Generalized Frequentist Methods for Particle Physics

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Abstract

Generalized frequentism was introduced in the early 1990’s to address problems that were not solvable using conventional frequentism. Such problems include the calculation of $p$ values and confidence intervals in the presence of nuisance parameters and/or when interest is focused on a complicated function of the parameters of the model under consideration. Although generalized frequentist methods are based on exact probability statements, they do not necessarily yield coverage in the conventional sense. However, simulation studies indicate that these methods tend to overcover, and often beat other available methods in terms of power and length of intervals.

We review the theory behind generalized frequentist methods, discuss their properties, and describe a recently developed procedure for constructing generalized $p$ values and confidence intervals. This procedure is then tested on Gaussian and Poisson problems typically encountered in high-energy physics.