Seminar: Logics in AI

May 3, 2018

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The Objective

Logics have been developed in large variety for artificial intelligence (AI). Among them are so-called non-monotonic logics that are especially useful in dealing with new information that can contradict previous knowledge. In cognitive science there has been recently a turn towards applying such logics to model human inferences, i.e. predicting human responses. In this seminar we will focus on non-monotonic logics and some findings from psychology and ask, if it is possible to model these findings by these logics. This seminar continues the successful seminar series consisting of self-study parts (i.e., the assigned logics and the psychological phenomena) and developing and defending an own approach (e.g., showing why or why not a logic can model the inferences).

Cognitive Modeling is a research discipline at the boundary of psychology and natural sciences such as computer science, which aims at explaining human behavior on a computational level. Apart from matching the observable properties of human cognition as closely as possible, cognitive modeling is invested in the advancement of a general understanding of cognition. Instead of relying solely on abstract mathematical formalization such as neural networks, models are supposed to offer a means of interpretation while striving for functional equivalence to the mental processes.

Requirements

This block seminary will take place on May 22rd-23th, 09:00-17:00. Presence is mandatory. Requirements:

1. Study the introductory articles:
    - M. R., C. Eichhorn, and G. Kern-Isberner. Simulating human inferences in the light of new information: A formal analysis. In Subbarao Kambhampati, editor, Proceedings of the Twenty-Fifth International Joint Conference on Artificial Intelligence (IJCAI16), pages 26042610, Palo Alto, CA, USA, 2016. AAAI Press. [Demonstrates how the different logics can/can't explain the Suppression Task]
    - R., Kola, Johnson-Laird (2017). Wason Selection Task: A Meta-Analysis. In G. Gunzelmann, A. Howes, T. Tenbrink, & E. J. Davelaar (Eds.), Proceedings of the 39th Annual Conference of the Cognitive Science Society (pp. PAGES).

Austin, TX: Cognitive Science Society.
mindmodeling.org/cogsci2017/papers/0192/paper0192.pdf

- Your assigned logic paper (or the slides of the lecture knowledge representation and reasoning)

2. Register in HiSinOne for the seminar
3. Answer the following questions by May 5th
   - Can you model the aggregated results of the Wason Selection Task by propositional logic? If so, how, if not why not (proofs!)
4. Study your respective logic (Reiters Default Logic, System P, ϵ-entailment of System P, Weak Completion Semantics,OCF)
5. Prepare a 10 min presentation explaining the respective logic
   - Explain the theory with examples
   - Describe the theory on an algorithmic level
6. Think about these questions in your assigned group of three students:
   - Can your logic explain the results on an aggregated level?
   - Can your logic explain the results on an inter-individuel level (see data in repository)?
7. Develop and implement your logics inferences and to explain it in a presentation (20 min per student).
   - Develop a flowchart describing the core processes
   - Describe your implementation on an algorithmic level
   - List all additional assumptions required for your implementation
   - Discuss possible improvements of your model
   - Pro/Cons of the theory
   - Think about the scope of your theory: Can it predict single participant answers?
   - Your presentation must be a single PDF document.
8. Present (5) and (7) with slides (30 min) during the seminar.

Timetable

Presence during the Seminar is mandatory. Submissions later that the deadlines given will not be accepted.

Event	Date	Address
First Meeting	16.04.18, 15:00	02-017, Building 101
Registration	16.-25.04.18	hisinone.uni-freiburg.de
Topic Preferences	16.-25.04.18	elfleinl@tf.uni-freiburg.de
Proofs	05.05.18	elfleinl@tf.uni-freiburg.de
Group & Topic Assignment	$<$ 3.05.18	-
Complete Presentation	17.05.18	elfleinl@tf.uni-freiburg.de
Seminar	22.-23.05.18, 09:00-17:00	SR 00-010/014, Building 101

Topics

Some logics (Topics 1, 2, 5) can be found in the lecture Knowledge Representation and Reasoning slides from the previous semesters

Topic 1: Reiter's Default Logic

- Reiter, R.: A logic for default reasoning. Artificial Intelligence 13(12), 81132 (1980)

Topic 2: System P

- Kraus, S., Lehmann, D., Magidor, M.: Nonmonotonic Reasoning, Preferential Models and Cumulative Logics. Artificial Intelligence 44(1-2), 167207 (1990)

Topic 3: Weak Completion Semantics

- Dietz, E.A., Holldobler, S.: A new computational logic approach to reason with conditionals. In: International Conference on Logic Programming and Nonmonotonic Rea- soning, pp. 265278. Springer (2015)

Topic 4: Ordinal Conditional Functions (OCFs)

- M. R., Christian Eichhorn, and Gabriele Kern-Isberner. Simulating human inferences in the light of new information: A formal analysis. In Subbarao Kambhampati, editor, Proceedings of the Twenty-Fifth International Joint Conference on Artificial Intelligence (IJCAI16), pages 26042610, Palo Alto, CA, USA, 2016. AAAI Press.

Topic 5: ϵ-entailment

- Chapter: 10.2 in J. Pearl, Probabilistic Reasoning in Intelligent Systems: Networks of Plausible Inference, Morgan Kaufmann, San Mateo, CA, 1988.
- Benferhat, S., Saffiotti, A., and Smets, P. (2000). Belief functions and default reasoning. Artificial Intelligence, 122(1-2), 1-69.

Additional notes regarding the presentation

- There is a presentation on 'How to give a Presentation': ais.informatik.uni-freiburg.de/teaching/ws16/seminar_robotnav/GivingAPresentation.pdf.
- There is also a lecture where you can learn about giving presentations: gki.informatik.uni-freiburg.de/teaching/ws1718/prosem/index_de.html