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On the On-Off Problem: an Objective Bayesian Analysis

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The On-Off problem, aka. Li-Ma problem, is a statistical problem where a measured rate is the sum of two parts. The first is due to a signal and the second due to a background, both of which are unknown. Mostly frequentist solutions are being used, but they are only adequate for high count numbers. When the events are rare such an approximation is not good enough. Indeed, in high-energy astrophysics this is often the rule, rather than the exception.

I will present a universal objective Bayesian solution that depends only on the initial three parameters of the On/Off problem: the number of events in the on-source region, the number of events on the off-source region, and their ratio-of-exposure.

With a two-step approach it is possible to infer the signal's significance, strength, uncertainty or upper limit in a unified way. The approach is valid without restrictions for any count number including zero and may be widely applied in particle physics, cosmic-ray physics and high-energy astrophysics. I apply the method to gamma-ray burst data.

Collaboration

– not specified –

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