Fabrizio Carpi

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Education

New York University — *Brooklyn, NY*
PhD in Electrical Engineering — *Expected graduation: Summer 2024*
- Advisors: Prof. Elza Erkip and Prof. Siddharth Garg.
- Research focus: communication and information theory, semantic communications, task-aware compression, applied machine learning.
- Courses: Machine Learning, Information Theory, Statistical Learning Theory, Digital Signal Processing, Mathematical Statistics.

Duke University — *Durham, NC*
Visiting Student for MS thesis — *03/2018 - 08/2018*
- Thesis title: "Exploring Machine Learning Algorithms for Decoding Linear Block Codes."
- 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.

University of Parma — *Parma, Italy*
MS in Communication Engineering — *10/2018*
BS in Information Engineering — *12/2015*

Experience

Samsung Research America — Standards and Mobility Innovation — *Plano, TX*
Research Intern — *06/2023 - 09/2023*
- Project: "AI-based Pulse Shaping Design" (python, pytorch).
  - Submitted one paper for publication and one patent.

Nokia Bell Labs — Radio Systems Research — *Murray Hill, NJ*
Communication Systems Summer Intern — *06/2022 - 08/2022*
- Project: "Channel state information (CSI) feedback: a semantic communications perspective" (Python, Pytorch).
  - Received the Outstanding Innovation Award after joining the best intern competition with the global student program (top 7%).
  - Developed proof of concept for autoencoder-based CSI feedback.
  - Presented project updates to higher managment and different divisions within the company.

Intel — Next Generation and Standards — *Remote*
Wireless Standards Research Intern — *05/2021 - 08/2021*
- Project: "AI-assisted channel state information (CSI) feedback for MIMO systems" (Python, Pytorch).
  - Implemented autoencoder-based simulations for beyond-5G use cases.
  - 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 borader audience and joined the AI-related group to discuss potential areas of ML-wireless integration.

New York University — Tandon School of Engineering — NYU Wireless — *Brooklyn, NY*
Graduate Research Assistant — *09/2019 - Present*
- 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.
  - Investigated performance of neural network-based solutions for end-to-end simulations.
- Project: "Efficient reinforcement learning for bit-flipping decoding" (Python, Tensorflow).
  - Developed a curriculum learning approach to accelerate convergence by modifying the exploration strategy.

Teaching Assistant — ECE 2233, Introduction to Probability — *09/2020 - 12/2020*
- Lead exercise sessions, held office hours, and prepared video tutorials for students.

University of Parma — Internet of Things (IoT) Lab *Parma, Italy*

Research Associate *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 received signal strength indicator (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.
  - Organized research meetings, collected WiFi and LTE measurements, implemented simulations, and drafted technical papers/reports.

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 International Workshop on Signal Processing Advances in Wireless Communications (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.

Leadership

- **Electrical and Computer Eng. PhD Students Organization (NYU Tandon)**, *Organizer* for peer-support and networking events. *09/2021 - Present*
- **NYU Tandon Graduate Admissions**, *Ambassador* representing NYU Tandon 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 the LTF network, an Italian leading non-profit organization for people in STEM (acceptance <20%). *09/2020 - 09/2021*

Publications

1. **F. Carpi**, S. Venkatesan, J. Du, H. Viswanathan, S. Garg, E. Erkip, *"Precoding-oriented Massive MIMO CSI Feedback Design,"* IEEE ICC 2023.
2. **F. Carpi**, S. Garg, E. Erkip, *"Single-Shot Compression for Hypothesis Testing,"* IEEE SPAWC 2021 + poster at IEEE CTW and ITR3 @ ICML.
3. **F. Carpi**, C. Häger, M. Martalò, R. Raheli, H. Pfister, *"Reinforcement Learning for Channel Coding: Learned Bit-Flipping Decoding,"* ALLERTON 2019.
4. M. Lian, **F. Carpi**, C. Häger, H. D. Pfister, *"Learned Belief-Propagation Decoding with Simple Scaling and SNR Adaptation,"* IEEE ISIT 2019.
5. **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.
6. **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,"* ISWCS 2019.