"AI Techniques for Knowledge Management" Tutorial Proposal for ECAI-2000

Stefan Decker
Stanford University
stefan@db.stanford.edu

Steffen Staab
AIFB, Karlsruhe University
sst@aifb.uni-karlsruhe.de

1 Tutorial Summary

Knowledge management (KM) is a discipline with the purpose of managing the knowledge assets of organizations. Though KM is deeply rooted in business management, IT support may add an enormous leverage for the effortless creation, conservation, sharing, and exploitation of organizational knowledge. AI has a long tradition in creating, interacting with and managing of knowledge and has developed many techniques, that may propel this knowledge management cycle inside an organization. In the tutorial, we will give an introduction in intelligent IT support for Knowledge Management that individual and communities of users in knowledge-intensive organizations may benefit from.

2 Tutorial Objectives

Knowledge management is a topic with a high potential for business and, thus, with a great potential for leveraging wide-spread acceptance and recognition of AI. The purpose of the tutorial is a twofold. First, AI researchers will learn about the potential that their contributions may make to the business world. Knowledge management success stories show the great demand for novel applications of AI techniques — and new basic AI research. Second, practitioners, will learn about how AI technology has succeeded in improving organizational knowledge management and that there is hardly any knowledge management purpose — as far as computer support is concerned — that has not already been approached by AI in the one or the other way. In contrast to many survey talks, we will concentrate on the technical issues underlying IT support for knowledge management.

3 Tutorial Content

We start the tutorial by explaining the general goals of knowledge management contrasting it with related, earlier approaches, such as expert systems or standard information systems (Part 3.1). We continue with a description of what tools and methodologies are currently available and applied in industry, thereby deriving the requirements that are still not met and that may be solved with the help of more advanced (AI) technologies (Part 3.2). In the core part 3.3, we delve into different technologies for knowledge management, their pros and cons, and — where applicable — some first case studies. Orthogonal to the technical dimension methodologies (such as presented with CommonKADS) provide a methodological background suited for applying a variety of knowledge management techniques in practice (part 3.4). Finally, we want to take up a scenario — possibly, scenarios issued by tutorial participants — and sketch how different knowledge management techniques may be applied there in the future (part 3.5).

3.1 Introduction

In the introduction we will approach the questions, "What is knowledge management?", "Why has knowledge management become important?","How has knowledge management evolved?". In particular, we will look at how knowledge management differs from better known techniques, such as rigid business process management, document management or expert systems. The introduction will also provide the ground for the issues that are to follow.

3.2 State-of-the-Industry

"Knowledge management"is a hot label in industry these days. Very often, however, it has been misused. We will contrast the misuse with intelligent knowledge management techniques that are currently applied in industry. Several examples for techniques are — *Collaborative Filtering*: Grapevine; *Groupware*: Lotus Notes, Open Text, Exchange, Intraspect; *Document Management*: Fulcrum, InQuery, LARS; *Information Retrieval*: Excalibur, Verity; *Text summarization*: Prosum, USU Value Base; *Database solutions*: Wincite, Dataware, Agentware; *Experience Factories*: by A.D. Little, by Xerox; *Experience Profiling*: by SD&M.

This list is not meant to be exhaustive or the gold standard, but it should give a fair impression of what is done in industry right now.

3.3 Techniques for Knowledge Management

Most of the techniques used in industry build on rather old technology. In order to give a vision of what AI techniques are currently researched for knowledge management we give a survey here:

3.3.1 Information Retrieval and Extraction Techniques

Information retrieval and extraction techniques profit from the increasing scalability found in current information extraction systems. Thus, besides the more common information retrieval capabilities (possibly extended with thesauri, e.g. CIN (Spallek, 1999)), one may apply information extraction, retrieval and summarization at various levels of granularity (Davies & Stewart, 1998). In addition, recommender systems that combine content with user profile-based techniques may also handle texts mixed with graphics or sound (cf. Pazzani (1999)).

3.3.2 Visualization Techniques

Making the knowledge worker master new knowledge does not only involve the retrieval of information, but also the understanding of new knowledge. Visualization techniques are used for both purposes. 3D metaphors of "knowledge gardens", virtual worlds with avatars, or just plain visualization of complex numerical data may provide the access and the graphical structure that makes knowledge accessible to knowledge workers. (cf. Chen & Davies (1999)).

