**Abstract**

Learning the structure of stochastic, noisy environments remains an important area of process and graph mining. This work presents an unsupervised, threshold-based method of process mining and anomaly detection using the SUBDUE graph-compression method and the Inductive Miner algorithm. The method generates a dendrogram of the compressing structural features of a workflow log, a taxonomical representation by which further analysis can be performed. Via this dendrogram, anomaly detection was performed by applying a Bayesian threshold to detect unusual traces and their components, and was evaluated on synthetic data over a range of parameter values and model types. Experimental results show 96% accuracy on an anomaly detection task for reasonable data and algorithmic parameters, reliable performance metrics across a range of these parameters, and competitive performance against a previously studied anomaly detection method known as the Sampling Algorithm. A real-world demonstration is also provided for software-testing log data generated from a software unit-test suite of function calls of the NASA Crew Exploration Vehicle (CEV) mission platform, with results identifying anomalous components of its design. The results are promising and inform future machine learning approaches using graph-based input representations.