Quickest Detection for a Poisson Process with a Phase-type Change-time Distribution

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We consider a change detection problem in which the arrival rate of a Poisson process changes suddenly at some unknown and unobservable disorder time. It is assumed that the prior distribution of the disorder time is known. The objective is to detect the disorder time with an online detection rule (a stopping time) in a way that balances the frequency of false alarm and detection delay. So far in the study of this problem, the prior distribution of the disorder time is taken to be exponential distribution for analytical tractability. Here, we will take the prior distribution to be a phase-type distribution, which is the distribution of the absorption time of a continuous time Markov chain with a discrete state space. We find an optimal stopping rule for this general case determine and give a numerical algorithm that calculates the parameters of ϵ-optimal strategies for any $\epsilon > 0$. We illustrate our findings on two examples.