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Real-time Detection of Covariance Shifts in Multichannel Profiles

Modern industrial systems generate real-time multichannel profile data for process monitoring and fault diagnosis. While most methods focus on detecting process mean shifts, identifying changes in the covariance structure is equally important, as process behavior often depends on interdependence among multiple variables. However, monitoring covariance in multichannel profiles is exacerbated by the high dimensionality and unknown, possibly sparse, shift patterns.
We address these problems by leveraging functional graphical models to represent conditional dependencies among profiles and enable interpretable monitoring. The proposed approach combines penalized likelihood ratio tests with varying penalties to adapt to diverse covariance changes. A diagnostic procedure based on change-point detection then identifies which relationships have shifted. A simulation study and a real-world case involving temperature profile monitoring are carried out to demonstrate the method's effectiveness and practical applicability.

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Special/ Invited session

Young Statisticians

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Primary authors: LEPORE, Antonio (Università degli Studi di Napoli Federico II - Dept. of Industrial Engineering); Prof. PALUMBO, Biagio (Università di Napoli Federico II); CAPEZZA, Christian (Department of Industrial Engineering, University of Naples "Federico II"); FORCINA, Davide (University of Naples Federico II)

Presenter: FORCINA, Davide (University of Naples Federico II)

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