GTTI on-line workshop

Associazione
Gruppo
Telecomunicazioni
e Tecnologie
dell'Informazione

Wireless Intelligence:
From Reconfigurable Surfaces to Edge/Cloud Communications

Friday, 26 March 2021

Organizers: M. Martalò, R. Raheli

TECHNICAL PROGRAM

14:00-14:10 - Welcome and Introduction
Riccardo Raheli (Università di Parma), Marco Martalò (Università di Cagliari).

14:10-14:55 - Massive MIMO and mmWave (Chair: Riccardo Raheli)
Andrea De Jesus Torres (Università di Pisa), Near-Field Communications with Large Intelligent Surfaces
We introduce and analyze a new system model for Large Intelligent Surfaces that considers the geometric near-field effects. By working with single antenna users in a Line-of-Sight scenario, we aim to highlight the differences with the classical far-field model and to compare the MMSE and MR decoders performance.

Andrea Pizzo (Università di Pisa), Holographic MIMO Communications
The constant looking for more bandwidth drives the operating frequencies of future wireless communications towards the mmWave and sub-THz bands. Current channel models are inadequate as they rely on the electromagnetic far-field assumption, which breaks down at these frequencies. A perfectly physically-meaningful channel model valid in the near-field and with arbitrary scattering is what we can provide.

Carmen D'Andrea (Università di Cassino), Resource allocation in Cell-Free Massive MIMO Systems via Hungarian Algorithm
In this presentation two resource allocation problems in cell-free massive MIMO systems are solved via the Hungarian Algorithm: user-AP association and pilot assignment. The key idea, in both cases, is formulating resource allocation as a weighted matching problem where suitable objective functions are maximized with respect to (binary) assignment variables.

Giovanni Interdonato (Università di Cassino), Enhanced Normalized Conjugate Beamforming for Cell-Free Massive MIMO
In cell-free massive MIMO the fluctuations of the downlink channel gain are large due to the distributed system topology. Hence, decoding schemes treating the channel as deterministic perform inefficiently. We propose a precoding scheme that equalizes the channel gain enabling the users to reliably decode data relying on statistical CSI.

Alessio Fascista (Università del Salento), Enabling Joint Localization and Synchronization in mmWave Multiple-Input Single-Output (MISO) Systems via Reconfigurable Intelligent Surfaces
This presentation aims at showing how reconfigurable intelligent surfaces (RISs) can be fruitfully used in mmWave MISO systems to enable the joint task of localization and synchronization. Specifically, it focuses on the challenging scenario of single-antenna receivers and a single base station (BS), exploiting only downlink (one-way) transmissions.

Questions & Discussion.

14:55-15:35 - Terrestrial and Non-Terrestrial Networks (Chair: Marco Martalò)
Francesco Linsalata (Politecnico di Milano), QoS Performances- and Age- Aware Aerial and Terrestrial CAV Networks
CAVs will be disruptive application in B5G network. Their characteristic is the presence of advanced sensors and communications capabilities. The collected sensors data can be analysed by the network to increase PHY performances. We aim to show how the adaptation and control of PHY parameters can prevent the loss of QoS.

Marouan Mizmizi (Politecnico di Milano), Beamspace Learning for Fast Initial Access in 6G Vehicle-To-Everything Communications
Fast and efficient Initial Access (IA) is a prerequisite for beam-based 6G V2X communication. The proposed method addresses this challenge by learning the beams-map exploiting recurrent vehicle passages in a training phase. In run-time, the vehicles utilize the learned beams-map for IA, reducing the overhead and access delay.

Luca Lusvarghi (Università di Modena e Reggio Emilia), Machine Learning for the Dissemination of CAMs in C-V2X Communications
In this work, a novel Machine Learning (ML)-based method to distribute Cooperative Awareness Messages (CAMs) among vehicles is presented. According to it, each vehicle forecasts its futureCAM inter-arrival times and autonomously

selects radio resources. Simulation results show thatthe ML-based solution outperforms the legacy LTE-V2X Mode 4 in all respects.

