algorithms

MDPI

Editorial

Special Issue on Process Mining and Emerging Applications

Antonella Guzzo †

Department of Computer Engineering, Modeling, Electronics, and Systems Engineering, University of Calabria, Arcavacata, 87036 Rende (CS), Italy; antonella.guzzo@unical.it
† Current address: Via Pietro Bucci, Building 44Z First Floor, 88036 Rende (CS), Italy.

1. Introduction

This article is the editorial of the "Process Mining and Emerging Applications" (https://www.mdpi.com/journal/algorithms/special_issues/processing_mining) Special Issue of the *Algorithms* journal.

Process mining is a research field aimed at developing algorithms and methodologies to extract useful knowledge from event data. The growing interest in this discipline is due to the increasing availability of data that provide detailed information on process executions and, at the same time, to the need of improving and supporting business processes in competitive and rapidly evolving contexts. Indeed, process mining allows companies (i) to critically and objectively understand the strengths and weaknesses of their processes; (ii) to develop performance management systems linked to the actual functioning of processes; and (iii) to address phenomena such as scarcity of resources, the evolution of standards, the spread of digital technologies, and growing competition on a global level. Process mining methods have been successfully applied to logs of business process execution recorded by transactional IT systems, with the ultimate goal of analyzing and improving organizational productivity along performance dimensions such as efficiency, quality, compliance, and risk. Moreover, such methods are being increasingly used—with an interdisciplinary perspective—in other application domains beyond those related to business processes, such as in the context of distributed ledger technologies (DLTs), robotic process automation (RPA), and the Internet of Things (IoT), to name just a few.

2. Special Issue

This Special Issue consists of five articles presenting novel approaches for process mining, which significantly contribute to the advancement of our knowledge in the field and open further avenues of research.

The first paper is entitled "Efficient Time and Space Representation of Uncertain Event Data" and is authored by Pegoraro et al. [1]. The work addresses the problem of analyzing event data containing uncertainty by introducing a new approach to efficiently calculate a graphical representation of the behavior contained in an uncertain process trace. The approach is studied from the theoretical viewpoint, and a number of optimizations are designed to improve its efficiency. Experiments on various uncertain event logs practically confirm its theoretical properties.

The second paper is entitled "Translating Workflow Nets to Process Trees: An Algorithmic Approach" and is authored by van Zelst and Leemans [2]. The authors deal with two important formalisms in process mining, namely process traces and workflow nets. In fact, while translating a process tree into a sound workflow net is trivial, the reverse is generally not possible. The work considers this task and presents an algorithm that detects whether a net corresponds to a process tree and, if so, constructs it. The algorithm is analyzed from the theoretical and the experimental viewpoints.

The third paper is entitled "Investigating Social Contextual Factors in Remaining-Time Predictive Process Monitoring—A Survival Analysis Approach" and is authored

Citation: Guzzo, A. Special Issue on Process Mining and Emerging Applications. *Algorithms* **2021**, *14*, 13. https://doi.org/10.3390/a14010013

Received: 4 January 2021
Accepted: 5 January 2021
Published: 5 January 2021

by Ogunbiyi et al. [3]. The work investigates the impact of social contextual features in the predictive process monitoring framework utilizing a survival analysis approach. In particular, it proposes an approach to censor an event log and to predict the remaining time of an in-flight process instance by using the survival function to estimate the throughput time for each trace, which is then used with the elapsed time to predict the remaining time for the trace. The proposed approach is benchmarked against existing approaches using five real-life event logs.

The fourth paper is authored by Tarik et al. and is entitled "Understanding Contrail Business Processes through Hierarchical Clustering: A Multi-Stage Framework" [4]. The authors propose a multi-stage hierarchical framework for business-logic-driven clustering of highly variable process logs. According to their approach, the raw event log is initially decomposed into high-level business classes; later, feature engineering is performed exclusively based on the business-context features to support the discovery of meaningful business clusters. A case study of a CRM process of one of the UK's renowned telecommunication firms is also presented.

Finally, the fifth paper in this Special Issue is authored by Elkhawaga et al. and is entitled "CONDA-PM—A Systematic Review and Framework for Concept Drift Analysis in Process Mining" [5]. The work focuses on analyzing scenarios presenting a concept drift, that is, the evolution of the business process over time. Concept drift analysis is, indeed, crucial to enable early detection and management of changes, namely, whether to promote a change to become part of an improved process or to reject the change and make decisions to mitigate its effects. Within this context, the authors propose a framework describing phases and requirements of a concept drift analysis approach, and they apply it to the approaches that have been proposed in the literature.

Funding: This research received no external funding.

Acknowledgments: The Guest Editor would like to thank all the authors for their articles in this Special Issue. She would like to thank all the reviewers, who have carried out thorough review work that was also appreciated by the authors themselves. She thanks Alina Chen and the staff of the *Algorithms* Editorial Office for their support. As an open access journal, *Algorithms* publishes quickly, which is a boon to the rapid dissemination of innovative research, which you will find in this Special Issue.

Conflicts of Interest: The Guest Editor declares no conflict of interest.

References

1. Pegoraro, M.; Uysal, M.S.; van der Aalst, W.M. Efficient Time and Space Representation of Uncertain Event Data. *Algorithms* **2020**, *13*, 285. [CrossRef]
2. van Zelst, S.J. Translating Workflow Nets to Process Trees: An Algorithmic Approach. *arXiv* **2020**, arXiv:2004.08213.
3. Ogunbiyi, N.; Basukoski, A.; Chaussalet, T. Investigating Social Contextual Factors in Remaining-Time Predictive Process Monitoring—A Survival Analysis Approach. *Algorithms* **2020**, *13*, 267. [CrossRef]
4. Tariq, Z.; Khan, N.; Charles, D.; McClean, S.; McChesney, I.; Taylor, P. Understanding Contrail Business Processes through Hierarchical Clustering: A Multi-Stage Framework. *Algorithms* **2020**, *13*, 244. [CrossRef]
5. Elkhawaga, G.; Abuelkheir, M.; Barakat, S.I.; Riad, A.M.; Reichert, M. CONDA-PM—A Systematic Review and Framework for Concept Drift Analysis in Process Mining. *Algorithms* **2020**, *13*, 161. [CrossRef]