Abstract PhD Thesis Felix Mannhardt

This thesis is about process mining: the analysis of an organization's processes by using process execution data. During the handling of a case or process instance data about the execution of activities is recorded in databases. We use such process execution data to gain insights about the real execution of processes.

In this thesis, we address research challenges in which a multi-perspective view on processes is needed and that look beyond the control-flow perspective, which defines the sequence of activities of a process. We consider problems in which multiple interacting process perspectives --- in particular control-flow, data, resources, time, and functions --- are considered together. We propose five multi-perspective process mining methods that deal with the interaction of multiple process perspectives:

- A conformance checking method that balances the importance of multiple perspectives to provide an alignment between recorded event data and a process model. The method provides reliable diagnostics and quality measures with respect to all perspectives of the process model

- A precision measure for multi-perspective process models with regard to an event log. The precision of a process model is determined as the fraction of the behavior possible according to the model in relation to what has actually been observed in the event log.

- A process discovery method that uses domain knowledge on the functional perspective of a process to improve the result of existing discovery methods. The domain knowledge is expressed as a set of multi-perspective activity patterns and a mapping between low-level events and instantiations of the activity patterns is computed. By grouping low-level events to instances of recognizable activities on a higher abstraction level the understanding of automatically discovered process models by stakeholders is facilitated.

- A process discovery method that uses the data perspective of a process to distinguish certain infrequent paths from random noise. The method discovers infrequent paths that can be characterized by rules by employing classification techniques. The data perspective is used to improve the discovered control-flow: Data- and control-flow are learned together.

- A decision mining method for discovering, potentially, overlapping decision rules. In contrast to existing methods for the same data values more than one alternative activity may be activated at a decision point.

All methods have been implemented, systematically evaluated, and applied in real-life situations in the context of four case studies.