3.3.3 Case-based reasoning

One of the most important purposes of knowledge management is the capturing of experience. Creating an "experience factory" (Basili et al., 1992) is usually done with case-based reasoning techniques. In many environments, knowledge workers are used to relying on previous experiences of theirs or others. Here, case-based reasoning techniques give access to similar cases that — to some extent — need not even be modeled explicitly. Examples for such techniques have, e.g., been described by Lenz et al. (1998).

3.3.4 Ontology and Metadata-based Knowledge Management

Explicit modeling of knowledge structures and knowledge pieces, such as is done in ontology-based approaches, may step in when the quality of service that is required in a particular knowledge management setting is too high for information retrieval-based or case-based techniques. Metadata standards and techniques like XML based RDF or even XML itself enables and support the explicit modelling of knowledge in and about documents. Though explicit modeling requires extra efforts, its benefits stem from implicit knowledge that becomes explicit, from validation of knowledge models underlying a company, or from combinations with other formally described systems, such as workflow systems. Decision support systems (e.g., Morgenstern (1998)), or knowledge sharing and access systems such as Shoe or Ontobroker (Decker et al., 1999) have proved successful in these respects. Especially standards like RDF will built upon these techniques and will leverage the influence of knowledge processing techniques and thus AI in general.

3.3.5 Knowledge Discovery

Given a particular modeling of knowledge pieces, support for the knowledge mangement circle is still not completed yet. In fact, additional benefit for knowledge management comes from knowledge management. Experience databases or projects descriptions, case bases and their like allow for the intelligent anal-

yses of their contents through OLAP and knowledge discovery techniques. A typical question that may be asked is, e.g., "What knowledge has John Doe?" or "Whose competence could allow us to compete or loose on the Latin American markets?".

3.3.6 Process support

Finally in this section, we want to consider how knowledge techniques combine with the overall process relevant to a company. Several models further the direct integration into the value creation chain, such as knowledge-based workflow systems by Margelisch et al. (1999) or Staab & Schnurr (1999).

3.4 Methodology

The methodological section completes the knowledge management techniques, since it is concerned about how to introduce knowledge-intensive technologies to an enterprise in general. This involves issues of business process modeling, though rigid schemes like event process chains need to be supplemented by knowledge acquisition techniques for more flexible problem decompositions, e.g. CommonKADS (Schreiber et al., 1999).

3.5 Interactive Scenario Session

To spice things up, we prepare a somewhat more elaborate scenario description. Interacting with the audience, we collect a number of requirements for the scenario. For this scenario we then outline a knowledge management solution. Our interest here is to offer researchers the possibility to detect applications for his research and the "business participant" to understand comprehensive solutions for his problems. Though we will have prepared sufficient material, this solution will again be worked out through interaction with the audience.

3.6 Live Demonstration

Before closing, we will give a live demonstration of our knowledge management system "Ontobroker" as it is applied to the scenario setting from above. This will include some demonstration of ontology construction and use in a typical user setting (Staab & Schnurr, 1999).

4 Prerequisite Knowledge

Some general IT knowledge and basic knowledge about AI is required.

5 Contact Information

Stefan Decker
Computer Science Department
Stanford University
Gates BLDG 4A, 425
Stanford, California 94305-9040
email: `stefan@db.stanford.edu`
phone: +1-650-723-1422
fax: +1-650-725-2588

Steffen Staab
AIFB, Karlsruhe University
76128 Karlsruhe, Germany
email: `sst@aifb.uni-karlsruhe.de`
phone: +49-721-608 7363
fax: +49-721-693 717

6 Resumes

6.1 Stefan Decker

Stefan Decker received his diploma in Computer Science and Mathematics from the University of Kaiserlsautern with the best possible result in 1995. From 1995 till 1999 he did his phd studies as the Institut AIFB, University of Karlsruhe. Since August 1999 he is working as a Postdoc at the Database-Group at Stanford University, USA. He has taught courses in knowledge management (summer term 1998), Web technologies (Winter 1998/1999) and XML/Metadata (Fall 1999).

