Two-stage data segmentation permitting multiscale change points, heavy tails and dependence

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Abstract

The segmentation of a time series into piecewise stationary segments is an important problem both in time series analysis and signal processing. In the presence of multiscale change points with both large jumps over short intervals and small jumps over long intervals, multiscale methods achieve good adaptivity but require a model selection step for removing false positives and duplicate estimators. We propose a localised application of the Schwarz criterion, which is applicable with any multiscale candidate generating procedure fulfilling mild assumptions, and establish its theoretical consistency in estimating the number and locations of multiple change points under general assumptions permitting heavy tails and dependence. In particular, combined with a MOSUM-based candidate generating procedure, it attains minimax rate optimality in both detection lower bound and localisation for i.i.d. sub-Gaussian errors. Overall competitiveness of the proposed methodology compared to existing methods is shown through its theoretical and numerical performance.

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