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Multivariate Singular Spectrum Analysis by Robust Diagonalwise Low-Rank Approximation

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Multivariate Singular Spectrum Analysis (MSSA) is a nonparametric tool for time series analysis widely used across finance, healthcare, ecology, and engineering. Traditional MSSA depends on singular value decomposition that is highly susceptible to outliers. We introduce a robust version of MSSA, named *Robust Diagonalwise Estimation of SSA* (RODESSA), that is able to resist both cellwise and casewise outliers. The decomposition step of MSSA is replaced by a robust low-rank approximation of the trajectory matrix that takes its special structure into account. We devise a fast algorithm that decreases the objective function at each iteration. Additionally, an enhanced time series plot is introduced for better outlier visualization. Through extensive Monte Carlo simulations and a practical case study on temperature monitoring in railway vehicles, RODESSA demonstrates superior performance in handling outliers than competing approaches in the literature.

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Type of presentation

Talk

Classification

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Primary authors: Dr CENTOFANTI, Fabio (University of Naples Federico II); Prof. HUBERT, Mia (KU Leuven); Prof. PALUMBO, Biagio (Università di Napoli Federico II); Prof. ROUSSEEUW, Peter (KU Leuven)

Presenter: Dr CENTOFANTI, Fabio (University of Naples Federico II)

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