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Titre : Real-time business process monitoring using formal concept analysis

The aim of this research, entitled "Real-time business process monitoring using formal concept analysis", is to propose a visualization technique using extended formal concept analysis (FCA) to help industrial managers monitor and analyze performance indicators. The approach consists of monitoring ongoing processes, periodically forecasting their likely routes and performance. FCA is used to analyze patterns of events in the historical process, logs and the visualization of relationships in a concept network. Using a reachability network, the expected values of key performance indicators (KPI) can be predicted and plotted, facilitating decision-making.

A business process is a set of activities carried out to achieve a common goal according to well defined corporate objectives. FCA is often used to draw lessons from past cases to help make decisions about current problems. A concept network developed from FCA serves as a data structure for visualizing relationships between previous cases.

Thus, by transforming a concept lattice into a scope lattice, the limitations of current process monitoring methods can be overcome. The development of a real-time approach to monitoring processes in progress enables final results to be predicted while the process is running.

Modern enterprise information systems, such as Enterprise Resource Planning (ERP) and Supply Chain Management (SCM) systems, increasingly incorporate business process modeling and automation. These are often referred to as process-aware information systems (PAIS). These systems use business process models to execute, monitor and analyze core business processes.

PAIS support workers' professional activities based on established business process models. Typically, these models include task sequences and characteristics (example : worker roles, task requirements).

In addition, the business process model indicates important variables and events such as cycle times and delays. All data is managed and monitored, and recorded in PAIS system logs. The results include KPI values and event details with the times at which they occurred. Events that occur during the execution of business processes can be closely linked to business process performance, i.e. to KPI values. Therefore, any significant event that may affect business performance can be considered an event for business process monitoring by business analysts. For example, a customer complaint surely affects customer satisfaction in service processes.

From the system log, the results are represented in event history models and used to build a reversibility lattice. It is then introduced as a new knowledge representation model. Real-time monitoring involves the use of lattices to predict performance and control business processes based on real-time event occurrences. The process is mainly divided into two phases. In the first stage, business analysts decide on the scope of business process

monitoring and set up a reversibility lattice based on event history models. The second stage involves monitoring based on real-time events.

The use of a conceptual lattice for real-time process monitoring has its limitations. Indeed, it is not suited to monitoring changes that occur over time.

There are four steps to building reversibility lattices for a given business process. First, a conceptual lattice is built from a historical process log. Secondly, a state is defined for each node of the concept lattice to describe the probability of event occurrences. Thirdly, an undirected edge representing the state hierarchy is converted into a directed edge representing the reachability between event patterns, defined as a reachable order. Finally, the probability of the state undergoing changes is evaluated as a function of cumulative state frequencies.