

Title: Intelligent Optimization for Complex Data: Methods, Models and Applications in Industry

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Abstract

Industrial systems generate data in many different forms, including signals, images and process measurements. Such data can be noisy, non-stationary, high-dimensional, heterogeneous and incomplete. In many cases, the important information is hidden in the data and may be missed when conventional optimization methods are applied directly. This session brings together intelligent optimization methods with multiresolution and multiscale representations, including wavelet, curvelet and shearlet transforms, as complementary tools for handling complex and structured data before and during optimization. Wavelets provide useful time-frequency analysis for non-stationary signals, while curvelets and shearlets are effective in capturing directional and multiscale features in images and higher-dimensional data. Combined with evolutionary, metaheuristic, multi-objective, stochastic and robust optimization methods, these approaches can support feature extraction, denoising, dimensionality reduction and model development for complex data.

The session welcomes contributions on optimization algorithms for high-dimensional, noisy and structured data, wavelet/curvelet/shearlet-based feature extraction, hybrid transform-optimization methods, and their use in AI and machine learning. Both methodological and applied studies are encouraged, with applications in manufacturing, process monitoring, fault diagnosis, predictive maintenance, image-based quality inspection, renewable energy, intelligent transportation and infrastructure. The session aims to connect mathematical transforms and optimization methods with practical industrial problems involving complex data and decision-making.

Key Themes and Topics

- Intelligent Optimization Methods for High-Dimensional and Complex Data
- Wavelet Transform and Multiresolution Analysis
- Curvelet and Shearlet Transform Methods for Directional and Multiscale Data
- Fractional Calculus and Fractional-Order Optimization Models
- Evolutionary, Metaheuristic and Nature-Inspired Algorithms
- Multi-Objective, Stochastic and Robust Optimization
- Optimal Control and Dynamic Systems
- Feature Extraction, Dimensionality Reduction and Representation Learning
- Mathematical Foundations of AI and Machine Learning
- Fuzzy Systems and Computational Intelligence
- Signal and Image Processing for Complex and Noisy Data
- Graph Theory, Network Models and Complex Systems
- Applications in Industry, Healthcare, Finance, Renewable Energy, Manufacturing, Transportation, Infrastructure, etc.

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