A weighted likelihood ratio test for change point analysis in time series

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\section{Abstract}

Homogeneity of parameters as well as structural stability are important aspects for time series data analysis. The common way to evaluate the structural stability is to test the model parameters for a possible change at an unknown time point, generally named as change point. It is an important problem in many scientific fields; such as, financial market analysis, quality control, medical researches, etc. It is not surprising that it has received great attention in the literature. Many test statistics including likelihood ratio (LR) based tests have been developed to detect unknown change points in the time series. The LR based test statistics may give unsatisfactory results on the change point detection and parameter estimations in the presence of unusual data points since such points have a great effect on the estimates obtained by the likelihood function. Using robust methods is a possible solution to deal with this problem.

In this study, we focus on the detection of change points in autoregressive of order $p$ (AR($p$)) models, and we restrict our attention on one change-point at an unknown time point. We propose a weighted likelihood based ratio test statistic to estimate the change point. The proposed test statistic is asymptotically equivalent to the conventional LR test under the null hypothesis of no change. The finite sample properties of the test statistic are illustrated by an extensive simulation study. Under considered scenarios, our proposed test statistic has better performance compared the conventional LR when there is a change in the model with possible outliers.