Do you want to apply cutting-edge process-mining techniques to your SAP data? Contact us!

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Process mining provides a range of proven techniques to improve the performance and compliance of business processes. The Process and Data Science (PADS) group led by the "Godfather of process mining", prof.dr. Wil van der Aalst, is one of the leading research groups in the field and business process management and machine learning. The group focuses on process mining and has developed cutting-edge techniques and software tools. The group works closely with industrial partners. Since extracting event data from information systems is limiting the application of process mining, the PADS group would like to conduct more projects applying process mining to SAP data. Therefore, we are looking for partnerships with organizations running SAP. We can offer our process expertise and a range of process mining tools. From our industrial partners, we expect the willingness to provide data and to contribute real-life SAP experiences. We can do the programming needed to extract data from SAP and have developed tools to support this. However, to test our ideas and tools, we need access to running SAP installations of organizations that want to improve operational processes using process mining. We welcome both organizations that have experiences with commercial process mining tools and want a "second opinion" and organizations that are new to the topic of process mining.

1 Motivation and Goal

Process mining has provided a wide variety of techniques that extract actionable insights from the execution data recorded by information systems [1]. These techniques have been applied to various domains, including healthcare, manufacturing, and logistics. Process Mining enables

practitioners to gain valuable process-related knowledge on the performance and compliance problems and improve the process based on the knowledge.

Currently, there are over 35 commercial process mining tools available. These have lowered the threshold to apply process mining technology. Many organizations have reported successful case studies in which process mining techniques have reduced operational costs significantly and increased customer satisfaction.

Despite the tremendous improvement in the accessibility to process mining, barriers need to be overcome to achieve the seamless adoption of the process mining technology in practice. One of these barriers is the extraction of event data from systems such as SAP. Numerous case studies show that the adoption of process mining using SAP data can provide dramatic process improvements. However, the extraction of event data still requires domain expertise and is time-consuming for new processes. Moreover, commercial tools typically do not provide state-of-the-art process discovery and conformance checking techniques.

As a leading process mining research group, we aim to facilitate the extraction of event data from SAP and lower the threshold to apply the cutting-edge process mining techniques we developed. Therefore, we are looking for industry partners using ERP systems (preferably SAP) that would like to start or extend process mining techniques to their ERP systems. **If you have a running SAP system and would like to reduce or remove operational friction, this is an ideal chance to deploy the process mining technology in your organization successfully**. This can be in the form of a Master project, a quick scan, or a research project.

If your organization is new to process mining projects, we can help you to get started and get the knowledge and experience needed to make investment decisions. If your organization has conducted process mining projects, we can help reach the next level and address data extraction and interpreting process mining results. In both cases, we expect the willingness to provide data and bring in SAP expertise and process-mining-related questions.

What is process mining? This section is for organizations that are new to process mining. Process mining bridges the gap between traditional model-based process analysis (e.g., simulation and other business process management techniques) and data-driven analysis techniques such as machine learning and data mining. This technology has become available only recently but is mature enough to be applied to processes of any type and of any complexity. The spectrum of process mining techniques includes process discovery, conformance checking, bottleneck analysis, predictions, and recommendations. The uptake of process mining is reflected by the growing number of commercial process mining tools available today. Over 35 commercial products support process mining (Celonis, Disco, Mehrwerk Process Mining, UiPath, ABBYY Timeline, Signavio, Minit, myInvenio, QPR, Lana, PAFnow, etc.). Also, many organizations (including Siemens, Uber, BMW, etc.) have adopted process mining to achieve transparency in their business processes and remove operations friction.

Who are we? The Process and Data Science Group (PADS), headed by prof.dr. Wil van der Aalst, is one of the research units in the Department of Computer Science at RWTH Aachen University. PADS's scope includes all activities where discrete processes are analyzed, re-engineered, and/or supported in a data-driven manner. PADS's main research focus is on process mining (including process discovery, conformance checking, performance analysis, predictive analytics, operational support, and process improvement). It is reasonable to say that PADS is the leading research group in the field of process mining with over 20 process mining experts. Most of the commercial tools are based on ideas and techniques first developed by prof.dr. Wil van der Aalst and his team. Inside PADS, we have created an SAP-centered process

