World Academy of Science, Engineering and Technology
International Journal of Transport and Vehicle Engineering
Vol:18, No:07, 2024

Non-Parametric Changepoint Approximation for Road Devices

Authors : Loïc Warscotte, Jehan Boreux

Abstract : The scientific literature of changepoint detection is vast. Today, a lot of methods are available to detect abrupt changes or slight drift in a signal, based on CUSUM or EWMA charts, for example. However, these methods rely on strong assumptions, such as the stationarity of the stochastic underlying process, or even the independence and Gaussian distributed noise at each time. Recently, the breakthrough research on locally stationary processes widens the class of studied stochastic processes with almost no assumptions on the signals and the nature of the changepoint. Despite the accurate description of the mathematical aspects, this methodology quickly suffers from impractical time and space complexity concerning the signals with high-rate data collection, if the characteristics of the process are completely unknown. In this paper, we then addressed the problem of making this theory usable to our purpose, which is monitoring a high-speed weigh-in-motion system (HS-WIM) towards direct enforcement without supervision. To this end, we first compute bounded approximations of the initial detection theory. Secondly, these approximating bounds are empirically validated by generating many independent long-run stochastic processes. The abrupt changes and the drift are both tested. Finally, this relaxed methodology is tested on real signals coming from a HS-WIM device in Belgium, collected over several months.

Keywords : changepoint, weigh-in-motion, process, non-parametric
Conference Title : ICRTSTRS 2024 : International Conference on Road Traffic Safety, Transport and Road Statistics
Conference Location : Helsinki, Finland
Conference Dates : July 18-19, 2024