AI-Assisted Business Process Monitoring

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Abstract. Business process monitoring involves tracking and analyzing operational business processes to gain insights into their performance, identify bottlenecks, and facilitate that they are running efficiently This tutorial introduces the participants into how modern AI methods can be employed to realize predictive as well as prescriptive business processes monitoring. Where predictive monitoring helps to answer "what will happen and when?" prescriptive monitoring allows answering "when to intervene and how?" Together, these monitoring approaches assist process managers and operators in deciding on when and how to intervene during an ongoing business process in order to prevent or mitigate the occurrence of an undesired process outcome.

This tutorial introduces the participants to advanced deep learning methods for business process monitoring: deep supervised learning for predictive monitoring, and deep reinforcement learning for prescriptive monitoring. The tutorial positions these deep learning methods within the overall framework of business process monitoring systems and explains how deep learning helps to address key challenges.

It presents empirical results on the effectiveness and cost savings of these deep learning methods, which are distilled into a set of recommendations for selecting appropriate deep learning methods in practice. Finally, the tutorial provides an outlook on future directions in AI-assisted business process monitoring, particularly elaborating the opportunities introduced by large language models (LLMs) and the need for explainable AI (XAI).

1 Content Outline

This tutorial is concerned with predictive and prescriptive business process monitoring [1, 2], introducing how advanced AI solutions can facilitate effective and cost-efficient BPM. It thereby addresses the dedicated topic of AI-*Driven Predictive BPM* [1] and is organized around our previous work on predictive [3. 6] and prescriptive [4, 5] monitoring. It follows the below structure:

Part 1: Background and Motivation

– Foundations

- BPM concepts, including events, cases, and event logs
- AI basics, including supervised learning and reinforcement learning

  - *Note: Level of detail will depend on audience's background*

– Process monitoring basics
  - Essential concepts of *predictive* process monitoring
  - Essential concepts of *prescriptive* process monitoring
  - Positioning within business process monitoring systems

– Process monitoring challenges and existing solutions

Part 2: Deep Supervised Learning for Predictive Monitoring

– Deep learning models for process prediction
– Encoding process data as input for prediction models
– Ensemble learning to assess prediction reliability

Part 3: Deep Reinforcement Learning for Prescriptive Monitoring

– Deep RL
– Artificial curiosity
– Formulating rewards

Part 4: Practical Recommendations and Outlook

– Empirical results
– Recommendations for selecting actual monitoring solutions in practice
– Future directions, including how to leverage LLMs for AI-assisted BPM and explainable AI for BPM.

2 Target Audience

– **Participants:** Practitioners, researchers/academics, and students.
– **Level of Tutorial:** Advanced; participants should have some knowledge on business process monitoring and management; knowledge of AI is not required, the basic concepts will be introduced during the tutorial.

3 Teaching Methods

The following main methods are employed to engage participants:

– **Think-Pair-Share to facilitate Active Learning:** Participants are asked to discuss questions related to real-world scenarios or problems throughout the tutorial and share their results with the audience via online polls.

  These polls are facilitated by the student interaction tool Pingo (https://trypingo.com/).
– **Adaptive Learning:** Based on the actual participants' background (determined using an online poll at the beginning of the tutorial), time and detail of the different topics is adapted (e.g., if needed, more time on foundations vs. if possible, more time on technical details is spent).

- **Chunking to Break the Monotony:**The tutorial is divided into four main, ca. 15 minute, parts (see above) with breaks for active discussions between the segments.
- **Examples and Case Studies:** To illustrate the application of AI methods, real-world examples and case snippets are presented.

4 Presenter Bio

Andreas is professor of software engineering in the faculty of computer science of the University of Duisburg-Essen (https://adaptive-systems.org/) and a chair of paluno, The Ruhr Institute for Software Technology (https://paluno.uni-due.de/en). Andreas' research is centered around the engineering of adaptive systems. His current research explores the use of AI for engineering adaptive systems, focusing both on adaptive software and adaptive business processes.

Andreas is active in European computer science bodies. In particular, he was Vice-Chairman of the Steering Committee of the European Technology Platform NESSI (The Networked European Software and Services Initiative), Deputy Secretary General of the BDVA (Big Data Value Association), and External Advisor in the Architecture Committee of AI4Europe (the EU AI On-Demand Platform). Andreas has acquired and co-led over 10 EU-funded research projects, including FIspace (Future Internet Collaboration in Agri-Food and Transport), RestAssured (Secure Data Processing in the Cloud), FInest (Future Internet enabled Optimization of Transport Networks) and TransformingTransport (Big Data Value in Mobility and Logistics).

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