

## Title: A Multi-Stage Deep Learning Approach for Business Process Event Prediction

**Keywords:** Business Process Event Prediction, Deep Learning, Business Process Management

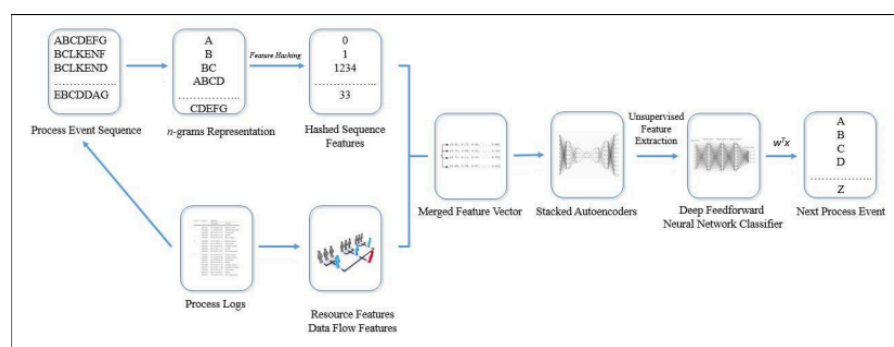
This document is a summary of a study proposing a multi-stage deep learning approach for predicting next business process events. It outlines the methodology, emphasizing the integration of advanced data preprocessing and deep learning techniques to enhance predictive accuracy in business process management.

Event log data from process executions is invaluable for predictive analytics, aiding in optimizing production plans, detecting anomalies, analyzing customer behavior, and managing risks. Effective predictive approaches are crucial to ensure smooth business operations. Inspired by deep learning's success in classification, this study proposes a multi-stage deep learning approach to predict next process events, focusing on data preprocessing for improved predictive ability. In fact, this paper aims to investigate the following research questions:

- RQ 1: Does the proposed multi-stage deep learning approach improve the predictive performance of the state-of-the-art applications?
- RQ 2: Do changes to parameters in various steps of the proposed approach, especially in the dimensionality reduction and deep neural networks, influence the prediction results?

For the motivation and related work part, recent literature explores predictive analytics in business process management, addressing regression and classification problems. This study focuses on predicting next business process events, aiming to enhance prediction accuracy through thorough data preprocessing and advanced deep learning techniques. Prior attempts include models based on Markov models, decision trees (by combining, and probabilistic finite automaton, with recent trends favoring deep learning.

The proposed approach formulates the next business process event prediction as a classification problem. It employs deep learning algorithms on extracted feature matrices representing various process characteristics. The process involves reconstructing business process events, applying feature hashing, and utilizing stacked autoencoders for hierarchical feature extraction. A deep feedforward neural network is then employed for prediction. Here are the different stages of a deep learning approach:



### Terminology

Event logs consist of process traces representing business process instances. Each trace comprises a sequence of events with attributes such as activity name, timestamp, and lifecycle transition. Predicting the next event involves forecasting the activity and lifecycle transition based on past event sequences.

### Data Preparation

Sequence encoding converts business process events into numerical input features. This study utilizes n-grams to model event dependencies, generating subsequences of events. Feature hashing and deep stacked autoencoder networks are employed for dimensionality reduction to mitigate computational costs and improve accuracy.

In conclusion, the proposed multi-stage deep learning approach offers a promising solution for predicting next business process events. By incorporating advanced data preprocessing techniques and leveraging deep learning algorithms, this approach aims to enhance predictive performance in business process management. It also highlights the superiority of the approach over existing methods in terms of **prediction accuracy** and discusses **potential future research directions**, including **real-time prediction**... Further experimentation and validation are required to fully assess its effectiveness across various domains.