

Learning Theories and Methods with Application to Digitized Process Manufacturing

Theme: Learning theories and methods play a significant role in process manufacturing, discrete manufacturing and many other fields, and it is also vital to ensure digital transformation. Digitization of process manufacturing is the process of converting information and knowledge of process manufacturing into a digital format with digital technologies, which include many powerful theories/methods/algorithms/technologies, such as artificial intelligence (AI), Internet of things (IoT), block chain and digital twins. The life-cycle data converted from the information and knowledge in the whole manufacturing process can be used for learning and intelligent decision-making. With the development of digital economy, how to realize the transformation of process manufacturing towards digitalization and intelligentization via new learning theories/methods/algorithms has become a key step to smart manufacturing. Digital transformation refers to the use of learning theories and digital technologies to promote extension and optimization in industrial chain, supply chain and value chain, whose purpose is to promote efficient decision-making and agile operation, as well as to ensure the security and privacy of information. However, the current learning and operation mode of process industry is still at the traditional informatization level, which is far from the vision of digital transformation. Hence, there is an urgent need to develop digital concepts in process industry by means of learning theories/methods/algorithms. For example, the problem of “isolated data island” in process manufacturing via traditional information technologies is difficult to handle, and it is imperative to carry out fusion analysis, in-depth understanding, autonomous learning and intelligent optimization based on life-cycle data. At the same time, the privacy and security of information are also worthy of attention. Considering the characteristics of data fusion and intelligent decision-making of digital technologies, the information from the actual physical system and the virtual twin system in process manufacturing is integrated for intelligent decision-making and safe operation to improve the response flexibility. With the deepening of the digital transformation of the process manufacturing via new learning theories/methods/algorithms, panoramic management of manufacturing plants and refined production management of intelligent manufacturing can be realized.

The main focus of this Special Issue will be on the new learning theories/methods/algorithms with application to digitized process manufacturing. This Special Issue provides a platform to promote interdisciplinary research and to share the latest developments in related fields. Detailed topics include, but are not limited to, the following:

- Virtual process manufacturing based on digital twin method
- Construction of digital platform for life-cycle data collection and fusion
- Process manufacturing environment awareness methods based on multi-modal data
- Data-driven online learning algorithms in modeling, optimization and decision-making
- Comparative learning in modeling and monitoring through industrial metaverse
- Data-driven abnormal early warning theories and methods for digital production mode
- Human-computer interaction for process manufacturing
- Knowledge graph and visualization for process manufacturing
- Intelligent resource coordination and scheduling methods in digital economy
- Causal analysis and inference theories with life-cycle data
- Federated learning and distributed learning algorithms in process manufacturing
- Few-shot/Zero-shot learning algorithms in process manufacturing
- Generative adversarial learning in the digital process manufacturing
- Intelligent fault tracing and analysis methods under digital production
- Multi-agent reinforcement learning algorithms under uncertainties
- Applications to typical process industries

IMPORTANT DATES

- 31, March, 2023: Paper submission deadline.
- 30, June, 2023: Completion of first round of review.
- 30, November, 2023: Completion of final review.
- 31, December, 2023: Submission of final manuscripts.
- 31, March, 2024: Scheduled Publication.

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SUBMISSION INSTRUCTIONS

- Read the Information for Authors at <http://cis.ieee.org/tnnls>.
- Submit your manuscript at the TNNLS webpage (<http://mc.manuscriptcentral.com/tnnls>) and follow the submission procedure. Please, clearly indicate on the first page of the manuscript and in the cover letter that the manuscript is submitted to this special issue. Send an email to the leading editor Prof. Feng Qian and Prof. Yang Tang with subject “TNNLS special issue submission” to notify about your submission.
- Early submissions are welcome. We will start the review process as soon as we receive your contributions.