

# Keynote Speaker I

## Prof. Olivier Rioul

Télécom Paris, Institut Polytechnique de Paris, France



Speech Time and venue: 09:10-09:55 | July 5, 2024 | Amphi V01

### *Information Lattices and Randomness Measures*

**Abstract:** Several lattice structures and corresponding entropic measures of information are presented for various purposes in computer science. First, based on the relatively unknown "lattice theory of information" of Shannon, where the lattice order is defined as a deterministic functional dependence, we present some preliminary considerations on the general problems of missing/complementary information and perfect reconstruction. These problems are solved for discrete variables with necessary and sufficient conditions, using Gács-Körner communication classes and geometric considerations based on Rajski's metric. Then, we extend the deterministic lattice structure using majorization theory which characterizes how the notion of randomness of any discrete random variable can be measured. This encompasses all known informational measures such as Shannon/Rényi entropies, guessing entropies, probability of error, etc. In another direction, when the deterministic functional relationships are randomized, we obtain the general definition of a communication channel (Markov kernel). In general, this is incompatible with the majorization lattice, except in the important case of a bistochastic (unital) channel which characterizes the majorization lattice order for both classical and quantum computation.

Olivier Rioul (<https://perso.telecom-paristech.fr/rioul/>) is full Professor at the Department of Communication and Electronics at Télécom Paris, Institut Polytechnique de Paris, France. He graduated from École Polytechnique and from École Nationale Supérieure des Télécommunications, Paris, France, where he obtained his PhD degree. His research interests are in applied mathematics and include various, sometimes unconventional, applications of information theory such as inequalities in statistics, hardware security, and experimental psychology. He has been teaching information theory and statistics at various universities for twenty years and has published a textbook which has become a classical French reference in the field.