过程系统工程

独立元子空间算法及其在故障检测上的应用

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摘要

针对高维数据建模问题，提出一种独立元子空间算法（ICSM），作为一种新的集成学习算法，ICSM利用独立元在不同变量上的贡献度来选取子空间，符合了集成学习的要求，具备了明确的物理意义，有效地克服了随机子空间算法（RSM）的主要缺点。在此基础上，进一步将ICSM应用于工业过程监控，提出了一种新的 ICSM-PCA 故障检测算法。首先在各个子空间内分别建立相应的PCA监测模型，然后根据T^2和SPE统计量的值计算出集成时各自的权重，最后构造两个集成统计量对工业过程进行监测。通过在 Tennessee Eastman (TE) 模型上的仿真研究，说明提出的算法具有较好的建模效果和故障检测能力。

关键词

[集成学习](#)　[随机子空间方法](#)　[主元分析](#)　[故障检测](#)

分类号

Independent component subspace method and its application to fault detection

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Abstract

To handle the modeling problem for high-dimension data, the independent component subspace method (ICSM) was proposed.As a new ensemble learning method, ICSM could overcome the main drawback of the random subspace method.It constructed subspaces according to independent components (ICs) contributions on different process variables.As a result, the modeling requirement of the ensemble learning method was satisfied, and its physical meaning was also well presented.Moreover, a new fault detection method named ICSM-PCA was also developed.Firstly, PCA monitoring models were build on different subspaces, then the weighted value of each model was computed based on T^2 and SPE statistics.Finally，two ensemble statistics could be built for monitoring industrial processes.A case study of the Tennessee-Eastman (TE) process illustrated that the proposed method showed good modeling performance and exhibited satisfactory fault detection ability.

Key words

[ensemble learning](#)　[random subspace method](#)　[principal component analysis](#)　[fault detection](#)

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