Discovering and Evaluating Workflow Organizational Patterns from Events Log: An Agent based Approach

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ABSTRACT

This paper contributes to address an important issue in Workflow mining: organizational patterns mining issue. First, it reveals a critical and comparative study of three representative Workflow mining systems (InWolve, WorkflowMiner and ProM). The major drawback of these systems is their inability to deal with organizational patterns mining. This work considers organizational patterns as being social structures defining the activity distribution among actors involved in the Workflow, as well as the interaction protocols ruling the communications between them. To compensate the previous drawback, the paper proposes an agent based approach that includes an Events Log model integrating the interactions among actors using a performative-based enrichment of Events Log. This paper also gives the principles of organizational patterns mining and shows how evaluate the quality of discovered patterns and notably the organizational structures in terms of flexibility, efficiency and robustness. Finally, it describes DiSCOOpFlow that implements a crisis case study to validate the contributions.

Keywords: Agent Technology, Crisis Case Study, Interaction Protocols, Organizational Structures, Workflow Mining

1. INTRODUCTION

The Workflow technology aims at automating the coordination of activities composing business processes. A Workflow Management System (WfMS) is a tool which allows the modeling, implementation and execution of one or several business processes. Traditionally, WfMS focuses on design, configuration and enactment steps (Van der Aalst, 2005). As a consequence, there are a few supports for diagnosis step. Moreover, support to the design step is limited to a simple editor rather than analysis which is largely neglected although

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useful for the design step. Very few WFMS propose a simulation to check and evaluate the design step and help interpretation of data through execution traces. Even if the majority of actual WFMSs (for instance Bonita (Miguel & Charoy, 2003), YAWL (Van der Aalst et al., 2004) and FlowMind (Flowmind, 2014) collect execution traces of business process instances, they do not propose a support to exploit this important information. In this context, the Workflow Mining (WM) area has recently emerged as a hot research topic (it is to note that Wil Van der Aalst is the founder of the Workflow Mining Initiative (Verbeek, 2014). More precisely, WM aims mainly at analyzing the Workflow execution traces (or Events Log) in order to mine the key Workflow perspectives such as the Organizational Perspective (OP), the Informational Perspective (IP) and the Process Perspective (PP), which help the monitor to enhance or propose a new Workflow (Van der Aalst, 2011; Van der Aalst, 2012).

Most existing workflow mining systems such as InWolvE (Herbst & Karagiannis, 2004), WorkflowMiner (Gaaloul et al., 2009) and ProM (Verbeek et al., 2010) focus only on the discovering of PP. Discovering of OP was not considered in existing WM systems.

We believe that organizational perspective mining is useful to improve the design of prescribed business processes.

The only system that supports the organizational perspective mining is ProM but unfortunately limited to actors, roles and few kinds of social networks based on specific cooperation techniques such as work-handover, subcontracting, working together, reassignments and doing similar tasks (Van der Aalst et al., 2009).

In our work, the OP discovering is not limited to the previous elements but also includes further advanced organizational patterns such as organizational structures (i.e., federation, coalition or hierarchy) and interaction protocols (i.e., contract net, vote or negotiation) since these are deployed in real inter and intra organizational processes (Hanachi & Sibertin-blanc, 2004).

A good application domain justifying the importance of the organizational patterns is the crisis management processes (CMP). Indeed, the CMP require cooperation and coordination of several participants distributed and structured as federations or hierarchies for instance. Also, these processes require the use of sophisticated interaction protocols to support consistency of communications between participants and in order to act effectively to the crisis. In this area, the discovery of the organizational aspect seems useful for understanding and explaining of such a crisis.

The rationale for existing propositions to deal only with PP mining lies in the use of an Events Log limited to activities’ execution and to the actors performing those activities. No interactions among actors are ever tracked.

Given the previous observations, many of the problems are not solved and questions are still asking for an answer, “How to discover advanced organizational patterns (i.e., organizational structures (OS) and interaction protocols (IPs) from Events Log that integrate exchanges/interactions between actors? How to evaluate them? According to which criteria? For that purpose, we will first give a comparative study of WM systems in order to emphasize their limitations for mining the organizational perspective. Then, we will show how the agent approach provides the good abstractions to model OS and IPs and to easily mine them through enriched Events Log. Finally, we explain how we evaluate the OS in terms of flexibility, efficiency and robustness.

The remainder of this paper is organized as follows. Section 2 compares three representative systems from the literature in order to underline their organizational perspective limitations. Section 3 proposes a new Events Log model, which extends existing models, to accommodate organizational patterns detection and analysis. It starts by motivating an agent-based approach to enrich the log-file structure and reveal our agent-based solution. Section 4 shows how to discover and evaluate organizational patterns using a crisis case study. More precisely, it gives the key principles of organizational patterns mining. Then, it explains how we evaluate the OS in terms of flexibility, efficiency and robust-
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