

Knowledge Representation and Multiagent Systems

Ulle Endriss

Institute for Logic, Language and Computation

University of Amsterdam

Knowledge Representation

KR is one of the fundamental topics at the very core of AI.

The research area of KR is concerned with the question of how to *encode* information using formal (symbolic) languages, how to *structure* such knowledge, and how to perform *inference* over it.

Topics of interest include:

- *epistemic logic*: modelling of knowledge and belief
- modelling of *uncertainty* and *vagueness*
- representation of and reasoning about *preferences*

Multiagent Systems

MAS consist of *autonomous agents* that interact, to further their own interests (*competition*) or in pursuit of a joint goal (*cooperation*).

While classical AI concentrates on modelling (specific aspects of) single agents, the reserch area of MAS puts the focus the interaction between different agents and on harnessing this potential.

Topics of interest include:

- *logics* for modelling agents (beliefs, desires, strategies, ...)
- *communication languages* and *interaction protocols*
- *economic paradigms*: negotiation, voting, game theory, ...

Example: Judgment Aggregation

Suppose three robots are in charge of climate control for this building. They need to make judgments on p (*the temperature is below 17° C*), on q (*we should switch on the heating*), and on $p \rightarrow q$.

	p	$p \rightarrow q$	q
Robot 1:	Yes	Yes	Yes
Robot 2:	No	Yes	No
Robot 3:	Yes	No	No

Related Research at the ILLC

Examples for recent work on judgment aggregation (JA):

- studying the *computational complexity* of decision problems arising in JA, e.g., the safety of the agenda (JAIR-2012)
- designing *new consistent/low-complexity/fair rules* for JA, e.g., based on the idea of a “most representative voter” (AAAI-2014)
- designing practical methods for aggregating human judgments collected through *crowdsourcing*, e.g., to provide high-quality annotated corpora for NLP researchers (COLING-2014)

U. Endriss, U. Grandi, and D. Porello. Complexity of Judgment Aggregation. *Journal of Artificial Intelligence Research (JAIR)*, 45:481–514, 2012.

U. Endriss and U. Grandi. Binary Aggregation by Selection of the Most Representative Voter. Proc. 28th AAAI Conference on Artificial Intelligence, 2014.

C. Qing, U. Endriss, R. Fernández, and J. Kruger. Empirical Analysis of Aggregation Methods for Collective Annotation. Proc. 25th International Conference on Computational Linguistics (COLING-2014).