THE UNIVERSITY OF CHICAGO | DEPARTMENT OF STATISTICS

Master's Thesis Presentation

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"Evaluation of McScan for Change Point Detection in High-Dimensional Linear Regression with an Application to Macroeconomic Data"

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Abstract

McScan is a recently developed change point detection method for high-dimensional linear regression models. Unlike many existing approaches, it detects structural changes by scanning discrepancies in local covariance rather than relying on local estimation of regression coefficients, thereby offering both statistical and computational advantages. This thesis evaluates the reproducibility and robustness of McScan through a comparative analysis with three alternative methods: MOSEG, CHARCOAL, and DPDU. Under Gaussian errors, McScan achieves a favorable balance between localization accuracy and computational efficiency. In contrast, although DPDU often yields smaller localization errors, it does so at a substantially greater computational cost. For post-segmentation estimation of the differential parameters, the proposed estimators LOPE and CLOM generally outperform the naive estimator. Furthermore, in the construction of simultaneous confidence intervals for these parameters, the multiplier bootstrap tends to provide better coverage than direct sampling from the limiting distribution. We further extend the simulation study to heavy-tailed errors following standardized Student's t distributions. The relative performance of the competing methods remains broadly stable across these settings, and McScan continues to provide a favorable balance between localization accuracy and computational efficiency. Finally, we apply McScan to the FRED-MD macroeconomic dataset under two alternative model specifications. The detected change point locations are broadly stable across specifications, while the estimated differential parameters exhibit greater sensitivity to model choice.
