



Preface to the Special Issue on Artificial Intelligence for Business Process Management 2019

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We are at the beginning of a profound transformation of Business Process Management (BPM) due to advances in Artificial Intelligence (AI) and Machine Learning (ML). Indeed, the application of AI and ML is impacting many application domains where process management perspectives and techniques are relevant, including industrial engineering, IoT, and emergency response, to name a few. The use of AI and ML in BPM has been discussed as the next disruptive technology that will touch almost all the business process activities being performed by humans. In some cases, AI will dramatically simplify human interaction with processes. In other cases, it will extensively support humans in the execution of tasks, and, in yet other cases, it will enable full automation of tasks that have traditionally required manual contributions. Over time, AI may lead to entirely new paradigms for business processes and operations. For example, instead of BPM models centered on process or on case management, we anticipate models that are based fundamentally on goal achievement, as well as we anticipate models that fully enable continuous improvement and adaptation based on experiential learning.

This Special Issue on Artificial Intelligence for Business Process Management 2019 of the *Journal of Data Semantics* focuses on the interplay between BPM and AI. It includes the extended versions of five selected papers from the 3rd International Workshop on Artificial Intelligence for Business Process Management (AI4BPM 2019), which took place with the Business Process Management Conference (BPM) in September 2019, in Vienna, Austria. The invited papers were selected by taking into account the quality, significance and relevance of the results they present. All the papers went through an additional peer review process.

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The paper “*Execution of Knowledge-Intensive Processes by Utilizing Ontology-Based Reasoning*,” authored by Rietzke et al., investigates the ontology-driven integration of data-centric and semantic business process modeling in the context of knowledge-intensive processes. Specifically, the authors present the ODD-BP approach, which combines the process metamodel with domain-relevant knowledge and data about process definitions and situational facts of process instances. As a result, all knowledge that somehow influences a process execution is semantically integrated into one unified knowledge base. This enables to infer the executability of tasks and the relevance of process-elements utilizing OWL2 and SWRL rules. The feasibility of the approach is evaluated leveraging a case study in the field of emergency call centers.

The paper “*Resource Controllability of Business Processes Under Conditional Uncertainty*,” authored by Zavateri et al., proposes Conditional Constraint Networks with Decisions (CCNDs) as a model to encode business processes that involve access control and conditional branches that may be both controllable and uncontrollable. They define weak, strong and dynamic controllability of CCNDs as two-player games, classify their computational complexity, and discuss strategy synthesis algorithms. In addition, they introduce Zeta, a tool for checking controllability of CCNDs, synthesizing execution strategies, and executing controllable CCNDs, by also supporting user interactivity.

The paper “*Towards Automated Support of Complaint Handling Processes: An Application in the Medical Technology Industry*,” authored by Hake et al., examines a data set from a large manufacturer of medical products to study how to provide automated support to the complaint handling processes in medical technology companies. The authors identify the automation potentials in the 8D reference process for complaint management and discuss their organizational and technical challenges. In addition, the paper shows how partial process automation can be achieved in practice by designing, implementing, and evaluating a deep-learning-based prototype for automatically suggesting a likely error code for future complaints, given their textual description.

The evaluation performed demonstrates that the prototype is able to assign the correct error code for more than 75% of all cases, thus outperforming the classification approaches used as a baseline comparison.

The paper “*Specifying and Executing User Agents in an Environment of Reasoning and RESTful Systems using the Guard-Stage-Milestone Approach*,” authored by Käfer et al., investigates the use of the Guard-Stage-Milestone (GSM) approach for specifying and executing user agents. The authors present an ontology to specify user agents and provide operational semantics to the ontology in a rule language that allows for executing user agents on Read-Write Linked Data. The approach is evaluated from a formal perspective and regarding performance. The paper shows that, despite the different assumptions of this environment in contrast to the traditional environment of workflow management systems, the GSM approach can be successfully transferred and applied to Read-Write Linked Data

The paper “*AI-empowered Process Mining for Complex Application Scenarios: Survey and Discussion*,” authored by Pontieri et al., investigates how classical process mining tasks (i.e., discovery, conformance checking, enhancement, detection, prediction, and recommendation) have taken advantage of complementary AI capabilities (ranging from knowledge representation to machine learning and inference methods), while paying a special attention to the challenging case where the log data at hand are low-level, incomplete, and/or heterogeneous. Specifically, the authors have focused on two different broad families of approaches, which hinge upon two different strategies for improving the performance of a target process mining task: (i) taking account for user-driven background knowledge; (ii) pursuing one or multiple auxiliary learning/inference tasks jointly with the target one. A systematic literature review has been carried out to support the analysis. The literature review confirms that both kinds of strategies constitute a valuable means for improving the quality of the results that can be achieved on incomplete, low-level, and heterogeneous logs, and even for enabling some level of operational support for lowly-structured processes.

The contributions to this Special Issue clearly show the strong interest of both research and industry in the interconnections between AI and BPM. These contributions also encourage the development of new approaches supporting this synergy and the definition of novel research directions where BPM problems represent valuable application scenarios for AI solutions.

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Guest editors

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