Artificial Intelligence
Nadim Obeid

Description

One of the central concerns of Artificial Intelligence is the design and implementation of intelligent/autonomous agents – intelligent entities that perceive their environment, reason, plan and execute appropriate actions to achieve their goals and have social abilities that allow them to communicate and interact with other agents.

The field of Knowledge Representation (KR) lies at the intersection of (at least) Artificial Intelligence and Information Management. KR is the attempt to provide rich representations of the world that supports building programs that are sensitive to the world via these representations. KR has been used to build expert and diagnostic systems, speech recognizers, games, automated planners, etc. and is the foundation of the Semantic Web which is an attempt to remake the World Wide Web so that the content is accessible not only to human beings, but to sophisticated artificial agents.

Students are expected to acquire a good understanding of the logical foundations of Knowledge Representation and Reasoning as well as to become familiar with current research trends in the field.

In this course, we will explore various formalisms for KR primarily focusing on classical first order logic and logics that depart from first order logic, such as defeasible (nonmonotonic) logic and/or description logic. Furthermore, we discuss logic formalisms which are designed for representing and reasoning about dynamical domains such as the situation calculus.

This course touches on logical models of agency, agent communication languages, multi-agent protocols and issues in agent architecture such as reasoning about action and planning.

Learning outcomes

Students are expected to:

- understand the fundamental principles of logic-based Knowledge Representation;

- be able to model domains in a logic-based language;

- understand the notion of a reasoning task;

- master the fundamentals of the reasoning algorithms underlying current systems;

- understand the fundamental tradeoff between representation power and computational properties of a logic-based representation language;

- be aware of several widely used knowledge representation languages; and

- understand how the theoretical material covered in the course is currently being applied in practice.

Instructor
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Lectures
Monday: 11 to 12:30 and Wednesday: 11 to 12:30.

Schedule

- week1-2: Introduction Artificial Intelligence, Autonomous Agents and Multiagent Systems.

- week3-week5: First-Order Logic, Second-Order Logic.

- week6-week7: Logic Programming (Prolog)

- week8-week10: Description logic

- week11-week13: Default logic and defeasible logic

- week13-week14: Situation Calculus (Ontology, Axiomatizing Actions, Qualification Problem, Frame Problem), Reasoning About Action in the Situation Calculus.

References
(1) Wooldridge M., An Introduction to Multiagent systems, Wiley, 2002.

(2) Reiter, R., Knowledge in Action: Logical Foundations for Specifying and Implementing Dynamical Systems, MIT Press, 2001.

(3) Ronald J. Brachman and Hector J. Levesque, Knowledge Representation and Reasoning, Elsevier/Morgan Kaufmann, 2004.