

ABSTRACT

Probabilities: Studies in the Foundations of Bayesian Decision Theory

Yang Liu

One central issue in philosophy of probability concerns the interpretation of the very notion of probability. The fruitful tradition of modern Bayesian subjectivists seeks to ground the concept of probability in a normative theory of rational decision-making. The upshot is a representation theorem, by which the agent's preferences over actions are represented by derived subjective probabilities and utilities. As the development of Bayesian subjectivism becomes increasingly involved, the corresponding representation theorem has gained considerable complexity and has itself become a subject of philosophical scrutiny. This dissertation studies systematically various aspects of Bayesian decision theory, especially its foundational role in Bayesian subjective interpretation of probability. The first two chapters provide a detailed review of classical theories that are paradigmatic of such an approach with an emphasis on the works of Leonard J. Savage. As a technical interlude, Chapter III focuses on the additivity condition of the probabilities derived in Savage's theory of personal probability, where it is pointed out that Savage's arguments for not requiring probability measures derived in his system to be countably additive is inconclusive due to an oversight of set-theoretic details. Chapter IV treats the well-known problem of constant-acts in Savage's theory, where a simplification of the system is proposed which yields the representation theorem without the constant-act assumption. Chapter V addresses a series of issues in the epistemic foundations of game theory including the problem of asymmetry of viewpoints in multi-agent systems and that of self-prediction in a Bayesian setup. These issues are further analyzed in the context of epistemic games where a unification of different models that are based on different belief-representation structures is also proposed.