Guest Editorial Preface

Special Issue on Semantic Technologies for Decision Making

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The aim of the Special Issue is to explore the use of semantic technologies to assist decision making.

Decision making can be regarded as a cognitive process resulting in the selection of a course of action among several alternative scenarios. Every decision making process produces a final choice. The output can be an action or an opinion of choice.

More and more software intended to assist decision-making processes is being developed using formal descriptions of concepts and relationships among concepts in the domain and reasoning; that is developed with the help of semantic technologies which enable the creation of formal models of the domain or assist in the decision process.

The purpose of the Special Issue is, therefore, to highlight recent developments in the use of semantic technologies and promote their application in advanced information, engineering and medical systems for decision making. Its objective is therefore to present and compare different approaches to real applications of semantic technologies at the heart of decision-making systems, by soliciting original scientific contributions in the form of theoretical and experimental research, and case studies.

This issue consists of 5 articles; some of them are extended versions of selected articles presented in the Invited Session on "Semantic Technologies for Decision Making" at the 18th International Conference on Knowledge-Based and Intelligent Information & Engineering Systems KES2014 held in September 2014, in Gdynia, Poland.

The article "Hybrid fuzzy-ontological project framework of a team work simulation system" proposes a virtual project environment to support the work of those who manage project teams in the planning and monitoring of projects. It relies on the agent-based design paradigm and uses intelligent inference mechanisms to support its functionalities. It can be applied in the work of project teams (e.g. in an IT support organization) and implemented on the basis of any operating system, as well as IT infrastructure. The main application of this system is seen in the planning of IT projects at the stages of constructing the team, defining tasks for the team and selecting methods and tools for the development and management of projects. This approach helps the project manager to plan the budget, schedule and scope of the project for any client requirements. The main functionalities of the proposed environment include support for the selection process of project team members, support for the selection process of information technology when the project team (IT support organization) migrates between different technologies of development and management (to reduce risk in the implementation of processes), support for the technology selection process to meet the functional requirements posed (reducing the time and costs of selecting technologies appropriate to the requirements of the project), compiling technologies to support software development processes (reducing the time and costs of selecting

technologies for the process carried out by the team), and analysis of the existing technologies and their readiness to be implemented or used to carry out other processes.

The article "From Finding to Explaining- Information Retrieval to Support Maritime Anomaly Analysis" addresses the problem of providing support for efficient search and forensic analysis of large collections of documents and proposes an approach to retrieve documents on the basis of their semantic content. It is based on semantic analysis and integration to structure, query and browse collections of interpretation reports. Domain knowledge is at the core of this approach, which is supported by an ontology and associated instances. In fact, maritime safety is an important aspect for coastal nations since security requirements in ports receives increasing attention and is intended to cover various aspects such as: surveillance of maritime traffic, prevention of pollution at sea, control of fishing activities, or identification and assessment of risk of threats and illegal activities. A typical scenario to detect abnormal behaviour involves operators analyzing a situation picture created by fusing video, radars, and intelligence information. Some information assets can be critical and then alerts are triggered in order to notify analysts of maritime incidents, highlighting abnormal and possibly threatening vessel behaviour. An investigation is then undertaken, aiming at identifying whether the behaviour is threatening or not, and it is completed by an investigation report. As people having different experience perform analysis differently, subjective factors shape the outcome and each report provides an individual interpretation of the situation. Hence, reports differ not only in terms of data, but also in terms of how the analyst interprets the scene, according to its own knowledge. While this collection is a valuable resource, domain experts willing to have access to reports are faced with the complexity of documents that are highly heterogeneous and possibly interdependent of each other. Thus, it is essential for maritime domain practitioners to rely on systems that are able to provide various strategies to retrieve documents related to maritime incidents they are working on.

