissions**, *Ambassador* representing NYU graduate programs with prospective students. — *02/2020 - 05/2023*
- **Italian Scientists & Scholars in North America Foundation (ISSNAF)**, *Mentee* within the ISSNAF network. — *01/2022 - 12/2022*
- **LeadTheFuture**, *Mentee* within an Italian leading non-profit organization for people in STEM (acceptance <20%). — *09/2020 - 09/2021*

Publications 🎓

[C5] **F. Carpi**, S. Venkatesan, J. Du, H. Viswanathan, S. Garg, E. Erkip, *"Precoding-oriented Massive MIMO CSI Feedback Design,"* in Proc. IEEE ICC 2023.

[J1] **F. Carpi**, L. Davoli, M. Martalò, A. Cilfone, Y. Yu, Y. Wang, G. Ferrari, *"Experimental Analysis of RSSI-based Localization Algorithms with NLOS Pre-Mitigation for IoT Applications,"* Computer Networks, vol. 225, 2023.

[C4] **F. Carpi**, S. Garg, E. Erkip, *"Single-Shot Compression for Hypothesis Testing,"* in Proc. IEEE SPAWC 2021. Also presented as a poster at IEEE CTW 2021 and ITR3 @ ICML 2021.

[C3] **F. Carpi**, C. Häger, M. Martalò, R. Raheli, H. Pfister, *"Reinforcement Learning for Channel Coding: Learned Bit-Flipping Decoding,"* in Proc. Annual Allerton Conference on Communication, Control and Computing (ALLERTON) 2019.

[C2] **F. Carpi**, L. Davoli, M. Martalò, A. Cilfone, Y. Yu, Y. Wang, G. Ferrari, *"RSSI-based Methods for LOS/NLOS Channel Identification in Indoor Scenarios,"* in Proc. IEEE ISWCS 2019.

[C1] M. Lian, **F. Carpi**, C. Häger, H. D. Pfister, *"Learned Belief-Propagation Decoding with Simple Scaling and SNR Adaptation,"* in Proc. IEEE ISIT 2019.