Comparing comparative process mining methods: towards a research agenda

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Comparing processes is a fundamental analytical task for organizations seeking to understand variation, performance differences, and opportunities for improvement. In domains such as healthcare, such comparisons are particularly relevant, for example when contrasting care pathways of different patient groups, examining how process execution differs over time periods, or benchmarking similar processes across hospitals or care networks. Process mining offers a data-driven foundation to support these types of comparisons by systematically analyzing event data that capture how processes are actually executed. Within the broader field of process mining, comparative process mining has been recognized as a distinct type of analysis, aimed at identifying differences and commonalities between process executions across variants, cohorts, or contexts [1].

Recent studies have highlighted several shortcomings in current comparative process mining methods. Firstly, existing techniques often narrowly focus on syntactic or control-flow aspects, neglecting perspectives such as probabilistic behavior, timing, or resource utilization [7]. Secondly, the definitions of what constitutes a relevant difference remain largely ad hoc, with little theoretical grounding. Finally, visualization techniques frequently fail to accommodate the complexity and multi-dimensionality of comparative findings [6].

The lack of standardization and methodological maturity in the field affects both theoretical progress and applicability. While methods such as log delta analysis enable verbalizing behavioral differences in natural language [3], they remain limited in scope and offer minimal support for multi-perspective or large-scale comparative settings. Likewise, recent methods that incorporate stochastic or statistical perspectives show potential, but they typically focus on localized or aggregate behavioral statistics, offering limited integration with an explicit process model that captures the global structure and relationships between process fragments [7].

To draw up a research agenda for comparative process mining, we propose

to review and compare existing comparative process mining methods. Over the past decade, a diverse set of methods has been developed to compare processes, often driven by specific analytical goals or application contexts. While these studies have demonstrated the potential of comparative process mining, they also reveal a fragmented methodological landscape, in which assumptions, comparison targets, and supported perspectives differ substantially across methods [2, 3, 5, 7, 6]. Limitations related to scope, interpretability, and perspective integration are frequently acknowledged in an ad hoc manner, but a systematic analysis that consolidates these insights across methods is still lacking. Given the growing relevance of comparative analysis within process mining, a structured comparison of existing methods is therefore needed to clarify their respective strengths and limitations and to create a research agenda for the further development of the field.

The need for improved support for comparative process mining is particularly evident in application domains where process comparison is a recurring analytical task, such as healthcare. In this context, process mining studies routinely compare care pathways across patient groups, time periods, or healthcare organizations, highlighting both the value of comparative insights and the practical difficulties of performing such analyses in a consistent and interpretable way with current methods [4]. By systematically analyzing existing comparative process mining methods, this work aims to contribute a clearer foundation that can better support process mining users and guide future advances in methods.

References

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