ACMS Statistics Seminar

Likai Chen
Washington University, St. Louis

Tuesday, October 25, 2022
101A Crowley Hall
3:30 PM – 4:30 PM

Change points detection for high dimensional time series via a two-way MOSUM

We propose a new inference method for multiple change-point detection in high-dimensional time series, targeting dense or spatially clustered signals. Specifically, we aggregate MOSUM (moving sum) statistics cross-sectionally by an l2-norm and maximize them over time. To account for breaks only occurring in a few clusters, we also introduce a novel Two-Way MOSUM statistic, aggregated within each cluster and maximized over clusters and time. Such an aggregation scheme substantially improves the performance of change-point inference. This study contributes to both theory and methodology. Theoretically, we develop an asymptotic theory concerning the limit distribution of an l2-aggregated statistic to test the existence of breaks. The core of our theory is to extend a high-dimensional Gaussian approximation theorem fitting to non-stationary, spatial-temporally dependent data generating processes. We provide consistency results of estimated break numbers, time stamps and sizes of breaks. Furthermore, our theory facilitates novel change-point detection algorithms involving a newly proposed Two-Way MOSUM statistics. We show that our test enjoys power enhancement in the presence of spatially clustered breaks. A simulation study presents favorable performance of our testing method for non-sparse signals. Two applications concerning equity returns and COVID-19 cases in the United States demonstrate the applicability of our proposed algorithms.