Stefan Decker's research interests cover the whole IT support for Knowledge Management, especially Ontology and Metadata based approaches (cf. (Decker et al., 1997a) (Decker et al., 1999)) and Knowledge Representation (c.f. (Decker, 1998)), but also modelling and analysis techniques for business processes (c.f. (Decker et al., 1997b)).

Stefan Decker has initiated and co-chaired several workshops and special tracks on Knowledge Management and Metadata, e.g.: KAW-99 Special Track on Ontologies and Metadata for Knowledge Retrieval, (Banff, Oct 16-22, 1999); KAW-99 Special Track on "Knowledge Management and Knowledge Distribution through

the Internet" (Banff, Oct 16-22, 1999); IJCAI-99 Workshop on Knowledge Management and Organizational Memories (OM-99), at IJCAI-99; Interdisciplinary Workshop on Building, Maintaining, and Using Organizational Memories (OM-98), at ECAI-98; Knowledge-Based Systems for Knowledge Management in Enterprises, at the 21st Annual German Conference on AI (KI-97); Workshop on Comparing Description and Frame Logics, Karlsruhe, 1997

Stefan Decker is or was Program Committee Member of the following conferences and workshops: "Conference on Cooperative Information Systems, COOPIS'2000"; the second and the third "International Conference and Exhibition on The Practical Application of Knowledge Management" in 1999 and 2000 in London; "Practical Case-Based Reasoning Strategies for Building and Maintaining Corporate Memories" (at ICCBR '99), `URL: http://www.iccbr.org/iccbr99/`;
and the "2nd Int. Workshop on Innovative Internet Information Systems (IIIS-99)", Copenhagen, Denmark, URL: `http://www.idt.ntnu.no/ monica/iiis-99/`.

He edited the following journal special issues: S. Decker & F. Maurer: Special Issue on Organizational Memory and Knowledge Management of the International Journal on Human-Computer Studies. October 1999. (Academic Publishers); A. Abecker, S. Decker & F. Maurer: Special Issue on Knowledge Management of the International Journal on Software Frontiers (Kluwer).

6.2 Steffen Staab

Dr. Steffen Staab received his prediploma from the University Erlangen-Nuremberg in 1992, his M.S.E. in Computer and Information Science from the University of Pennsylvania in 1994, and his Ph.D. in Informatics from Freiburg University in 1998. Since then he has been working in the field of knowledge management as a consultant in industry and as a project manager and lecturer at Karlsruhe University. He has been teaching courses on Lisp (summer term 1997), knowledge management (summer term 1999), text mining (winter term 1999/2000) and knowledge discovery (winter term 1999/2000). During the summer break 1999, he received a post-doctoral short-term research fellowship from the knowledge management research group at British Telecom, Ipswich.

Dr. Staab's research interests cover the whole "knowledge management cycle" from applications for analysing documents, structuring the knowledge repository with ontologies, and intelligent systems building thereon. Correspondingly, he has done research and worked in several fields of AI relevant to knowledge management (Staab & Studer, 1999), including knowledge-based systems (cf., e.g., Staab & Schnurr (1999), Barnekow et al. (1999), Staab (1999)), knowledge representation and reasoning (Staab, 1998; Staab & Hahn, 1999), and text understanding (Staab & Hahn, 1997b; 1997a; Staab, 1999). He received a best paper award for his contribution to ECAI-98 (Staab, 1998).

Steffen Staab has initiated and co-chairs a workshop on "*Bringing Knowledge to Business Processes*" at the AAAI Spring Symposium Series-2000. He is co-editor of a special issue "*AI in Knowledge Management*" of Elsevier's Journal of Knowledge-Based Systems (with Eric Tsui and Brian Garner; to appear 6/2000) and he is program chair 2001 of the bi-annual German conference on Knowledge Management. He is a PC member of the "*Third International Conference on Practical Aspects of Knowledge Management*, Basel, CH, 2000".

7 Audio-visual Requirements

Besides of the usual power-point presentation, we plan to give a live system demonstration. Both will require a projector.

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