Theoretical Statistics and Mathematics Unit

Indian Statistical Institute

203 B.T. Road, Kolkata - 700108

Seminar for Thesis Proposal Defence

Date: July 17, 2026
Time: 12 Noon

VENUE:

L-Infinity, 5th Floor, A.N. Kolmogorov Bhavan, ISI Kolkata

SPEAKER:

Spandan Ghoshal

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TITLE:

Some Nonparametric Methods for Change-point Analysis of High-dimensional Data

ABSTRACT:

Modern data acquisition technologies routinely generate high-dimensional multivariate sequences in which the underlying distribution may change abruptly over time. Detecting the existence of such change-points and estimating their locations are fundamental problems in statistics with applications in many areas including finance, climate monitoring and genomics. However, many existing change-point detection methods are either not applicable or perform poorly when the data dimension is comparable to or exceeds the sequence length. This thesis develops several distance-based nonparametric methods for change-point detection that are suitable for high-dimensional data. The proposed methods include approaches based on averages of pairwise distances, graph-based techniques using the shortest Hamiltonian path, methods based on hierarchical clustering, and derangement-based constructions. Their asymptotic properties are investigated under both the classical fixed-dimensional framework, where the sample size tends to infinity, and high-dimensional regimes, where the dimension increases while the sequence length may remain fixed or also increase.

The proposed methodologies are primarily based on Euclidean distances. However, in high-dimensional settings, other suitable distance measures can often provide better performance, particularly when the changes occur beyond the first two moments of the underlying distributions. Furthermore, while almost all existing methods estimate the number of change points through repeated applications of two-sample tests, our change-point detection method based on hierarchical clustering consistently estimates the number of change-points without relying on any testing procedure, thereby substantially reducing the computational cost. Our theoretical findings are supported by simulation studies and analyses of real data sets, demonstrating the effectiveness and practical applicability of the proposed methods for high-dimensional change-point analysis.

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