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Big Data Analytics

[Summary 4/4]

Introduction
Nowadays, Predictive Process Monitoring (PPM) studies mainly focus on underlying architectures. They rely on Deep Learning techniques such as Long Short-Term Memory (LSTM) and neural networks, leveraging data logs to enhance the monitoring process[1].

PPM and the use of external information
PPM optimizes business processes by focusing on process outcomes, completing tasks, and predicting events. The article aims to determine whether or not PPM can use data from external information such as digital documents. Promising results have already been observed:

- A group of researchers managed to improve LSTM model prediction quality by incorporating context information. They leveraged Hidden Markov Models (HMM) to determine the outcomes of sequences.
- A second group of researchers successfully improved the accuracy of PPM predictions and lowered the error rate regarding time completion. To do so, they used both structured and unstructured data from external sources.

Overall, digital documents offer an additional data stream that can be leveraged to enhance Business Process Management.

PPM and the use of textual data
In digital transformation[2], predictive business process monitoring operates with process mining techniques, Machine Learning, control flow of perspective event data, and additional data.
On one hand, Process mining techniques use historical data to analyze and improve processes. On the other hand, Predictive monitoring uses recorded information of complete process instances and real-time data to identify and prevent potential issues.
The main objective is to identify the influence of textual information on predictive monitoring. Researchers tried different approaches to leverage textual data. First, the "white-box" approach is a set of human-interpretable models based on statistics. Then, they focused on the "black-box approach involving Neural Networks. These are powerful as they use LSTM, which offers accurate predictions of future events. As a result, researchers found that merging related historical data and textual information improves the monitoring process' effectiveness.

PPM versus Prescriptive Process Monitoring
Predictive process monitoring and prescriptive process monitoring are two approaches that enhance the overall monitoring process[3]. Predictive process monitoring aims to **predict**

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[1] Summary of "Utilizing the omnipresent: Incorporating digital documents into predictive process monitoring using deep neural networks".
[2] Summary of "Text-Aware Predictive Monitoring of Business Processes."
[3] Summary of "Automatically reconciling the trade-off between prediction accuracy and earliness in prescriptive business process monitoring".

future events and **prevent issues** while prescriptive process monitoring aims to **identify the right time to take action** and the **strategy** that must be implemented in a case. Predictive monitoring can forecast a case's progress using event logs, which are composed of categorical and numerical attributes. This method's accuracy is fundamental to avoid deviations and unnecessary adaptations. There are various types of predictions based on the time they occur in the life cycle. These prediction points are defined considering relevant activities or time distance. In addition to the events information, predictive models consider the different costs related to undesired outcomes, intervention, adaptation, and compensation.

Several approaches are considered when it comes to prescriptive process monitoring.
- First Positive Prediction: This approach is easy to implement but may lead to false alarms as it doesn't consider data accuracy.
- Static Prediction Point: This approach uses fixed prediction points but may miss issues as it lacks the accuracy of individual data for cases.
- Thresholding: Based on a cost model, this approach defines adaptation, compensation, and penalty costs to determine the optimal threshold.
- Online Reinforcement Learning (Online RL): This approach is based on the reliability of predictions. It continuously adjusts considering past decision accuracy without specific rules.

Business Process Management and regulations
Research has shown that AI contributes to optimizing Business Process Management. However, AI is associated with several risks[4], urging the need for governance and regulations. The risks associated with AI involve:
- **Misalignment with business goals**: AI systems act based on optimization goals. Their actions are highly influenced by their environmental understanding. A misalignment between AI systems and business objectives could result in inefficiency.
- **Learning bias**: AI systems use various data streams for training purposes. Hence, AI's behavior is influenced by the data it uses. That is why the choice of data streams must align with the intended outcomes.
- **Transparency**: Advanced Machine Learning algorithms such as Deep Neural networks can be difficult to interpret, reducing human supervision ability. This induces the need for explanation systems integration within the models and algorithms.

To summarize, AI is a valuable asset that can serve multiple purposes, but the fast development of AI-based technologies generates more risks. Such risks must be addressed for AI to keep progressing while maintaining safety and transparency.

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[4] Summary of "AI Agency Risks and their Mitigation through Business Process Management: a Conceptual Framework."