Modeling Data for Enterprise Systems with Memories

Tamara Babaian, Bentley University, Waltham, MA, USA
Wendy Lucas, Bentley University, Waltham, MA, USA

ABSTRACT

Enterprise Resource Planning (ERP) systems are widely used but notoriously difficult to learn and master. The authors propose that a database approach to representing the system’s tasks, interface components, and usage logs in conjunction with the ERP domain data can serve as a foundation for improving system usability. The framework the authors designed supports automatic logging of user-system interactions and automated analysis of the logged data for enabling a variety of interface enhancements and assessments that can be performed dynamically by the system. Compared to existing work on usage logging, the authors’ framework expands the logging capabilities of ERP systems while providing a unifying basis for many different kinds of applications of log data.

Keywords: Data Model, Enterprise Resource Planning (ERP), Enterprise System, Usability, Usage Analysis, Usage Logging

INTRODUCTION

Enterprise Resource Planning (ERP) systems are vital for managing the processes and resources of modern organizations. The significant corporate investments in these systems do not always provide the desired results, however, and inadequate usability characteristics are at least partly to blame (Iansiti, 2007; Hamerman, 2007; Cooprider et al., 2010; Topi, Lucas, and Babaian, 2005).

To achieve a breakthrough in the usability of large-scale enterprise systems, we have followed the design science research methodology (Hevner, March, Park, and Ram, 2004) by applying our understanding of how ERP systems are used in practice to the development of innovative artifacts (Babaian and Lucas, in press; Lucas, Xu, and Babaian, 2013). The key idea behind our approach is to build into the enterprise system knowledge and awareness of its own design and its history of interactions with the user. This requires representing the system’s task structure, interface components, and automatically collected records of all system-user interactions in a data model, which we refer to as the Task-Interface-Log, or TIL, model (Lucas and Babaian, 2012), and making that model an integral part of the system’s design.

The contribution made by this paper is in demonstrating how the TIL model serves as a unifying foundation for a wide range of
applications, such as process instance detection, automated usability assessments, and usage-based system enhancements. While all ERP systems maintain usage logs for failure diagnosis, performance monitoring, and auditing purposes (e.g., SAP NetWeaver 7.0, 2013), those logs do not provide sufficient information on the details and context of interactions for supporting this variety of applications. We have designed the TIL model specifically for the purpose of being able to effectively utilize usage history in system-user interactions. This places specific requirements on the ability of the data model to enable the quick identification of the broader context of an interaction, the experience level of the user, the actions typically performed by others working on the same task, and so on. The TIL model makes these types of inquiries possible via a novel approach to tying the contextual information to the keyboard and click-level histories of interaction events.

In the next section of this paper, we discuss related work. This is followed by a description of our framework, which has been implemented in SQL and embedded in an ERP prototype. We then demonstrate the efficacy of our framework as an infrastructure on which a variety of established interface features and evaluation techniques can be built. We close with concluding remarks.

RELATED WORK

ERP systems support business processes throughout the enterprise, with each of those processes consisting of separate but related transactions. Researchers have explored applying data mining to system logs for identifying the composition of transactions into processes within desktop and web-based enterprise applications (e.g. Greco, Guzzo, and Sacc, 2005; Khasawneh and Chan, 2006; Bayir, Toroslu, Cosar, and Fidan, 2009; Shen, Fitzhenry, and Dieterich, 2009; van der Aalst, 2011). Rozinat and van der Aalst (2008) have shown that process sequences mined from ERP system logs often deviate from prescribed processes. Discovering the ways in which users actually perform processes with systems can provide critical input to organizations, which rely on ERP systems for standardizing around best practices. At the same time, knowledge of typically performed processes enables a variety of system enhancements, such as intelligent workflow assistants, auto-generated To-Do lists, and the automating of workflows.

As noted by van der Aalst (2010), data mining-based approaches to process detection suffer from the noise inherent in environments with a high degree of task concurrency, such as the multi-user enterprise systems environment. In contrast, our approach combines log information with a noise-free specification of process tasks in the TIL model, allowing for the accurate, noiseless detection of process instances.

Adaptive interfaces (Jameson, 2008) collect and utilize log data to dynamically create user models and produce a variety of user-tailored system behaviors, including having the system take over a user’s routine tasks, adjusting the interface layout for the optimal fit with the user’s needs in different computing environments (Gajos, 2012), adaptively providing information and advice about how to use the system (Linton, Joy, Schaefer, & Charron, 2000), and monitoring the progress of the user’s learning in tutoring systems (Brusilovsky & Cooper, 2002).

The idea of associating usage log data with GUI components, similar to how it is done in our prototype, has been explored by several researchers. Hollan, Hutchins, and Kirsh (2000) discuss the value of encoding digital objects with information about the history of their use. The Passages system (Gyllstrom, 2009) captures the details of its users’ histories of interactions with text as first class entities, enabling users to perform sophisticated searches such as finding all files that have been skimmed but not completely read.

Contemporary ERP systems include the logging of a variety of events, including system errors and messages, user access to documents, application and workflow execution traces, and changes to the database (SAP NetWeaver 7.0. Documentation, 2013). These logs are intended
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