Fuzziness, logic and probability

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Fuzzy logic (in narrow sense) aims at providing formal logical grounds, usually in terms of truth-functional many-valued systems, to reason with notions that are inherently gradual, and hence admitting partial degrees of truth, in contradistinction with the two-valuedness of classical logic.

On the other hand, uncertainty refers to the lack of information which does not allow one to set whether a well defined (non fuzzy) event or proposition is true or not. Uncertainty is usually quantified (belief degrees), and Probability theory is certainly the most well-known formalism of quantified uncertainty, between those that aim at modelling reasoning under uncertainty. Such a research has had a remarkable influence also in the field of logic, indeed many logics which allow reasoning about probability have been proposed in the literature.

An alternative treatment, originally proposed by Hajek and colleagues, allows the axiomatization of uncertainty logics in the framework of fuzzy logic by clearly distinguishing truth and belief degrees. The basic idea is to consider, for each classical (two-valued) proposition A, a new (fuzzy) modal proposition PA which reads "A is probable" and take as truth-degree of PA the probability of A. This approach has been generalized to treat and reasoning with conditional probability in de De Finetti's sense, and it provides a logical reading of some important issues in Coletti and Scozzafava's setting of coherent conditional probability. The talk will survey all these aspects.