

Master Internship/Stage de Fin d'Études 2023/2024

“Secure Integrated Sensing and Communication Systems”

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Location: The student will be working at the COMELEC Department of Telecom Paris.

Related Fields: Information theory, Detection theory, Communication theory, Security.

Project Description: Modern cellular communication systems evolve towards multi-functional environments, which represents also a key feature of future 6G standards [1]. At the core of this new paradigm is the dual-functionality of integrated sensing and communication (ISAC) which combines the two tasks into a single hardware, a single waveform, and common signal processing units. This evolution will not only allow to reduce hardware costs and improve energy efficiency and spectrum usage, but will also allow fruitful cross-fertilization between the two tasks. In fact, integrating sensing directly into the communication signal is an important step towards providing ubiquitous sensing, a key feature of important applications such as autonomous driving or automated manufacturing sites.

Significant progress in the development of ISAC systems has already been obtained in the fields of communication, signal processing, and information theory. In this project we shall consider the advanced scenario with security requirements against internal and external eavesdroppers [2]. In particular, our focus will be on ISAC systems where the sensing task is to detect a single parameter (for example the presence of an obstacle) [3] while the eavesdropper should not learn this same parameter. Our goal will be to design ISAC systems respecting these security constraints and even determine the fundamental performance limits of such security-constrained systems. In addition to security-constraints for the sensing parameters we will also analyze the impact of security constraints on the communicated messages.

Expected Skills: The candidate is expected to have good analytic skills and a solid background in probability and information theory. The project is of fundamental and theoretical nature, but also involves also a small part on programming.

References

- [1] W. Tong and P. E. Zhu, *6G: The Next Horizon: From Connected People and Things to Connected Intelligence*. Cambridge University Press, 2021.
- [2] M. Ahmadipour, M. Wigger, and S. Shamai, “Integrated communication and receiver sensing with security constraints on message and state,” in *2023 IEEE International Symposium on Information Theory (ISIT)*, 2023, pp. 2738–2743.
- [3] S. Faour, M. Hamad, M. Sarkiss, and M. Wigger, “Testing against independence with an eavesdropper,” in *2023 IEEE Information Theory Workshop (ITW)*, 2023, pp. 277–282.