Topics for seminar on process analysis (CS 719 & SM 457, HWS 2021)
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The following topics are suggested for the literature study you shall conduct. The questions after each topic are included to provide a bit more information of what the topic entails and can serve as inspiration for the research question that you will aim to answer in your literature study.

**Develop your own:** You are also free to propose your own topic by looking at publications at key venues such as the international conferences on Business Process Management (BPM), Advanced Information Systems Engineering (CAiSE), and Process Mining (ICPM), as well as journals such as Information Systems and Decision Support Systems. Topics can relate to research areas such as business process management, process mining, process analysis, stream processing, and robotic process automation.

**Business process management:**

1. **Business process redesign.** As an essential phase in the BPM lifecycle, business process redesign entails significant economic value by introducing innovation, reducing costs, as well as improving quality, productivity, and customer experience. However, identifying and using redesign opportunities properly is notoriously difficult. To support this task, a variety of automated and non-automated methods have been proposed. What is the state-of-the-art in process design and redesign? What are their capabilities, limitations, and potentials for future research?

2. **Business process architectures.** Business process architecture can be defined as an organized overview of business processes with their relations and guidelines that determine how they must be organized. There are a number of approaches to design a business process architecture including techniques that can automatically discover a business process architecture from repositories of event logs or process models. What approaches for business process architecture design exist and how they can be classified?

3. **Resource allocation.** Proper resource allocation is a key issue in providing efficient usage of resources in business process execution. Choosing the “right” resource allocation strategy is not a simple task. Many solutions from different fields have been proposed to solve this problem during the past decade. What techniques exist in process mining for optimal resource reallocation?

4. **Business process resilience.** The consequences of the new normal brought on by the COVID-19 pandemic highlight the importance of process resilience as a key dimension in BPM for organizations that yearn for stability in light of uncertain circumstances. With resilience, we here refer to a process’ ability to react to and recover from interruptions or changes. How is resilience in business processes commonly measured and assessed?
5. **Chatbots for business process management.** Chatbots are becoming increasingly popular, due to their ability to automate customer interactions and to elicit user input to complement automated analyses. As such, chatbots can play various roles in the BPM lifecycle, ranging from the (partial) automation of business processes, to support for the elicitation of process requirements. Which opportunities have been explored and are still open in this regard?

6. **Identifying process automation and RPA opportunities.** Automating parts of a business process, through RPA or otherwise, can provide considerable efficiency gains. However, given the sheer size and complexity of operations in organizations, it may be hard to determine on which processes or parts thereof an organization should (first) target its optimization efforts. Which techniques have been developed that support the automated identification of such automation opportunities in business processes?

**Process mining:**

7. **Object-centric process mining.** Traditional process mining requires that each process instance can be captured in a flat representation, assuming that all events in a process instance have a one-to-one relation to each other, e.g., one offer per loan application. Object-centric process mining tries to move away from this assumption by allowing for the representation of one-to-many and many-to-many inter-relations. What process mining methods and analysis techniques currently exist for this paradigm?

8. **Learning rules from event data.** Event data is often multi-perspective, it includes information about executed activities (control flow perspective), the time of their execution (time perspective), the resource that executed them (resource perspective), and many other relevant data attributes (data perspective). Therefore, the detection of temporal rules, e.g., which activities are executed in which order, and dependencies between different attributes is crucial to obtain a comprehensive understanding of how processes are truly executed. What process mining techniques exist that can learn rules or patterns contained in event data?

9. **Mixed granularity in event data.** Event data serves as the basis for data-driven process analysis. Often, this data is recorded at different granularity levels. This can lead to misleading process models after applying automated process discovery approaches. What techniques exist to unify the granularity level of event logs and/or process models?

10. **Autoencoders for business processes.** An autoencoder is an unsupervised learning technique that learns efficient representations for a set of data using artificial neural networks. This technique showed to be useful in solving some fundamental process mining tasks, e.g., dimensionality reduction, concept drift detection, anomaly detection, etc. How do autoencoders work and how existing applications in process mining can be systemized?

11. **Explainable predictions in process monitoring.** Predictive process monitoring has received widespread attention in recent years. However, in order for users to trust and react properly
to predictions made about the future of a process instance, it is important that predictions are not just accurate, but can also be understood by users. What approaches have been proposed for explainability in predictive process monitoring and are there further opportunities provided by developments in, e.g., the area of explainable AI?

12. **Privacy-aware process mining.** Process mining techniques use event logs as input, which record data about the execution of organizational processes. These event logs often contain sensitive information about individuals involved in the execution of a process, which means that publishing the logs themselves can lead to ethical and legal violations of an individual’s privacy. To overcome this, various techniques and approaches have been proposed for privacy-aware process mining. Which use cases do they tackle and which challenges exist here?

13. **Sample-based process mining.** With the increasing availability of event data, the scalability of process mining techniques, such as process discovery and conformance checking, can become a performance bottleneck when applied on large event logs. Therefore, various approaches have been proposed that strive to obtain high-quality process mining results by using only a sample of the available event data, rather than the full log. Which use cases do these approaches tackle and how do they work?

Stream processing:

14. **Stream-based process mining.** Traditionally, process mining is done in a post-hoc manner using event logs that capture process executions over a certain timespan. Recently process mining on event streams has received an increasing amount of attention. What are the challenges and techniques when considering event data in the form of streams rather than event logs, e.g., when aiming at the discovery of process models?

15. **Online pre-processing of event data.** Recently, the notion of online process mining received an increasing amount of attention, whereby techniques are applied on ongoing event streams rather than post-hoc, on event logs. However, these techniques assume the input stream to be free of noise and other data quality issues, which is often not realistic. Which techniques exist to pre-process event streams for process mining in real-time and which techniques for offline pre-processing could be adapted or moved to an online setting?

16. **Complex event processing and process analysis.** Complex Event Processing (CEP) analyzes streams of low-level event data to recognize important patterns, for instance, specific sensor measurements that follow each other within a certain period. How can concepts from CEP be employed in the context of business process analysis?