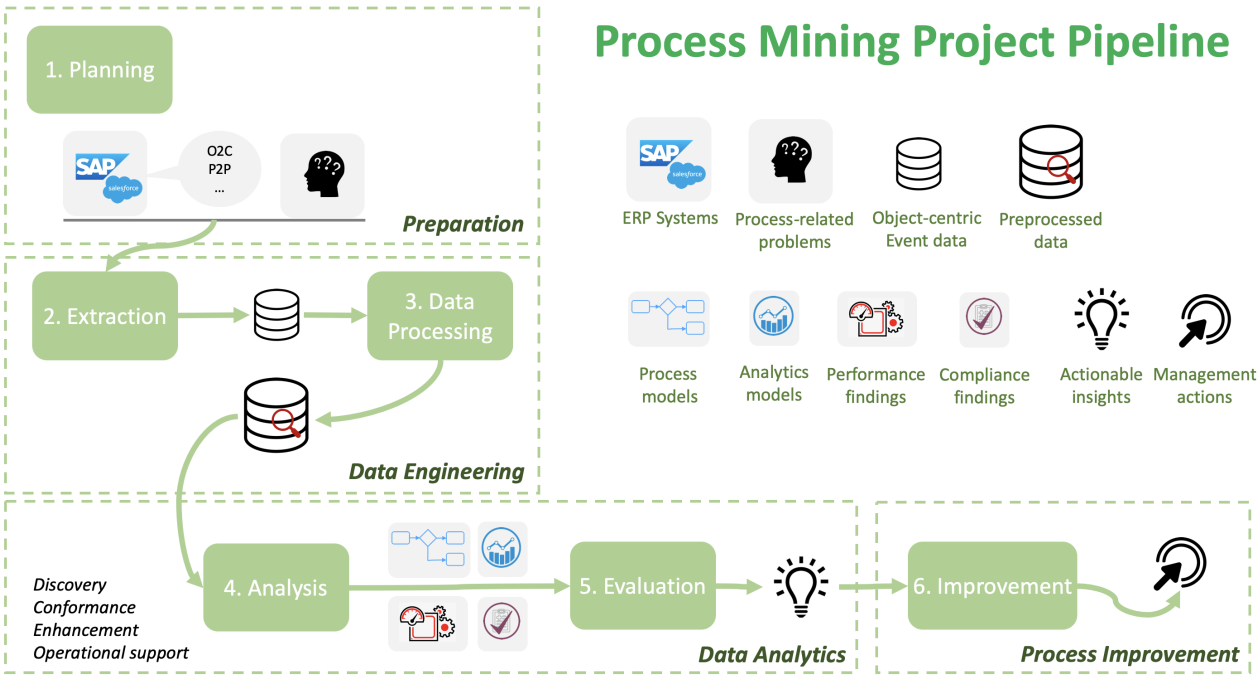

Figure 1: *A process mining project pipeline*

mining working group. Our main goal is to facilitate the successful application of process mining techniques from ERP systems with many tables and different entities (especially the SAP ERP system).

2 Process Mining Project Pipeline & Our Offers

Process mining is most effective if it is used daily for multiple processes. Organizations successfully applying process mining (e.g., Siemens, BMW, Lufthansa, Uber, and Zalando) have reached a scale allowing them to save millions of Euros [3]. To realize such large-scale adoption of process mining in your organization, the first step is to launch several process mining projects and acquire experience.

The process mining discipline provides several project methodologies aiming at supporting process mining projects. For instance, the L* life-cycle model [1] and the Process Mining Project Methodology (PM^2) [2] provide clear guidance to practitioners on how they proceed process mining projects which aim to improve process performance and compliance to rules and regulations.

Figure 1 shows a process mining project pipeline that guides the organization that seeks to apply process mining based on ERP systems data. We will explain the pipeline in detail in the following, emphasizing the challenges in each stage and our offerings to deal with them under the objective of better adopting the technology.

1. Planning This stage is to set up the project and determine the research questions that need to be answered at the end of the project in a way that improves the process performance.

Challenges

- It is difficult to determine the scope of a process mining project since ERP systems support multiple business processes in an organization. For example, the SAP ERP system supports business processes such as operations (e.g., sales and distribution, material management, etc.), financials (e.g., financial accounting, management accounting, etc.), human capital management (e.g., training, payroll, etc.).
- Moreover, since each process has different characteristics, it is challenging to define well-posed process-related problems relevant to the process. This process requires both comprehensive domain knowledge and an in-depth understanding of both the data science and process science aspects essential to assess the feasibility of process mining projects.

Our offerings

- Providing relevant case studies that may work as benchmarks for the project.
- Providing guidelines for defining the problems handled by projects based on the taxonomy of process-related problems.
- Providing consultancy of whether the feasible solution exists for the defined problems.

2. Extraction This stage aims to extract event data from information systems that will provide insights into the defined problems.

Challenges

- Process mining techniques require event logs that describe who did what activity at which time to derive data-driven insights. Extracting process-centric data (i.e., event logs) from ERP systems is challenging since the ERP systems store the records of process executions in a data-centric manner. The extraction process includes identifying relevant tables in the database, merging them based on the relationship, and making manual queries to extract events. It requires not only process knowledge but also in-depth awareness of data requirements for process mining.
- Moreover, traditional approaches for the extraction is not properly working since they assume a single case notion (e.g., patient, manufacturing product, etc.) in the event log. In ERP systems, multiple objects are intertwined, making it difficult to assume a single case notion. For example, in the O2C process of the SAP ERP system, multiple objects (e.g., order, invoice, delivery, shipment, etc.) coexist.

