UTEP Mathematical Sciences

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Quickest detection in the Wiener disorder problem with post-change drift uncertainty

We consider the problem of quickest detection of an abrupt change when there is uncertainty about the post-change distribution. In particular, we examine this problem in the continuous-time Wiener model where the drift of observations changes from zero to a random drift with a prescribed discrete distribution. We set up the problem as a stochastic optimization in which the objective is to minimize a measure of detection delay subject to a constraint on frequency of false alarms. We design a novel composite stopping rule and prove that it is asymptotically optimal of third order under a weighted Lorden criterion for detection delay. We also analyze the conditional identification error for the post-change drift asymptotically. Our composite rules are based on CUSUM stopping times, as well as their reaction periods, namely the times between the last reset of the CUSUM statistic process and the CUSUM alarm. The established results shed new light on the performance of CUSUM strategies under model uncertainty and offer new asymptotic optimality results in this setup.

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