

# Learning Process Models When Data Are Scarce: Transferable Knowledge for Process Monitoring and Optimization

Manabu Kano

*Kyoto University, Department of Informatics*

## ABSTRACT

Industrial process data analytics is fundamentally constrained by data scarcity. Process data are strongly dependent on operating regimes, product grades, control policies, equipment, and scale. These characteristics make it difficult to build reliable models for new plants, new products, abnormal conditions, or future operating regimes. This talk discusses emerging approaches for learning process models under such data-scarce conditions. Relevant sources of transferable knowledge include mechanistic models, laboratory experiments, previous products and plants, and pretrained time-series representations. I will discuss how such knowledge can be exploited

through grey-box or hybrid modeling, physics-informed machine learning, transfer learning, and time-series foundation models. The focus will be on these methodologies and their applications to industrial process monitoring and optimization. Particular attention will be paid to source selection and negative transfer.

© 2026 by the authors. Licensed to PSEcommunity.org and PSE Press. This is an open access article under the creative commons CC-BY-SA licensing terms. Credit must be given to creator and adaptations must be shared under the same terms. See <https://creativecommons.org/licenses/by-sa/4.0/>