Our offerings

- Extracting high-level events of the standard SAP processes in an automated manner.
- Supporting the semi-automated extraction of fine-grained events.
- Extracting object-centric event logs that overcome the limitations of traditional event logs.

3. Data Preprocessing This stage is to prepare the event data so that the following mining and analysis techniques can produce optimal results.

Challenges

- Simply applying process mining tools to raw event logs does not guarantee to extract useful insights. Under the fact that 80 percent of data analysis efforts are devoted to preprocess data, one of the most demanding steps in process mining projects is to apply appropriate process-aware preprocessing methods in raw event data.
- This preprocessing phase is more challenging in ERP systems since many records in the systems are generated by human actions. This makes the recorded data error-prone (e.g., missing data, incorrect data, imprecise data, etc.) Moreover, multiple objects in ERP systems require advanced preprocessing methods that consider the interaction among different objects, making it difficult to apply traditional case filtering approaches.

Our offerings

- Providing requirements for appropriate processing of event data.
- Providing recommendations of preprocessing methods fitting to the characteristics of process mining techniques on demand.
- Providing supports for the development of new preprocessing techniques for necessary adaptations.

4. Mining and Analysis This stage is to apply process mining techniques to the preprocessed event data and get insights into the processes which answer the research questions.

Challenges

- The process mining discipline has provided a broad collection of techniques, including process discovery, conformance checking, enhancement, operational support, etc. It is challenging to figure out which techniques are suitable for providing the optimal results that will be interpreted into the insightful knowledge relevant to solving the process-related problems.
- Moreover, each technique has been further developed into different branches to meet the different requirements of various business processes. Since each organization and process has unique environmental contexts and inherent nature, it is difficult to determine which branch of the technique will be most suitable for the investigation process.
- Often, organizations need new approaches that serve their limited conditions and fulfill the particular necessity. Sometimes, it can be done by engineering the event data or applying minor modifications in the algorithms. More frequently, the development of novel algorithms is required.

Our offerings

- Recommending candidate techniques fitting to the needs.
- Suggesting most suitable branches of process mining techniques and proper ways of adaptations.
- Supporting the development of new algorithms.

5. Evaluation In this stage, the previous stage's findings are validated by the domain experts and interpreted to identify possible action points.

Challenges

- This is a key phase in any process mining project since we need to refine the previous stages depending on the validation results. Thus, active discussions among stakeholders are necessary with comprehensive domain knowledge and a thorough understanding of the techniques. Lacking either of them will result in the wrong interpretation.
- Likewise, a good interpretation requires domain knowledge and a detailed understanding of limitations in the process mining techniques at usage. Since the project results' interpretations determine the next follow-up actions, possible pitfalls and limitations should be discussed along the way.

Our offerings

- Providing background information for the validation and further refinement suggestions.
- Helping the interpretation by provisioning limitations of used techniques.

6. Improvement This stage transforms actionable insights into actual management actions that support the process to improve performance and compliance.

Challenges

- Businesses may have available management actions that can be used for process improvement. However, it is non-trivial to uncover the possible options and which of them are effective measures for process improvement.
- Those management actions are not limited to the process redesign or the business process reengineering, which requires fundamental changes in the underlying process. Actions at the operational level, such as changing routing rules, suspending process instances, etc., will enable the continuous improvement of operational processes. However, it is challenging to connect the process mining diagnostics to the operational actions.

Our offerings

- Providing guidelines which help to determine effective process improvement actions available in the organization.
- Implementing the framework of action-oriented process mining.
- Evaluating the effects of management actions using our automation engine for ERP systems.

3 How can we collaborate?

If you have running SAP systems in your organization and recognize the necessity to improve the supported processes, we are eager to collaborate to improve your organization's processes and further enhance process mining's applicability to the practice. We are open to various formats of collaboration. Please feel free to propose a format that fits the needs of your organization best.

- Master projects (projects of 6 months, where an experienced Master student is developing and applying process mining techniques using your data and driven by your questions).

- Quick scans (a professional analysis of your data by an experienced process mining expert).
- Joint research projects (longer-term collaborations involving PhDs and larger consortia).
- Software development projects (embedding novel process mining techniques in your information systems).

Independent of the format chosen for the collaboration, we expect that you can provide SAP and questions. Note that this requires a time investment of the organization. In return, the organization gets access to state-of-the-art process mining expertise and software.

Interested? Contact us! If you are interested in discussing the various options, please contact us. Please send an email to sap@pads.rwth-aachen.de describing the type of collaboration you seek.

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