An Efficient Method for Online Steady State Identification in Multivariate Gaussian Processes

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Abstract

Most of existing steady state detection approaches are designed for univariate signals. For multivariate signals, the univariate approach is often applied to each process variable and the system is claimed to be steady once all signals are steady, which is computationally inefficient and also not accurate. We propose an efficient online method for multivariate steady state detection. It estimates the covariance matrices using two different approaches, namely, the mean-squared-deviation and mean-squared-successive-difference. To avoid the usage of a moving window, the process means and the two covariance matrices are calculated recursively through exponentially weighted moving average. A likelihood ratio test is developed to compare the difference of the two covariance matrices and to detect the steady state. The intensive numerical studies and real case study show that the proposed method can accurately detect the steady state of a multivariate system.

Keywords: Multivariate signal; steady state detection; exponentially weighted moving average; likelihood ratio test.