SIKS-course “Knowledge Representation & Reasoning:
Foundations and Applications”

DATE: April 9-10, 2018
**LOCATION**: [Mitland Hotel](http://www.mitland.nl/) , Utrecht

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*Monday, April 9*

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10.00 - 12.00   Modal logic for Representing Knowledge and Reasoning in Games,

by dr. ir. Jan Broersen (UU, filosofie)

This lecture will start out with a brief introduction of modal logic, assuming basic knowledge of propositional logic. The use of modal logic as a knowledge representation formalism will be motivated and demarcated. We will then turn our attention to interacting agents as studied in game-theory and will study the application of modal logic in this field. In this context we will consider the problem of assigning responsibility for outcomes of interactions in games, devoting special attention to the notion of responsibility ‘voids’.

12.00 - 13.00  *lunch*

13.00 – 15.00 Semantics on the Web by dr. Klaas Andries de Graaf (VU)

This lecture discusses the requirements for shared meaning on the Web and introduces the syntactic and semantic foundations of a family of Web-based knowledge representation languages known as Semantic Web Technology.
After this lecture, you will have basic knowledge of URIs, RDF, RDFS, OWL, inferencing and SPARQL. The lecture includes hands-on practice in which
you build a model (an 'ontology') for information in some domain, and apply logic/reasoning rules to inferred knowledge.

15.00 – 15.15 *break*

15.15 – 17.15 Linked Open Data by dr. Ali Khalili (VU)

Within the course, we will present Linked Data as a set of best practices for publishing and connecting structured data on the Web. These best practices have been adopted by an increasing number of data providers over the past years, leading to the creation of a global data space that contains many billions of assertions – the Web of Linked Data. The presentation will cover the following topics:

* Linked (Open) Data Principles
* Linked Data Lifecycle
* An overview on Linked Data Cloud
* DBpedia and its applications

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*Tuesday, April 10*

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09.30 -11.30 Bayesian networks for reasoning under uncertainty dr. Silja Renooij (UU)

In this tutorial, Bayesian networks as framework for representing and probabilistic reasoning in complex problem domains are explained. The importance of probabilistic independence and how this is exploited is presented, as well as a simple algorithm for computing probabilities from a Bayesian network. The benefits and drawbacks of the Bayesian network graph are discussed, both from a computational and a knowledge representation perspective. Finally, acknowledging that a model is never perfect, sensitivity analysis as a tool for studying the effects of model inaccuracies is considered.

11.30 - 11.45  *Break*

11.45 - 12.30   Causal Reasoning (part 1) by dr. Thijs van Ommen (UvA)

A large part of human reasoning is causal: it considers not just passive observation, but also what would happen if we were to take some action. In this tutorial, we will look at the formalization of reasoning about cause and effect, following Judea Pearl's framework. Building on the theory of Bayesian networks, we will see what assumptions are needed to draw causal conclusions. We will also look at some specific rules for causal reasoning, such as the do-calculus for reasoning about perfect interventions, and the back-door criterion for covariate adjustment in causal prediction.

12.30 - 14.00   *lunch*

14.00 – 14.45 Causal Reasoning (part 2) by dr. Thijs van Ommen (UvA)

14.45 - 15.00  *break*

15.00 - 17.00  Qualitative Modelling and Reasoning by dr. Bert Bredeweg (UvA)

Humans continuously reason about the systems that surround them. This kind of reasoning is sometimes referred to as common-sense reasoning, partly because it is often intuitive and because humans do not use any numerical information to do so. Similarly, experts (physicists, engineers, biologists, etc.) use conceptual knowledge when explaining or arguing about system behaviour, even when data is abundant. A key challenge is to understand this kind of reasoning and to create means for automating it using computers.

Qualitative Reasoning is at the heart of this research. It is an innovative approach within Artificial Intelligence that involves non-numerical descriptions of systems and their behaviour, preserving all the important behavioural properties and distinctions. It has been applied successfully to problems in the automotive industry, to aeronautics and spacecraft, thermodynamics, and ecology. In addition to real-world applications the research focuses on cognition and education; explaining human reasoning and developing means to support and enable this ability.