Keyword ”Experience Management”

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Motivation

Experience management has a high relevance for the industry as recent studies between 2001 and 2005 show (e.g., KPMG 2001, FhG-WM 2005). In the Fraunhofer study, experience management was the top item among the challenges regarding knowledge and information. “Experience base” was the top item for planned usage/installation among the IT support for knowledge management. Core technologies for realizing experience management systems that come from the field of artificial intelligence are related to decision making, knowledge acquisition and extraction tasks – e.g. case-based reasoning, ontologies, machine learning, and natural language processing.

An important motivation for implementing experience management are increasing demands in industry towards process improvement approaches such as CMM Level 5, Six Sigma, etc.: All these approaches aim at better understanding, stabilizing, standardizing, and optimizing processes and decisions in order to achieve a better and more repeatable product quality, e.g., by automation at a more fine-grained level, for production lines as well as for business processes.

Definitions

Experience is knowledge or practical wisdom gained from what one has observed, encountered, or undergone (Webster's Dictionary). Experience is concerned with what was true or false, correct or incorrect, good or bad, more or less useful (Richter 1998). This means that experience has a certain validity that is bound to the contexts/situations where it occurred.

It can be represented by a rule, a constraint, some general law or advice, or simply by recording a past event (Richter 1998). Its validity can be explicitly represented (e.g. Nick 2005) and/or assured through respective quality assurance processes (e.g., Bergmann et al. 2003, Tautz 2001). Furthermore, experiences can be abstracted to have more general experiences that are valid in more contexts.

An experience representation consists of a description of the actual knowledge item (e.g., a problem and a solution), the contexts in which it has been extracted and applied and information about its validity in these contexts, that is, if and to which degree a knowledge item could be applied in these contexts.

Examples for experiences:

- a particular solution to a particular problem that occurred
- a lesson learnt from a certain episode
- a particular decision made in a concrete situation
- a particular piece of information relevant for a making a certain decision.
- a best-practice workflow/process appropriate for handling a certain kind of task.

An *Experience Management System (EMS)* is a socio-technical system that is established for managing, reusing, and recording experiences among its “users”. Experiences can be recorded and reused using a software system, which is operated by people. Usually, these people also do not or cannot make all aspects of their experience explicit for various reasons. So, assuring that the relevant experiences are recorded and reused requires further organizational measures.

Object of investigation of the field *Experience Management (EM)* are EMSs and their integration into business processes. EM considers all relevant processes for build-up, operation, use, maintenance, evaluation, improvement, and management of EMSs. EM also includes the organizational and social measures that foster the acceptance and the continuous use of the system by its users. As a research field, EM looks at the methods and technologies that are suitable for collecting experiences from various sources (documents, data, experts, etc.), recording/packaging, reusing, adapting, and maintaining experiences – including the respective organizational and social measures. Thus, EM is a special form of knowledge management (cf. Bergmann 2002).

In the intersection of EM and Artificial Intelligence, we focus on EMSs with a software system – in the following called EMS software.

An EMS software supports a certain set of operations related to reuse, adaptation/modification, and recording of experiences and capturing feedback. For these operations, their counterparts in the business processes have to be identified during the build-up of an EMS. If necessary, the business processes must be modified to include EM-related activities. Furthermore, the EMS software should be technically integrated with the business process support software (e.g., workflow system, production line control software) in order to assure that EM activities are executed.

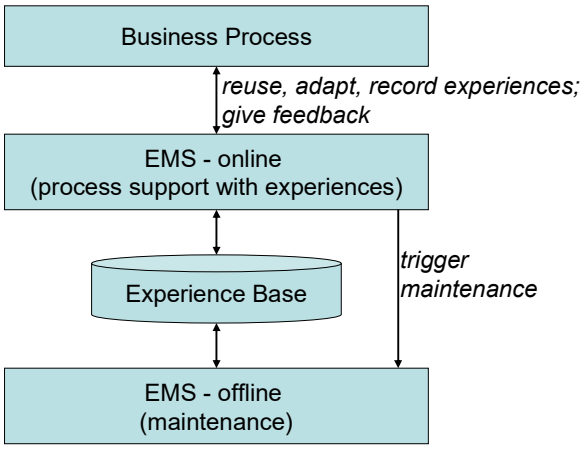

Figure 1 EMS software consists of online and offline components. The online components are directly linked to the business process. The offline components might be triggered by the online components.