Roberto Puddu *(Università di Cagliari), Self-Configurable IoT Satellite Gateway with QoS Traffic Management*
In many IoT applications, sensors and actuators are distributed over wide areas, sometimes not reached by terrestrial networks. In such scenarios, called Internet-of-Remote-Things, satellites can play a significant role. This work presents the implementation and test of an IoRT gateway, focusing on the self-configurability and on the QoS-based traffic management.
Questions & Discussion*.*

15:35-15:50 - COFFEE BREAK

15:50-16:30 - Deep Learning and Optimization (Chair: Riccardo Raheli)
Luciano Miuccio *(Università di Catania), Deep Learning based PRACH load estimation for future mMTC scenarios*
In massive IoT scenarios, the introduction of random access schemes based on the traffic estimation is crucial to avoid network collapse. So, the work proposes a DNN-aided traffic load estimation method based on BS's known information. This method is compared with schemes available in literature in terms of accuracy.
Fabio Saggese *(Università di Pisa), Deep Reinforcement Learning for URLLC data management on top of scheduled eMBB traffic*
The coexistence of different types of traffic is a relevant research issue for 5G and beyond networks. We discuss a deep reinforcement learning algorithm able to dynamically slice the available physical layer resources between URLLC and eMBB traffics.
Silvia Mura *(Politecnico di Milano), Distributed Relay Selection Game in 6G Vehicle To Vehicle Communication*
In highly dynamic beam-based communications, such as for 6G V2V, link blockage leads to performance degradation. An opportunistic relay selection procedure mitigates the link blockage and increases the communication coverage. Vehicles proactively concur for available relays' access and sharing by exploiting the network information and a distributed multi-buyer multi-seller game.
Ligia Maria Moreira Zorello *(Politecnico di Milano), 5G Radio Access Network: Traffic-aware Optimization of Baseband function placement*
A key concept of 5G RAN is the functional split, which improves network flexibility by placing baseband functions over network nodes. Their positioning is an optimization problem subject to the service and split constraints. We propose a machine-learning-aided optimization that computes the function placement based on the dynamic service traffic.
Questions & Discussion*.*

16:30-17:10 - Edge and Cloud Communications (Chair: Marco Martalò)
Sergio Martiradonna *(Politecnico di Bari), Edge Intelligence in Dynamic Radio Access Network Slicing for B5G Mission-Critical Services*
The combination of computing capabilities at the network edge and AI promise to turn future mobile networks into service- and radio-aware entities. In this context, this work presents a novel architecture using Deep Reinforcement Learning at the edge to address RAN Slicing and RRM optimization supporting latency-sensitive applications.
Arcangela Rago *(Politecnico di Bari), Enabling mobile edge intelligence through deep learning techniques*
Deep learning promises to really meet the mobile edge intelligence paradigm. This contribution describes a Multi-Task Learning model, running directly at the network edge, for jointly classifying and predicting mobile radio patterns and a Convolutional LSTM architecture to anticipatorily allocate communication and computational resources through users' mobility and requests predictions.
Giovanni Perin *(Università di Padova), Towards green edge computing through renewable energy resources and distributed control*
A major challenge in the transition from cloud to edge computing services concerns the management with low environmental impact of this architecture. Distributed and predictive optimization-based algorithms for job scheduling in edge systems co-powered by renewable sources are presented in this workshop, considering IoT and IoV scenarios.
Enrico Testi *(Università di Bologna), Blind Wireless Network Analytics*
The presentation focuses on the development of a tool for wireless network analytics in stealth mode by observing over-the-air spatial and temporal spectrum usage through radio-frequency sensors. Blind source separation is used to unmix the received signals, and a set of new machine learning-based approaches for network analysis are proposed.
Questions & Discussion*.*

17:10-17:55 - PANEL: Intelligent Wireless Networks Towards 2030 (Chairs: Riccardo Raheli, Marco Martalò)
Stefano Buzzi *(Università di Cassino),* ***Marco Chiani*** *(Università di Bologna),* ***Luca Sanguinetti*** *(Università di Pisa),* ***Umberto Spagnolini*** *(Politecnico di Milano).*

17:55-18:00 - Wrap-Up
Riccardo Leonardi *(Università di Brescia),* ***Maria Sabrina Greco*** *(Università di Pisa).*