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Bayesian inference for measurements by counting

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Counting processes occur very often in several scientific and technological problems. The concept of numerousness and, consequently the counting of a number of items are at the base of many high-level measurements, in fields such as, for example, time and frequency, optics, ionizing radiations, microbiology and chemistry. Also, in conformity assessment and industrial quality control, as well as in everyday life, counting plays a fundamental role.
The occurrence of error in counting is real and needs to be addressed. It might occur, for example, that one fails in counting an object because of some reasons, such as human or instrumental errors. In such a case, the measurand, i.e., the number of items intended to be counted, is underestimated. On the other hand, one may count a non-existing object, hence obtaining an overestimate of the measurand.
In a previous paper [Metrologia 2012, 49 (1), 15-19], a general model for measurements by counting was proposed which allows an evaluation of the uncertainty compliant with the general framework of the "Guide to the expression of uncertainty in measurement"[JCGM 100:2008]. The present work considers the same scenario but facing the problem from a Bayesian point of view. In particular, we discuss in detail the (discrete) likelihood function of the counted objects and give the posterior probability mass function associated with the measurand for selected prior distributions.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

Bayesian inference, counting, uncertainty

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