Guest Editorial

Special Issue: Intelligent Engineering Techniques for Knowledge Bases

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Knowledge bases are encountered in different AI areas such as configuration, planning, diagnosis, semantic web, game playing, and others. Very often the amount and arrangement of the elements in the knowledge base outstrips the capability of a knowledge engineer to survey them and to efficiently perform maintenance operations – a situation that triggers an enormous demand of extending and improving existing development and maintenance practices. The goal of this AI Communications Special Issue on “Intelligent Engineering Techniques for Knowledge Bases” is to show novel and innovative research related to different knowledge engineering tasks. The major topics of the special issue include aspects of knowledge evolution, automated knowledge base repair, consistency maintenance, knowledge acquisition, and knowledge representation.

The paper on “Challenges of Knowledge Evolution in Practice” by Andreas Falkner and Alois Haselböck provides an overview of major challenges in industry related to knowledge evolution which are, for example, knowledge base redesign, schema evolution, upgrade of configuration instances, adaptation of the solver, and the maintenance of test suites. On the basis of the PartnerUnits problem, the authors discuss advantages and disadvantages of different configuration knowledge representations such as Generative Constraint Satisfaction and UML/OCL.

In their paper on the “Automated Repair of Scoring Rules in Constraint-Based Recommender Systems”, Alexander Felfernig, Stefan Schippel, Gerhard Leitner, Florian Reinfrank, Klaus Isak, Monika Mandl, Paul Blazek, and Gerald Ninaus introduce an approach to the automated repair of constraint sets which are representing scoring rules dedicated to the determination of rankings for alternative recommendations calculated by knowledge-based recommenders.

The paper on “Maintaining Consistency in a Robot’s Knowledge-Base via Diagnostic Reasoning” written by Stephan Gspandl, Ingo Pill, Michael Reip, and Gerald Steinbauer deals with the challenges of real-world deployments of autonomous robots. Such challenges are, for example, error-prone action outcomes, inaccurate sensor perception, and exogenous events that easily lead to inconsistencies between the actual real-world situation and the internal representation of the autonomous robot. Gspandl et al. introduce a belief management system
that is capable of handling different fault types. On the basis of an empirical study the authors show the applicability of their approach in terms of a significantly increased number of successfully completed robot missions.

In their paper on “Beyond Physical Product Configuration - Configuration in Unusual Domains” Lothar Hotz and Katharina Wolter discuss different characteristics of configuration knowledge representations in the context of non-pure physical products. The authors introduce two case studies (scene interpretation and software-intensive systems) and discuss major criteria for enabling configuration problem solving beyond pure physical products.

The paper “On Rule Systems Whose Consistency Can be Locally Maintained” by Guy Narboni introduces a constraint-based rule representation language which allows the assurance of global consistency solely on the basis of determining local consistency. This approach allows for a search-free determination of solutions for given product configuration problems. The applicability of the presented concepts is shown on the basis of a working example from the domain of car configuration.

In their paper on “Sigma: An Integrated Development Environment for Formal Ontology” Adam Pease and Christoph Benzmüller introduce their development environment for logical theories (Sigma). This environment has been applied for the development and maintenance of the open ontology SUMO (Suggested Upper Merged Ontology). In this paper the authors focus on an in-depth discussion of their experiences when applying Sigma and discuss major properties of the Sigma approach to knowledge base analysis and debugging.

The paper on “WeCoTin - a Practical Logic-based Sales Configurator” by Juha Tiihonen, Mikko Heiskala, Andreas Anderson, and Timo Soininen introduces a commercialized environment for the development and maintenance of knowledge-based configurator applications. Beside an in-depth discussion of the underlying knowledge representation (weight constraint rules) and the major components of the configuration environment, the authors provide an in-depth analysis of the size and complexity of the configuration knowledge bases developed with WeCoTin.

Finally, in their paper “On Classification and Modeling Issues in Distributed Model-based Diagnosis” Franz Wotawa and Ingo Pill are discussing knowledge representation aspects in distributed system diagnosis. The authors formally characterize diagnosis problems in distributed settings and provide an in-depth analysis of corresponding theoretical properties.
Summarizing, the papers of this AI Communications special issue exhibit the discipline of knowledge engineering as a very active field of research with new and challenging application domains and corresponding research questions also attracting a remarkable industrial interest.

Bios of co-editors:

Alexander Felfernig is professor at the Graz University of Technology (Austria). His research interests include knowledge engineering in intelligent systems development (configuration and recommendation knowledge bases), intelligent user interfaces for knowledge-based applications, and psychological issues in intelligent systems development. Furthermore, he is one of the Managing Directors of ConfigWorks, a company which focuses on the development and deployment of innovative knowledge-based recommendation technologies. Alexander Felfernig is author of many papers accepted in international journals and conferences. Furthermore, he is co-organizer of international workshops/conferences in the areas of recommender & configuration systems. In 2006 he initiated the Recommender Systems Workshop at ECAI, in 2009 he was the program co-chair of the ACM International Conference on Recommender Systems.

Franz Wotawa is professor of software engineering at the Graz University of Technology and Dean of the Computer Science Faculty. In 2003 he founded the Institute for Software Technology and served from 2003 to 2009 as the head of the institute. His research interests include model-based and qualitative reasoning, theorem proving, mobile robots, verification and validation, and software testing and debugging. Currently, Franz Wotawa works on applying model-based diagnosis to software debugging and automated test-case generation as well as on program repair. During his career Franz Wotawa has written more than 200 papers for journals, books, conferences, and workshops. He has supervised 55 master and 21 PhD students. Franz Wotawa has been member of a various number of program committees and has organized several workshops as well as special issues of journals. He is member of IEEE Computer Society, ACM, AAAI, the Austrian Computer Society (OCG), and the Austrian Society for Artificial Intelligence.