Cognitive Logics

Features, Formalisms, and Challenges

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The Problem

- Systems of tomorrow will closely interact with humans and demonstrate features of human information processing
- But: Process of human reasoning is exception tolerant, robust, flexible, and demonstrate common sense
- Systems of today often do not demonstrate this ...

Reverse Engineering

Given: Problems consisting of premises (input) and conclusions (output)

Question: Which inference system built on general cognitive features generates the respective output for the given input?

Cognitive Logics

Logic-based formalisms that are:

- cognitively adequate
- incorporates principles of human rationality specifics of human inference processes
- and is empirically validated

A Transdisciplinary Field

Injects cognition into formal inference systems:

Data Side: Extract phenomena from psychological experiments to check cognitive adequacy

Formal side: A ground language to compare formalisms and to evaluate them on empirical data and cognitive principles

Evaluation measure: Different measures (beyond inferential adequacy, e.g., intermediate step correspondence)

Example

Analysis of prominent formal systems:

- System P
- Reiter's default logic
- Logic programming under the weak completion semantics
- System Z
- c-representations

Selection of Challenges

- Which formal principles from rationality formalized in AI are grounded in human reasoning, i.e., are cognitively-adequate?
  - Is it possible to axiomatize plausible reasoning?
- Which benchmarks problems are useful to evaluate cognitive logics?
- How can we formalize psychological theories as baseline theories to compare with cognitive logics?

Website: http://cognitive-logics.org

Evaluation framework CCOBRA: https://github.com/CognitiveComputationLab/ccobra