Cape-KR 2024

Invited talks and tutorials

Monday 29 January 2024

11:00-12:00 & 14:00-15:00

Inductive reasoning, conditionals, and belief revision

by **Gabriele Kern-Isberner, TU Dortmund**

(partly joint work with Wolfgang Spohn, University of Konstanz)

This talk/tutorial presents a broad view on inductive reasoning by embedding it in theories of epistemic states, conditionals, and belief revision. More precisely, we consider inductive reasoning as a specific case of belief revision on epistemic states which include conditionals as a basic means for representing beliefs. We present a general framework for inductive reasoning from conditional belief bases that also allows for taking background beliefs into account, and illustrate this by probabilistic reasoning based on optimum entropy as well as by ranking- theoretic reasoning based on so-called c-revisions. We illustrate the constructive usefulness of our approach, as well as its integrating power.

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Tuesday 30 January 2024

09:30-10:30 & 11:00-12:00

Knowledge Representation and Databases: well-founded approaches

by **Enrico Franconi, Free University of Bozen**

Using a classical logic setting, I will introduce the formalisation of knowledge bases, databases, and their interoperability. Starting from the classical formalisation of databases and knowledge bases from database theory, I will introduce the notion of query answering in the various approaches. I will then focus on the notion of knowledge representation as the basis for describing conceptual models, and how conceptual models can be formally reverse engineered from databases. I will also mention views and view updates, based on the notion of lossless transformations of knowledge bases.

Wednesday 31 January 2024

09:00-10:00

Comparing SHACL and OWL from the Perspective of Description Logics

by **Mantas Simkus, TU Wien**

SHACL and OWL are two prominent standards of W3C for managing graph-structured data on the Web. These two languages are designed for different purposes, yet they also have significant commonalities. Specifically, SHACL is designed for expressing constraints and performing validation of graph-structured data, while OWL is geared towards describing general knowledge about problem domains and enabling automated reasoning over datasets containing graph-structured data. The goal of this talk is to discuss the differences and the commonalities of SHACL and OWL by employing the framework of Description Logics (DLs). We will recall the well-known connection between DLs and OWL, and then focus on showing how SHACL can be positioned in the context of DLs. Specifically, we will discuss some of the efforts to clarify the semantics of (recursive) SHACL, the connection between SHACL and DL terminologies, the efforts obtain new formalisms that combine SHACL and OWL, and the new methods for explaining and possibly repairing constraint violations in SHACL.

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Thursday 1 February 2024

09:00-10:00

On belief update according to Katsuno & Mendelzon: Novel insights.

by **Eduardo Fermé, University of Madeira**

Abstract: The aim of Belief Change Theory is to provide a formal framework for understanding how an agent's beliefs evolve in response to new evidence. Over the past 35 years, various operators have been proposed to handle different types of situations and evidence. The core of this theory consists of belief revision operators, which are designed to update an agent's beliefs based on more reliable evidence. The standard model is the AGM revision, proposed by Alchourrón, Gärdenfors and Makinson.

Another important class of operators are update operators proposed by Katsuno and Mendelzon in 1991 (KM-update). The difference between revision and update operators is that revision operators aim to correct an agent's beliefs, whereas update operators aim to incorporate the results of a change in the world, without presuming that the agent's previous beliefs were incorrect. This difference is often summarized as belief revision being concerned with changing beliefs in a static world, while update is concerned with the evolution of beliefs in a dynamic world.

In this presentation, we will showcase recent research that revolves around the KM-update model of belief change.

The interconnection between KM update and AGM revision. We will examine the relationship between these two approaches.

The relation with Erasure and constructive methods for KM update

The iteration of update. We will explore the methodology of incorporating iterative updates, drawing inspiration from the work of Darwiche and Pearl of iterated AGM revision.

KM-update assumes that any situation can be updated into one satisfying that input, which is unrealistic. We propose and characterize a model where not all the inputs are "reachable". The model's efficacy in accurately capturing changes occurring in the world.

By delving into these areas, we aim to provide a comprehensive understanding of KM-Update and its associated research developments.

Thursday 1 February 2024

11:00-12:00

How to Agree to Disagree: Managing Ontological Perspectives using Standpoint Logic

by **Sebastian Rudolph, TU Dresden**

The importance of taking individual, potentially conflicting perspectives into account when dealing with knowledge has been widely recognised. Many existing ontology management approaches fully merge knowledge perspectives, which may require weakening in order to maintain consistency; others represent the distinct views in an entirely detached way. This talk presents an alternative, referred to as Standpoint Logic, a simple, yet versatile multi-modal logic “add-on” for existing KR languages intended for the integrated representation of domain knowledge relative to diverse standpoints, which can be hierarchically organised, combined, and put in relation with each other.

Starting from the generic framework of First-Order Standpoint Logic (FOSL), we first present the fragment of so-called sentential formulas, for which we provide a polytime translation into the standpoint-free version. This result yields decidability and favourable complexities for several decidable fragments of first-order logic, including the very expressive description logic SROIQbs underlying the OWL 2 DL ontology language. By virtue of this, existing highly optimised OWL reasoners can be used to provide practical reasoning support for ontology languages extended by standpoint modelling.

Shifting our focus to tractable lightweight formalisms of enhanced scalability, we present Standpoint EL+, a standpoint extension of the popular description logic EL. Satisfiability in this logic is in PTime thanks to a satisfiability-checking deduction calculus that allows for a implementation in Datalog.

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Friday 2 February 2024

09:00-10:00

Foundations of logic programming semantics: an operator-based perspective

by **Jesse Heyninck, Open Universiteit Heerlen**

Logic programming is one of the most popular and successful KR-languages, and offers efficient solvers, paradigmatic applications, and a host of extensions and tools. Even though the answer set semantics has been consolidated as the main semantics for logic programming, other interesting semantics exist, and extending the answer set semantics beyond the core language fragment often proves challenging.

This tutorial offers an account of the semantics of logic programming from the perspective of approximation fixpoint theory (AFT). We will survey the main ideas behind this theory, using normal logic programs as a leading example. Furthermore, it is demonstrated how the framework allows defining semantics for extensions to normal logic programs, such as disjunctive, aggregate or choice logic programs, or autoepistemic logic.