Using Intuitionistic Logic as a Basis for Legal Ontologies

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1. INTRODUCTION

Classical Description Logic has been widely used as a basis for ontology creation and reasoning in many knowledge specific domains. These specific domains naturally include Legal Artificial Intelligence. As in any other domain, consistency is an important issue for legal ontologies. However, due to their inherently normative feature, coherence (consistency) in legal ontologies is more subtle than in other domains. Consistency, or absence of logical contradictions, seems more difficult to maintain when more than one law system can judge a case. This is called a conflict of laws. There are some legal mechanisms to solve these conflicts, some of them stating privileged fori, other ruling jurisdiction, etc. In most of the cases, the conflict is solved by admitting a law hierarchy or a law precedence. Even using these mechanisms, coherence is still a major issue in legal systems. Each layer in this legal hierarchy has to be consistent. Since consistency is a direct consequence of how one deals with logical negation, negation is also a main concern of legal systems.

Negation and subsumption play a central role in ontology coherence. An adequate intuitionistic semantics for negation in a legal domain comes to the fore when we take legally valid individual statements as the inhabitants of our legal ontology. This allows us to elegantly deal with particular situations of legal coherence, such as a conflict of laws, as those solved by Private International Law analysis. This paper briefly presents our version of Intuitionistic Description Logic, called $\text{iALC}$ for Intuitionistic ALC (ALC being the canonical classical description logic system). We also discuss the jurisprudence foundation of our system, and show how we can perform a coherence analysis of “Conflict of Laws in Space” by means of our system $\text{iALC}$. This

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paper reports work-in-progress on using this alternative definition of logical negation for building and testing legal ontologies and reasoning in AI.

2. JURISPRUDENCE AND INTUITIONISM

One of the main problems from jurisprudence (legal theory) is to make precise the use of the term “law”. In fact, the problem of individuation, namely, what counts as the unit of law, seems to be one of the fundamental open questions in jurisprudence. Any approach to law classification requires firstly answering the question “What is to count as one complete law?”\(^1\). There are two main approaches to this question. One is to take all (existing) legally valid statements as a whole. This totality is called “the law”. The coherence of “the law” plays a central role in this approach, whilst whether coherence is built-in by the restrictions induced by Nature in an evolutionary way, or whether it should be object of knowledge management, seems to be a long and classical debate. The other approach to law definition is to take into account all legally valid statements as being individual laws. This view, in essence, is harder to share with jurisprudence principles, since those are concerned with justifying the law. Both approaches agree with legal philosophy and jurisprudence stemming from the Legal Positivism tradition initiated by Hans Kelsen\(^2\). The latter, however, seems to be more suitable to Legal AI. It is also considered by theoreticians, at least partially, whenever they start considering ontological commitments, such as, taking some legal relations as primitive ones\(^3\), primary and secondary rule\(^4\) or even a two-level logic to deal with different aspects of law (see logic-of-imperation/logic-of-obligation from Bentham\(^5\)). In fact, some Knowledge Engineering (KE) groups pursue this approach as a basis for defining legal ontologies. We also follow this route.

It is important to note that we avoid the use of any deontic logic, since this leads to well-known contrary-to-duty paradoxes and their variants. We

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