International Journal of Multidisciplinary and Current Research ISSN: 2321-3124
Research Article Available at: http://ijmcr.com

High Level Information System for knowledge intensive services

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Received 12 Aug 2017, Accepted 10 Oct 2017, Available online 20 Oct 2017, **Vol.5 (Sept/Oct 2017 issue)**

Abstract

Our society needs and expects more high-value services. Such "knowledge-intensive" services can only be delivered if the necessary organizational and technical requirements are fulfilled. In addition, the cost-benefit analysis from the service provider point of view needs to be positive. Continuous improvement and goal-directed (partial) automation of such services is therefore of crucial importance. As a contribution to this the current research vision for (partially) automated support of knowledge workers based on intelligent information systems focusing on the use of experience. For the implementation of such a vision we base on the integration of approaches from artificial intelligence and software engineering. A "deep" integration of case-based reasoning and experience factory is a first successful step in this direction

Keywords: *Wide area network, Web, Data mining, security*

1. Introduction

The shift of relative importance from more traditional product factors to the new, increasingly important product factor ''knowledge" characterizes the developing new economical structure. Knowledge- intensive services and especially knowledge work represent a quickly increasing part of the service sector. ''Knowledge-intensive work" includes activities that require an intensive education and experience on a specific subject that has been accumulated over many years.. ''Knowledge intensive services" need the resource knowledge as their most important input factor for delivering the respective service [Cra03]. "Knowledge work" denotes activities that not only base their problem solving process on knowledge acquired once, but also necessarily have to revise, improve and update their knowledge. Experience represents the success-critical knowledge for knowledge-intensive services and knowledge work.

Within this research, vision of how to develop intelligent information systems for supporting knowledge work and knowledge-intensive services with a specific focus on the use of experience will be described. This enables automated processing of knowledge and offers a unique added-value if compared with more traditional approaches.

Future information systems users expect to be easily supported, information systems to behave ''intelligently" and learn from experience, and to improve their behavior by this. As a consequence, such intelligent information systems should be flexible, modular, and easily to adapt, and maintain. These systems should contain a lot of valuable knowledge understandable for both the user and the computer. That is why such systems are also called ''knowledge-based".

Implementing such intelligent information systems involves SE approaches, experience factory and software product-lines as well as case-based reasoning, intelligent agents, and machine learning form AI. In addition, there are a lot of relationships to knowledge management and business processes, which may be viewed as part of business information systems.

2. Integration of agent technology, case-based-reasoning, experience-factory, and software product-lines

Experience factory (EF) is a logical and/or physical infrastructure for continuous learning from experience. It includes an experience base for knowledge storage and knowledge reuse. The experience factory concept was introduced in the mid 1980s to support the central process of SE, the software development process [BR88]. Basili and Rombach consider software development running in projects separate from the learning organization experience factory because these two sub-organizations have different goals. Projects have to achieve their project goals, that is, developing software according to the given requirements. Experience factory, however, supports learning across projects. From a projects perspective this can be viewed as additional effort and might lead to a goal conflict. Such a separation of learning and project organization is a characteristic feature of an experience factory [Bas94a] and has been validated in practice.

Experience factory bases on the - so-called quality improvement paradigm, a goal oriented learning cycle for the experience based improvement of project planning, project execution, and project learning. Goal-oriented measurement and evaluation is used as a systematic procedure for evaluation. While the experience factory manager has the overall responsibility, the .experience manager has associated the task of deciding about content development and structuring. The experience engineer is responsible for packaging and analyzing the experience base. While the librarian cares about the technical and administrative tasks, the project supporter finally is the main contact to the respective projects.

From an experience factory perspective in the mid 1990s the important problems were how to implement an experience base, how the necessary processes for developing an experience factory/base should look like in detail, as well as how experiments about implementation issues could be carried out.

The integration of the experience factory and the case- based reasoning concepts led to numerous advantages. Case-based reasoning provided an appropriate technology for implementing the experience base. addition, a lot of detailed knowledge about the case- based reasoning processes was already available in the corresponding community and could be used as a very good starting point for describing experience factory processes. The experience factory approach provided knowledge about organizationally embedding case-based reasoning systems in commercial organizations. In addition, it contributed an approach-that could be easily applied for evaluating case-based reasoning systems: goal-oriented measurement and evaluation.

Enhancing the integration of experience factory and case- based reasoning also led to the integration of systematic reuse into the software development process. As a consequence, the implementation of the experience/case base was based on the software product-line approach and introduced, as so called ’’experience based information systems”. Thus, an experience/case base was no more realized as single system but as a whole system family. The underlying system architecture is shown in Figure 1. As several of the presented components have different implementations, the architecture describes a family of systems, which definition is based on a number of responsibly designed, common features.

3. Vision

The vision is to develop intelligent information systems for supporting knowledge work and knowledge- intensive services, focusing on creating added-value through increasingly automated use of available knowledge. This resulted in the idea of a “knowledge product-line”. A knowledge-line denotes the systematic application of the software product-line approach to the knowledge included in intelligent information systems. Fig.3. Product-line architecture for EF/CBR systems [Nic05]

Knowledge-lines enable the necessary ’’knowledge level modularization” for building potential variants in the sense of software product-lines. This is achieved through the use of multi-agent systems as a basic approach for intelligent information systems. An intelligent agent is implemented as a case based reasoning system and each case-based reasoning system agent is embedded in an experience factory that is responsible for all necessary knowledge processes like knowledge inflow, knowledge outflow as well as knowledge analysis. Such an experience factory is potentially fully automated, because software agents are available for each role within the experience factory, and perform these roles in an increasingly automated way. For example, machine techniques are used for analyzing, evaluating, intaining the case base. As part of the vision both -based reasoning system agents as well as factory agents can learn from experience. As nee, the vision considers distributed learning as a model for future (intelligent) software least one software agent However, each software agent ’“bay’arr associated human coach who is responsible for the role that is jointly taken over by the software agent and its human coach. The human role owner ’’introduces the agent to his job” by taking over difficult decisions and providing his experience. Based on the case-based reasoning/experience factory approach and machine learning techniques the respective software agent should learn while interacting with its human coach and autonomously take over more and more tasks. This enables a gradual transition from purely human based processes to processes where routine tasks are increasingly taken over by software agents, and humans can spend more time on creative tasks.

Using, the software product-line approach enables a modularization already on the knowledge level. The modules have associated the variability’s and requirements that they satisfy. As a consequence, such knowledge-line modules can be selected using a catalogue of requirements. By this, the For each role within an experience factory there is at development of further experience factories is simplified and speeded up. Nick [Nic05] has identified an efficiency improvement by a factor > 4 for developing the design of an experience based information system. Further efficiency improvement for the build-up of experience factories is expected from increasing automation of an experience factory build-up agent

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