



Editorial: recent advances in process analytics

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Processes reflect the interplay of events, activities, data, and decisions that lead to a final outcome in business. They describe and control the temporal evolution of an information system's status in the conduction of work for organizations, thus pervading a vast area of their operations. Capturing, enhancing, and predicting the control flow, information exchange, and resource utilization in this context help to understand and expand the boundaries of process capabilities. Process mining and analytics pursue these objectives primarily with an evidence-based approach, through knowledge extraction, elaboration, and reasoning tasks on process data. The research area is multifaceted and includes the automated discovery of process models from event logs, the monitoring and prediction of running instances, conformance and compliance checking, and process enhancement. To this end, a plethora of techniques and methods are employed, ranging from automated reasoning to machine learning, from database theory to software engineering, and more (Dumas et al., 2023; van der Aalst and Carmona, 2022; Dumas et al., 2018). Advances in process analytics can contribute to the evolution of intelligent information systems with next-generation process-aware architectures, algorithms, and methods.

This Special Issue of the Journal of Intelligent Information Systems includes extended, revised versions of selected papers from four international workshops that took place in 2021, co-located with the top conferences in the area of process analytics: (i) Artificial Intelligence for Business Process Management (AI4BPM) and (ii) Declarative, Decision, and Hybrid approaches to Processes (DEC2H), at the International Conference on Business Process Management (BPM, Marrella and Weber 2022); (iii) Leveraging Machine Learning in Process Mining (ML4PM) and (iv) Process Querying, Manipulation, and Intelligence (PQMI), at the International Conference on Process Mining (ICPM, Munoz-Gama and Lu 2022). The invited papers were selected based on their quality, significance of results, and relevance to the themes both of the workshops and the journal. All papers went through an additional peer-review process. The featured articles are briefly summarized below.

In “*Multi-perspective enriched instance graphs for next activity prediction through graph neural network*”, Chiorrini et al. (2023) propose a novel technique based on Instance Graphs and Deep Graph Convolutional Neural Networks in the context of predictive process monitoring to forecast the next activity to be performed in a partial process run. To this end, it processes information by combining control-flow and data perspectives.

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In “*Can recurrent neural networks learn process model structure?*”, Peeperkorn, vanden Broucke, and De Weedt (2022) investigate in depth the suitability of Long Short-Term Memory Nets (LSTMs) for automated process discovery. Therefore, they design and apply a systematic evaluation strategy that measures the quality of the models extracted from event logs in terms of fitness, precision, and generalization.

In “*Performance-preserving event log sampling for predictive monitoring*”, Fani Sani et al. (2023) tackle the process instance selection problem with the aim of improving the sampling of input training data in the context of predictive process monitoring. They assess the effectiveness of their approach against the three key tasks of the next activity, remaining time, and outcome predictions.

In “*Applying MAPE-K control loops for adaptive workflow management in smart factories*”, Malburg et al. (2023) present an approach to autonomic, adaptive workflow management in a smart-factory scenario. To this extent, they build upon the architectural blueprint of MAPE-K (Monitor, Analyze, Plan, and Execute over a shared Knowledge) control loops resorting to Internet of Things, Semantic Web Services, Workflow Management Systems, and Complex Event Processing technologies.

In “*A natural language querying interface for process mining*”, Barbieri et al. (2022) present an architecture to support process analytics via questions expressed in natural language. Also, the authors devise a taxonomy of natural language queries for process mining, which they use to guide and assess their reference implementation combining Natural Language Processing techniques and existing process mining tools.

In “*Model-based decision support for knowledge-intensive processes*”, Seidel et al. (2022) challenge the management of long-term objectives in knowledge-intensive processes. Their solution builds upon the fragment-based case management modeling notation and first-order logic. It not only allows process actors to specify goals but also provides indications of whether their actions are in line with those goals or not.

The contributions to this Special Issue highlight the growing research interest in techniques that operate on multiple perspectives and span across different fields to advance the state of the art in process analytics. These articles illustrate the advantages of holistic approaches and pave the way for future endeavors in the area.

To conclude, we would like to thank all the authors for their efforts to prepare and revise their manuscripts, and the referees, who thoroughly reviewed the submissions and provided valuable suggestions for improvement. We also wish to express our gratitude to Prof. Zbigniew W. Ras, the Editor-in-Chief of the Journal of Intelligent Information Systems, and the editorial staff, for their availability and prompt assistance.

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