

An Agent Approach to Manage Heterogeneous and Distributed Knowledge

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ABSTRACT

Emphasis on knowledge and information is one of the challenges of the 21st century to differentiate the intelligent business enterprises. Enterprises have to develop their organization in order to capture, manage, and use information in a context of continually changing technology. Indeed, knowledge and information are completely distributed in the information network of the company. In addition, knowledge is, by nature, heterogeneous, since it is provided from different information sources like the software, the technical report, the meeting statements, etc. The authors present in this article the architecture of a multi-agent system, which allows the capitalization of the distributed and heterogeneous knowledge. They then present how the agents help business experts to design ontologies in detailing this problem and how the agents extract knowledge from different user databases by using a semantic approach.

KEYWORDS

Agent-Based Modeling, Knowledge Management, Ontology, Semantic Approach

INTRODUCTION

The industrial interest in methodologies and tools enabling capitalization and management of distributed and heterogeneous knowledge grew stronger, especially in designing complex products within an extended enterprise. The development of these complex products involves a multi-disciplinary team (mechanics, automation, designers, engineers and technicians methods, etc.) to work collaboratively to design, develop and industrialize this product. In these projects environment, Knowledge is heterogeneous, since it comes from different sources. Rahman in (Rahman 2016) highlights the importance to develop the best practice to manage data, information and knowledge. Knowledge is also distributed throughout the enterprise network since each professional actor uses his own software tool connected to the entire corporate network.

The establishment of knowledge management system is strategic for companies. These last years' prove that the fact of not managing knowledge is a loss of competitiveness. But the knowledge management of the company is quite complex because it does not consist only of collecting and disseminating knowledge through the application of new technologies. Indeed, according to Ermine (Ermine 2010), It is a long-term program that starts from a strategic intent, which requires a good analysis of the nature of knowledge and know-how of the company and which led to the development of various and adapted tools. The confirmation made by Ermine proves that the mechanisms of knowledge management are complex.

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In additional, inside an engineering project, the knowledge is provided from different information sources (multitude of professional software tools, several different databases, etc.) which are distributed all over the network of the company. Moreover, the population of the projects actors is, by nature, heterogeneous and distributed. Thus, we propose the use of the agent paradigm that has proved its effectiveness in solving complex problems in information environments where entities are by nature heterogeneous and distributed.

We have identified four complex problems in our knowledge management approach; the knowledge bases definition by the experts, the knowledge identification and research inside the enterprise network, the knowledge broadcast and evaluation by the professional actors and the reuse of the knowledge during professional activities. All these complex problems are treated by four different agents communities, which represent four parts of the knowledge management system.

The first part of our system is an ontology editor, which allows to professional experts to create the structure of their knowledge base i.e. to define all the knowledge they want to capitalize and the relations between them. Since the creation of concepts in ontology is described in natural language, each person can define the same concept differently. Indeed, we face here the problem that business expert can add a concept to the ontology which doesn't match exactly with the content of the database of the business application, but it matches a synonym for instance. For that reason, we need a system that helps these professional experts in creating ontologies that fit with the existing databases.

This paper describes our work to help professional experts in creating their ontologies with our knowledge-based system. This first part of the system is called OCEAN, which is the ontology creation package. This paper is organized as follows: after a presentation of some works on the application of multi agents system (MAS) to develop a knowledge management system in section 2, section 3 introduces our MAS approach to support KM in OCEAN platform and the contribution of this system. At the end we describe the results of an experiment by using OCEAN in an industrial context.

AGENTS AND ONTOLOGIES TO MANAGE HETEROGENEOUS AND DISTRIBUTED KNOWLEDGE

OCEAN is a multi-agent system aiming to support the knowledge management process with four functionalities; the knowledge definition, the knowledge extraction, the knowledge evaluation and the knowledge reuse. We present in this section the interest of using a MAS to support the knowledge management process.

MAS Used in Knowledge Engineering

The aim of knowledge engineering is to gather, study, organize and represent knowledge. Multi-agent systems have already proved their efficiency to support such tasks. Klusch (Klusch, 1999) made a list of the services that a multi-agent system can offer in a knowledge management approach:

- Search, acquire, analyse and classify knowledge coming from various information sources;
- Give information to human and computing networks once usable knowledge is ready to be consulted;
- Negotiate on knowledge integration or exclusion into the system;
- Give explanation to the quality and reliability related to the integrated knowledge;
- Learn progressively all along the knowledge management process;

Such services are mostly implemented to create two MAS categories devoted to knowledge management. The first MAS type is based upon an agent cooperation to solve complicated problems related to knowledge types. Some of these MAS were created as complementary tools in information management (workflow, ontologies, information research systems and so on) to design platforms

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