

Management of Uncertainty in Statistical Analysis: Problems and Perspectives

Renato COPPI

Dipartimento di Statistica, Probabilità e Statistiche Applicate
Università di Roma “La Sapienza”
P.le Aldo Moro, 5 – 00185 Rome, Italy
e-mail: renato.coppi@uniroma1.it

ABSTRACT

Uncertainty in Statistics may stem from different sources: randomness, imprecision, vagueness, partial or total ignorance, granularity of language, etc.

Classical Statistics has been developed by focusing on one of them, namely “randomness”, essentially concerned with stochasticity of empirical phenomena. Subjective probability has extended the scope of “probabilistic” Statistics to theoretical ingredients, such as parameters of a model, in principles by means of a coherent use of Bayesian reasoning, often in practice through a confusing utilization of intensive computational procedures in a “formal” Bayesian framework.

The theory of Fuzzy Sets and its developments in the domains of Logic, Mathematics, Cognitive Sciences and Technology, have provided the grounds for a reformulation of Statistical Methodology which may allow us to cope separately or simultaneously with the different sources of Uncertainty, at both the Empirical (observed data) and Theoretical (models, assumptions, etc.) levels.

In this talk, the above mentioned broader approach to Statistics is examined. The “Informational Paradigm” is briefly described as a way to conceptually account for the various statistical methods which have already been proposed and will possibly be developed within this perspective.

The case of Statistical Regression is taken as an example for illustrating the above considerations. Classical inferential approaches, as well as possibilistic and fuzzy least squares ones, are discussed, along with approaches based on the simultaneous management of randomness and imprecision/vagueness through the notion of “Fuzzy Random Variable”.