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Nota di contenuto	Contents; Preface; PART I Critical review and outline of the Bayesian alternative; 1 Uncertainty in physics and the usual methods of handling it; 1.1 Uncertainty in physics; 1.2 True value, error and uncertainty; 1.3 Sources of measurement uncertainty; 1.4 Usual handling of measurement uncertainties; 1.5 Probability of observables versus probability of 'true values'; 1.6 Probability of the causes; 1.7 Unsuitability of frequentistic confidence intervals; 1.8 Misunderstandings caused by the standard paradigm of hypothesis tests; 1.9 Statistical significance versus probability of hypotheses 2 A probabilistic theory of measurement uncertainty2.1 Where to restart from?; 2.2 Concepts of probability; 2.3 Subjective probability; 2.4 Learning from observations: the 'problem of induction'; 2.5 Beyond Popper's falsification scheme; 2.6 From the probability of the effects to the probability of the causes; 2.7 Bayes' theorem for uncertain quantities: derivation from a physicist's point of view; 2.8 Afraid of 'prejudices'? Logical necessity versus frequent practical irrelevance of the priors; 2.9 Recovering standard methods and short-cuts to Bayesian reasoning

2.10 Evaluation of measurement uncertainty: general scheme2.10.1 Direct measurement in the absence of systematic errors; 2.10.2 Indirect measurements; 2.10.3 Systematic errors; 2.10.4 Approximate methods; PART 2 A Bayesian primer; 3 Subjective probability and Bayes' theorem; 3.1 What is probability?; 3.2 Subjective definition of probability; 3.3 Rules of probability; 3.4 Subjective probability and 'objective' description of the physical world; 3.5 Conditional probability and Bayes' theorem; 3.5.1 Dependence of the probability on the state of information; 3.5.2 Conditional probability
3.5.3 Bayes' theorem3.5.4 'Conventional' use of Bayes' theorem; 3.6 Bayesian statistics: learning by experience; 3.7 Hypothesis 'test' (discrete case); 3.7.1 Variations over a problem to Newton; 3.8 Falsificationism and Bayesian statistics; 3.9 Probability versus decision; 3.10 Probability of hypotheses versus probability of observations; 3.11 Choice of the initial probabilities (discrete case); 3.11.1 General criteria; 3.11.2 Insufficient reason and Maximum Entropy; 3.12 Solution to some problems; 3.12.1 AIDS test; 3.12.2 Gold/silver ring problem; 3.12.3 Regular or double-head coin?
3.12.4 Which random generator is responsible for the observed number?3.13 Some further examples showing the crucial role of background knowledge; 4 Probability distributions (a concise reminder); 4.1 Discrete variables; 4.2 Continuous variables: probability and probability density function; 4.3 Distribution of several random variables; 4.4 Propagation of uncertainty; 4.5 Central limit theorem; 4.5.1 Terms and role; 4.5.2 Distribution of a sample average; 4.5.3 Normal approximation of the binomial and of the Poisson distribution; 4.5.4 Normal distribution of measurement errors; 4.5.5 Caution
4.6 Laws of large numbers

Sommario/riassunto

This book provides a multi-level introduction to Bayesian reasoning (as opposed to "conventional statistics") and its applications to data analysis. The basic ideas of this "new" approach to the quantification of uncertainty are presented using examples from research and everyday life. Applications covered include: parametric inference; combination of results; treatment of uncertainty due to systematic errors and background; comparison of hypotheses; unfolding of experimental distributions; upper/lower bounds in frontier-type measurements. Approximate methods for routine use are derived and ar