The third article "Ontologies to Lead Knowledge Intensive Evolutionary Algorithms" shows that the use of knowledge engineering can greatly enhance the definition of an evolutionary algorithm for a real case. The project is developed in a health care system environment, specifically oriented to the transportation of patients, normally from or to some health care center. The need to develop a specific application arises from the fact that companies that take care of the logistics of the trips must manage a large number of requirements and restrictions when making an itinerary. The problem consists in satisfying the daily requests of the patients while maximizing the benefits, minimizing the costs and fulfilling different legal constraints. The requests are basically for pick-ups and/or deliveries of the patients to or from their house to some health care center. There are different types of vehicles than can be used for a journey and each of them has an associated cost. There are also the costs for the assignment of a crew, composed by a set of one or two employees, to a given vehicle or for a given patient. The legacy software environment, in particular the conceptual model of the information system, represents a body of knowledge and skills within the transportation company, which should be used in the implementation of the optimization module. To take all these constraints into account, the authors propose a methodology centered on an extended domain ontology for the definition of knowledge-intensive evolutionary algorithms, whose parameters and constraints represent a huge volume of structured data.

The article "The Conceptual MADE Framework for Pervasive and Knowledge-Based Decision Support in Telemedicine" deals with telemedicine services, which are widely regarded as offering huge opportunities for supporting patient empowerment and patient self-management, enabling the control of the disease management process to be placed close to the patient. At the same time, it is well recognized within the medical community that the adoption of clinical practice guidelines, which document the current best clinical practice as supported by the latest scientific evidence, can improve and ensure the quality of patient care by facilitating adherence to proven best practice. Therefore, as part of the European project MobiGuide (http://www.mobiguide-project.eu), which aims to provide knowledge-based decision support to patients whenever necessary, the authors apply body area networks not only to telemonitoring, but also for providing pervasive decision support to patients based on the best available clinical knowledge derived from clinical guidelines. Therefore, to enable pervasive and knowledge-based decision support to be provided in telemedicine, a conceptual

framework was developed for modelling and executing clinical knowledge as networks of four types of concurrent processes: Monitoring (M), Analysis (A), Decision (D) and Effectuation (E). In this way, the required decision support functionality can, as presented in this article, be distributed at run-time by mapping different portions of the knowledge across the devices constituting the system. This MADE framework was applied to model a clinical guideline for gestational diabetes mellitus and to derive a prototype knowledge-based system that executes the resulting MADE network. Thus it is shown to support the full development trajectory of a telemedicine system, including analysis, design and implementation.

Finally, in the article "Supporting Robot Task Planning in Deterministic and Probabilistic Conditions by Using Semantic Knowledge Base", a method is proposed to increase the reliability of generating symbolic plans by extending the Semantic Knowledge Based (SKB) plan generation system (i.e. the system which depends on semantic knowledge base and semantic actions model to generate the plans) to take into account the amount of information and uncertainty related to existing objects, their types and properties, as well as their relationships with each other. This approach constructs plans by depending on probabilistic values, which are derived from statistical relational learned models such as Markov Logic Networks (MLN). In fact, generating plans in real world environments using a mobile robot planner is a challenging task due to the large amount of information, uncertainty and dynamics in the robot environment. Therefore, task planning should take in consideration these issues when generating plans. The ability of a robot to reliably generate plans for its tasks and detect failures is essential to its performance and autonomy. The use of domain semantic knowledge has been proposed as a source of information for deriving implicit information and generating semantic plans.

The Special Issue has highlighted semantic technologies as a core enabling technology in decision making in a variety of domains. The added value is in the improved quality of the decision making process due to the richness of the additional knowledge sources, organized on semantic basis, which allows more alternatives to be explored. In addition, the use of semantics provides computational support to fully explore, trace and justify the rationale of the recommended decisions.

The Guess Editors wish to thank all contributing authors as well as the Editorial staff of the Journal for providing the opportunity to compile this Special Issue. We hope that the Special Issue will be received with interest by the readers of the International Journal of Knowledge and Systems Sciences.

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