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DETECTING MULTIPLE CHANGE POINTS: THE PULSE CRITERION

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Abstract: Exhaustive search-based optimization algorithms can be computationally intensive and hypothesis testing-based procedures may encounter the false positive problem. To avoid these problems, we revisit change point detection of means and variances in a sequence of observations. We also propose a novel criterion, using a signal statistic to define a consistent estimation, even when the number of change points can go to infinity at a certain rate as the sample size goes to infinity. The signal statistic exhibits a useful "PULSE" pattern near change points, such that we can simultaneously identify all change points. The estimation consistency holds for the number of change points and for locations, in a certain sense. Furthermore, its visual nature means the locations can be more easily identified using plots than when using existing methods in the literature. The method can also detect weak signals in the sense that those changes go to zero. As a generic methodology, it may be extendable to handle other models. Numerical studies validate its good performance of the proposed method.

Key words and phrases: Double average ratios, multiple change-points detection, threshold, visualization.

1. Introduction

When there is a sequence of observations available, change point detection has attracted significant attention in a variety of research fields. For example Wu and Zhao (2007) detected mean changes in time series data for financial modeling, and Muggeo and Adelfio (2011) identified genes associated with diseases by applying a method of change point detection for means. There are a number of methods available in the literature; see, for example, Niu, Hao and Zhang (2016) for a comprehensive review.

Here, we focus on detecting mean changes, and as an adoption of the method, detecting variance changes. The following brief review stimulates us to consider a new way of investigating this issue, which has the potential to handle more

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