Perspectives on the Formal Representation of the Interpretation of Norms

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Introduction

In our society norms are communicated in natural language, and no-one has yet come up with a method that can unambiguously transfer a natural language into a formal specification that can be used by rational agents acting in a complex and dynamic environment, aiming to achieve goals fitting the agents' intentions. We use agent-based models to test the effectiveness of policies, for example in the SARNET project.

In AI and Law literature four typical approaches for representing norms have been suggested: the rule-based approach, the case-based approach, the logic-based approach and the frame-based approach. See below for a short description of the approaches.

We argue that only a frame-based approach can be used to create a transparent, explicit and formal description of the interpretation of law.

Why use norm-frames?

To create concepts that can be used as objects in a formal language, that are linked to text string in a normative source in natural language. Thus creating a basis for:
1. Linking to a specific version of normative source
2. Making implicit references to other normative sources explicit
3. Making implications of normative interpretations explicit.

The Flint-language

We use the Formal Language for the Interpretation of Normative Theories (Flint-language) to create a task independent formal description of the interpretation of normative sources.

The Flint-language is used to represent interpretations of normative sources in natural language by putting text fragments from the source into a framework based on Wesley Newcomb Hohfeld's legal relations.
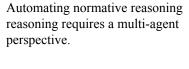
Focus

The Flint-language allows us to:
1. let those interpretations be validated by domain experts
2. allowing for translation of these interpretations into formal, explicit and functional specifications in a state and state-transition perspective
3. create representations that can be used in practice by administrative organizations
4. produce inter-coder independent models of interpretation.

Task independent interpretation and task dependent specification

An interpretation of a normative source should include the perspective of all potentially involved agents and their behavioral context. Our interpretation model, expressed in the Flint-language includes all these perspectives.

Normative reasoning is about the agents own intentions, abilities, powers and duties. Taking into account the position of all other agents involved, including possible future behavior.

Automating normative reasoning reasoning requires a multi-agent perspective.

The multi-agent perspective made explicit in our interpretation model allows for translation to a more specific perspective or task
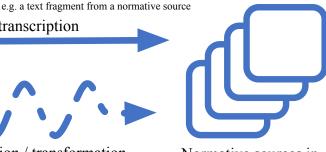

transcription

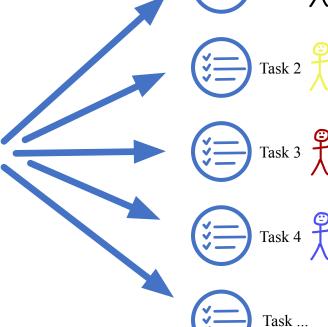Transcription: making a copy of something, e.g. a text fragment from a normative source

translation / transformation

Translation: the conversion of a text from one language to another.
Transformation: changing the form or appearance of an something.

Normative sources in natural language

Normative sources in formal language

Task 1
Task 2
Task 3
Task 4
Task ...

Examples of application domains:
1. interpretation models for checking the legal quality of Dutch immigration law and a translation to operational policy
2. interpretation models of Wage Tax and VAT
3. models for expressing policies of collaborating ISPs (SARNET)

Rule based approach

The main assumption behind the *rule-based approach* is that legislation can be represented as production rules, e.g. having the form of 'if A, then B' or 'if A, then add B'

The rule-based approach as it is used in practice, is highly pragmatic and ad-hoc. The rule-based approach has no solution for extracting formalized rules from normative sources in natural language.

Case based approach

The *case-based approach* represents laws as cases and uses cased-based reasoning techniques to reason with them. These techniques are being used to model analogical reasoning, or rather to solve actual problems (cases) by retrieving similar past cases, and use them to solve the one at hand.

Logic based approach

The *logic based approach*, is an omnipotent approach for Legal Knowledge Engineering. Logic to specify truth maintenance systems was the first formalization that could run on digital computers. Logic has been used for reasoning (modeling inferences, implementing these and analyzing their computability, or complexity), justification (is this reasoning valid), and representation (domain representation and representing ontological commitments).

Frame based approach

The *frame-based approach* for legal knowledge engineering uses text fragments from normative sources in natural language and classifies these fragments as elements of a frame. The quintessence of the frame-based approach is the transformation of a normative source in natural language into a (semi-)formal interpretation.