

Chapter 13

Epilogue



To conclude this book, we first summarize the reasons why conformance checking is an important field on its own. Then we report on the different aspects of conformance checking, and how they have been introduced through the book. Finally, we illustrate challenges that can be tackled by the research community and industry to ensure that the widespread application of conformance checking is possible.

Conformance Checking Without doubt, aligning recorded and modelled behaviour is a key enabler for understanding how the processes in an organization work in reality. By looking at the reality from the model's perspective, several insights can be obtained and through continuous monitoring using conformance checking techniques, improved processes can be attained. Last, but not least, through conformance checking, operational processes can automatically be monitored for compliance to regulations and alignment with business goals.

Description of the Book In Part I of the book, the reader is introduced to the field of conformance checking. First, important factors that contextualize the field are considered, as well as the positioning of conformance checking with respect to other disciplines. Also the spectrum and setting of the field is described.

Using intuitive explanations and with the help of a running example, the main inputs of conformance checking techniques are described: event logs and process models. Quality dimensions are then informally introduced, for having an informal understanding on metrics that evaluate the relation between recorded and modelled behaviour. Finally, a qualitative analysis is presented that considers three complementary ways of relating recorded and modelled behaviour: rule checking, token replay and alignments.

Part II of the book is devoted to providing an algorithmic insight to the core techniques for conformance checking. Preliminaries as well as formal definitions of the main elements are introduced. Then we show an in-depth algorithmic description of the state-of-the-art technique for computing so-called *alignments*, which provide

a mathematical foundation to the conformance checking techniques presented in this book. The discussion on variations in the algorithmic and heuristic approaches may trigger future research on improving the computation of alignments, which to date is the lion's share of conformance checking and its most challenging problem.

In Part II, we also reflect on important concerns related to alignments, such as the non-uniqueness of optimal alignments and properties that quality metrics computed on top of alignments should adhere to. Finally, we broaden the scope of alignment-based conformance checking by reporting on variations of the main technique, so that it can be applied for different purposes. We, for example, show how to include the data and resource perspective in conformance checking and we show how conformance checking can be performed in an online setting or in scenarios where the process descriptions are not Petri nets. Also, an alternative for computing alignments using so-called event structures is described.

Part III is focused on applications of conformance checking. It starts by illustrating that conformance artefacts are not the end of the story, but instead enable further analyses to reflect on the process beyond control flow. Among them, we highlight performance analysis and decision point analysis as prominent examples. We also discuss the generalizing ability of process models. Furthermore, we show that conformance checking opens the door to repairing either process models or event logs, so that the representations are modified to better represent the underlying process. We stress the importance of trust in both the log and the model in this section.

Finally we turn our focus to software support for conformance checking, by describing an open-source initiative that contains most of the techniques described in this book. On a more general setting, we then list requisites on the functionality that any software for conformance checking should have in order to satisfy important requirements for its successful application.

Challenges in Conformance Checking Although conformance checking is a well-established field, the maturity of the different techniques varies significantly. One example is the metrics available: Whilst fitness or even precision are considered well evaluated through current metrics, accurate generalization metrics that additionally can be evaluated efficiently are yet to come.

Alignments are a central pillar of current techniques for conformance checking, as has been illustrated through this book. However, the complexity requirements of the state-of-the-art techniques hamper their application for large instances. Alternative approaches, like the decomposition or structural techniques presented in Part II of this book, only alleviate the problem, at the expense of losing the guarantee of important properties like optimality. Also, when incorporating other dimensions like data or resources, so that multi-perspective conformance checking is enabled, the complexity of the problem increases significantly, making it difficult to be applied for real-life problems. We envision new contributions also for multi-perspective conformance checking in the near future that can overcome this limitation. A similar situation is observed with online techniques for conformance checking.

With remarkable exceptions, the industry uptake of conformance checking has been limited so far. This holds both for developing commercial software that incorporates conformance checking features, and for applying conformance checking practices into the daily activities of organizations. Clearly, the former enables the latter, i.e., if more tools were made available for organizations, conformance checking would be applied more often.

In brief, in order to have a population of commercial software for conformance checking, more research should be conducted, so that the important computational challenges are overcome. In spite of the aforementioned limited industry uptake, there exist few tools in the market with conformance checking features. In general, the available tool support for conformance checking mostly applies simple techniques, so that the software can provide results in reasonable time.

The future for conformance checking is ahead us; are you willing to join?