Invited Talks

Ontology-Based Monitoring of Dynamic Systems

Franz Baader, TU Dresden

Our understanding of the notion "dynamic system" is a rather broad one: such a system has states, which can change over time. Ontologies are used to describe the states of the system, possibly in an incomplete way. Monitoring is then concerned with deciding whether some run of the system or all of its runs satisfy a certain property, which can be expressed by a formula of an appropriate temporal logic. I consider different instances of this broad framework, which can roughly be classified into two cases. In one instance, the system is assumed to be a black box, whose inner working is not known, but whose states can be (partially) observed during a run of the system. In the second instance, one has (partial) knowledge about the inner working of the system, which provides information on which runs of the system are possible.

In this talk, I will review some of our recent research that investigates different instances of this general framework of ontology-based monitoring of dynamic systems. I will also sketch possible extensions towards probabilistic reasoning and the integration of mathematical modeling of dynamical systems.

Franz Baader has been a full professor of theoretical computer science at TU Dresden since 2002, and dean of the Faculty of Computer Science of TU Dresden since 2012. He obtained his PhD in computer science at the University of Erlangen in 1989. He was a senior researcher at the German Research Centre for Artificial Intelligence (DFKI) in Kaiserslautern and Saarbrücken for four years, and associate professor of theoretical computer science at RWTH Aachen for eight years. His main research area is logic in computer science and artificial intelligence, in particular knowledge representation (description logics, modal logics, ontologies) and automated deduction (term rewriting, unification theory, combination of decision procedures). He was program chair of the KI'01, CADE'03, LPAR'04, and RTA'07 conferences, is an editorial board member of several journals in AI and logic in computer Sscience, and has published more than 200 refereed articles in major journals and conferences. He is a member of the Academia Europaea and an ECCAI fellow, and was for twelve years president of CADE Inc., the organization that runs the International Conference on Automated Deduction.

Knowledge Representation Meets Computer Vision: From Pixels to Symbolic Activity Descriptions

Tony Cohn, University of Leeds

While the fields of KR and computer vision have diverged since the early days of AI, there have been recent moves to re-integrate these fields. I will talk about some of this work, focusing on research from Leeds on building models of video activity from video input. I will present techniques, both supervised and unsupervised, for learning the spatio-temporal structure of tasks and events from video or other sensor data, particularly in the case of scenarios with concurrent activities. The representations exploit qualitative spatio-temporal relations which have been an active area of research in KR for a number of years. I will also talk about the problem of robustly computing symbolic descriptions from noisy video data. Finally, I will show how objects can be functionally categorised according to their spatiotemporal behaviours.

Tony Cohn holds a personal chair at the University of Leeds, where he is professor of automated reasoning and director of the Institute for Artificial Intelligence and Biological Systems. His work on knowledge representation and reasoning has a par-

ticular focus on qualitative spatial/spatio-temporal reasoning, the best known being the well cited region connection calculus (RCC). His current research interests range from theoretical work on spatial calculi and spatial ontologies, to cognitive vision, modeling spatial information in the hippocampus, and detecting buried underground assets (e.g. utilities and archaeological residues) using a variety of geolocated sensors. He has been chairman or president of SSAISB, ECCAI, KR inc, the IJCAI Board of Trustees and is presently editor-in-chief of the AAAI Press, *Spatial Cognition and Computation,* and the *Artificial Intelligence* journal. He was elected a founding Fellow of ECCAI, and is also a Fellow of AAAI, AISB, the BCS, and the IET. Work from the Cogvis project won the British Computer Society Machine Intelligence prize in 2004, and the VAULT system from his Mapping the Underworld project won a 2012 IET Innovation Award.

Datalog+/–: Questions and Answers

Georg Gottlob, University of Oxford

Datalog$^{+/?}$ is a family of languages for knowledge representation and reasoning. These languages extend Datalog with features such as existential quantifiers, equalities, and the falsum in rule heads, and, at the same time, applies restrictions to achieve decidability and tractability. After a general overview of the Datalog$^{+/?}$ family, this talk will focus on more recent issues. Among other things, I will report on the combination of the two main decidability paradigms guardedness and stickiness, yielding the Tame Fragment, and on incorporating non-monotonic negation and disjunction into Datalog+/–:. I will also report about a special version of Datalog$^{+/?}$ suitable for reasoning with reverse-engineered UML class diagrams, and about the TriQ language that expresses SPARQL with entailment regimes.

Georg Gottlob is a professor of informatics at Oxford University, a Fellow of St John's College, Oxford, and an adjunct professor at TU Wien. His interests include knowledge representation and reasoning including ontological reasoning, logic and complexity, database theory, graph decomposition techniques, and web data extraction. Gottlob has received the Wittgenstein Award from the Austrian National Science Fund, is an ACM Fellow, an ECCAI Fellow, a Fellow of the Royal Society, and a member of the Austrian Academy of Sciences, the German National Academy of Sciences, and the Academia Europaea. He chaired the Program Committees of IJCAI 2003 and ACM PODS 2000. He is currently a member of the editorial boards of *CACM* and *JCSS*. He was the main founder of Lixto (www.lixto.com), a company that provides tools and services for web data extraction which was recently acquired by McKinsey & Company. Gottlob was awarded an ERC Advanced Investigator's Grant for the project DIADEM: Domain-centric Intelligent Automated Data Extraction Methodology project. More information on Georg Gottlob can be found on his Web page (www.cs.ox.ac.uk/people/georg.gottlob).

Great Moments in KR Talk

Situation Calculus: The Last 15 Years

Sheila McIlraith, University of Toronto

In 2001 Ray Reiter published his seminal book, *Knowledge in Action: Logical Foundations for Specifying and Implementing Dynamical Systems*. The book represented the culmination of 10 years of work by Reiter and his many collaborators investigating, formalizing, and extending the situation calculus, first introduced by John McCarthy in 1963 as a way of logically specifying dynamical systems. While researchers continue to extend the situation calculus, it has also seen significant scientific deployment to aid in the specification and implementation of a diversity of automated reasoning endeavors including diagnosis, web services composition and customization, and nonclassical automated planning. In this talk I will examine the important role the situation calculus has more recently been playing in explicating nuances in the logical specification and realization of some of these diverse automated reasoning tasks.

Sheila McIlraith is a professor in the Department of Computer Science, University of Toronto. Prior to joining the University of Toronto, she spent six years as a research scientist at Stanford University, and one year at Xerox PARC. McIlraith's research is in the area of knowledge representation and automated reasoning, with specific interest in reasoning

about dynamical systems and decision making in its many guises. She has 10 years of industrial research and development experience developing artificial intelligence applications. McIlraith is a fellow of AAAI and a past associate editor of the journal *Artificial Intelligence.* She is past program cochair of the 13th International Conference on Principles of Knowledge Representation and Reasoning (KR2012), and the International Semantic Web Conference (ISWC2004). In 2011 she and her coauthors were honored with the SWSA 10-year Award, recognizing the highest impact paper from the International Semantic Web Conference, 10 years prior. Her research has also made practical contributions to the development of next-generation space systems and to emerging web standards.