Topic abstract:

In the last years, technological progress has enabled public safety operators to use very advanced devices, such as drones with high definition cameras, unnamed ground vehicles, and teleoperated robots, that require broadband communications. This is problematic since, nowadays, Public Safety Communication (PSC) is based on land mobile radio systems, which ensure the utilization of dedicated resources, but is specifically designed for voice transmissions. The scientific community has addressed this challenge by integrating PSC in the cellular networks, thus ensuring that emergency applications can experience the benefits of LTE and 5G technologies. The drawback is that commercial applications compete for the same resources exploited by emergency services, which may compromise the PSC reliability.

The network slicing paradigm can overcome these challenges by enabling the definition of multiple logical networks with dedicated resources over the same physical communication facilities. In case of a PSC scenario, applications with different priorities can be associated with different slices, each provided with specific features. Moreover, the slices supporting PSC can be instantiated only when their services are required (e.g., an emergency occurs), thus increasing the overall utility. At the same time, the management of PSC systems involves new challenges, including the variability of network resources, due to the inner volatility of wireless connectivity and the vulnerability of structural network elements to natural or anthropic disasters.

In this work, we designed a hierarchical learning architecture, where multiple agents cooperate to orchestrate network slices under different working conditions. Our hierarchical architecture will support PSC in a much more efficient way than conventional approaches, allowing the current telecommunication networks to assist emergency operators (e.g., firefighters, policemen, healthcare professionals) without the need for a dedicated infrastructure. Besides, our research will further investigate the potentials of hierarchical learning in the current and future telecommunication systems, as well as in other fields with similar implications, including autonomous driving, industrial automation, and healthcare.