So, these business processes with EM-related activities define the requirements for an EMS software. Hence, general models for such EM-related activities and the realization of their technical operations are subject to EM research. Another subject is the evaluation of these items.

Contributions from different AI fields to EM

In the following, we show some existing and possible contributions from different AI related fields to EM.

Case-based reasoning (CBR) provides technologies and knowledge processing processes for EM. The well known R^4-CBR Cycle (Aamodt & Plaza 1994) is already a closed loop of experience reuse and recording and can be considered an early model for EM. Tautz & Althoff (1997) demonstrated this by providing an organisational interpretation of the CBR cycle in the context of the experience factory approach. From the technological point of view, particularly similarity-based retrieval technology from textual and structured case bases is highly useful for experience retrieval. More recent work integrates CBR into the application context of real world business processes and adds to it the knowledge engineering processes for experience base development, validation and maintenance (Tautz 2001, Bergmann 2002, Nick 2005, Minor 2006).

Ontologies for experience representation and additionally required background knowledge can be represented in various ways. EM Systems with origins in CBR are typically based on relational or object-oriented representations. However, they have very similar expressiveness to recent semantic web standards (Bergmann & Schaaf 2003) and recent tools (e.g. the tool e:ias from empolis) enable the use of OWL ontologies. Following this type of representation, deductive reasoners for description logic (e.g. for OWL) can support experience retrieval by semantic information access (e.g. tools from Ontoprise).

Experience maintenance is important because an EMS is a dynamic system, i.e., particularly in closed-loop EMSs, experiences are validated and new experiences are collected continuously. Thus, maintenance is apparently essential. Maintenance should be orientated to user needs/goals (Nick 2005). As supporting technologies, machine learning methods seem to be promising for discovering new experiences or not yet validated hypotheses.

The ontology and background knowledge has to be maintained as well: Here the methods and technology depend on the method and technology chosen for the EMS. Approaches for ontology evaluation (Bloehdorn et al. 2006) are relevant as well as maintenance approaches for CBR systems (Leake et al. 2001, Nick 2005).

Finally, the inherent integration of EM activities into the business process immediately asks for an integration with workflow and process management approaches. This relation is of two kinds: first, the processes of a business workflow provide the context in which experience is reused and hence process information should be used during experience retrieval. Second, experience itself can be in the form of best practice workflows describing a proven procedure for performing a certain tasks. Experience management can help

making workflow management systems more flexible by supporting reuse of process experience (Sauer et al. 2006).

Future challenges

From an AI perspective, building EMS software requires a lot of integrative work, i.e., integrating different AI methods/algorithms into an ensemble that forms the EMS. Thus, the focus for EM is more on integration than on a sole improvement of single AI technique. This integration challenge can best be addressed in the context of real practical applications of EM.

Making experience management work requires a tight integration of the experience management system with the business processes and the involved persons, objects, and the environment it serves (KPMG 2001, FhG-WM 2005)· This integration requires a mix of organizational/social and technical measures. For these technical measures, the new fields of Pervasive Computing and Ambient Intelligence are very interesting for EM. Both fields equip the environment with sensors and actuators so that the EMS could receive a picture of the current situation of its world and even act using the actuators.

For the integration of EM with the Web, recent trends in the Web 2.0 area seem to provide promising technology for providing more sophisticated support for services focussing on community-based opinion and experience exchanges.

For the future we expect that any kind of intelligent agent / system will make experience on its own and learn from this experience. EM will be necessary to support these learning processes and, as a consequence, will have to become automated and operated by software agents (Althoff et al. 2006, Althoff et al. 2005).

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