Revisiting rationality in a world intoxicated by AI - the role of causality

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Abstract:
In the first part of this talk, I will retrospectively connect the dots of research I and my co-authors have conducted to propose a unifying view on fundamental questions of probability, decision theory, and quantum mechanics. The discussion will centre on the concept of self-consistency (coherence) in probability, initially reporting on its relation to logic, algebra, and efficient computation. This will lead to emphasise its temporal aspects in relation to Bayes' rule and the latter's relation to logic, passing through closely related questions of conglomerability and the sure thing principle. It will also highlight the basic equivalence with decision theory and social choice even in the general case of non-expected-utility theories. This will then lead to a natural follow-up in quantum mechanics, which is essentially probability under bounded rationality. In the second part of the talk, I will argue that the insight sketched above is still missing a fundamental element for a full understanding of how rationality operates in the world: causality. Both probability and causality are fundamental concepts, but their relationship and the unique capabilities of causality do not seem to be fully understood. Causality arises when the world is divided into subject (investigator) and object (problem of interest). Consequently, it plays a particularly important role in scientific applications, especially when the goal is to change the world rather than merely observe it and to imagine new worlds. As such, it is an important addition to the bag of probabilists, who have mostly been neglecting it for a long time - along with many others. I will provide perspectives for integrating the two concepts in a profitable and relatively straightforward manner. Most importantly, causality can also be read as a formalisation of the scientific method, which is something we seem to be in urgent need of adopting in the current context of widespread (Gen)AI intoxication.