Compound Poisson Disorder Problems with Nonlinear Detection Delay Penalty Cost Functions

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Abstract. The quickest detection of the unknown and unobservable disorder time, when the arrival rate and mark distribution of a compound Poisson process suddenly changes, is formulated in a Bayesian setting, where the detection delay penalty is a general smooth function of the detection delay time. Under suitable conditions, the problem is shown to be equivalent to the optimal stopping of a finite-dimensional piecewise-deterministic strongly Markov sufficient statistic. The solution of the optimal stopping problem is described in detail for the compound Poisson disorder problem with polynomial detection delay penalty function of arbitrary but fixed degree. The results are illustrated for the case of the quadratic detection delay penalty function.

Keywords Bayesian sequential change detection; Compound Poisson disorder problem; Optimal stopping; Piecewise Deterministic Markov Processes.