Towards Measurable Intelligent Inference

Position paper on the future of legal argumentation with cases in AI&Law

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Introduction

Research on modeling legal argumentation with cases has explored various ways to represent cases and arguments about them. Strong connections to computational models of argument exist with regard to representation and inference/semantics. While many insights have been gained, I will argue in this short paper that, from the perspective of a potential future user of a legal-case-argumentation tool, the state of the art in the field does not yet enable the development of systems capable of drawing intelligent and useful inferences from available knowledge. In order to tackle this challenge, I advocate for a more detailed exploration of value-based/purposive reasoning and the corresponding knowledge representation problems as well as for a commitment to an implementation and empirical evaluation of developed formalisms.

Limitations of Current Knowledge and Value Representations

Formal models of legal argumentation with cases have been construed with the assumption of having certain formalized knowledge available. The most prominent representation of cases is that of dimensions/factors as originally introduced by HYPO [3] and taken further by CATO [1] and IBP [4] as well as by the theory construction model [9]. Factors/dimensions are stereotypical fact patterns in the domain of discourse and of potential relevance to the case and need to be manually encoded into the representation. However, even a significant advancement in this natural-language-processing problem of recognizing archetypical fact patterns in case descriptions would not by itself move the available formalisms into a position of making a practical contribution. This is because formal models of legal arguments with cases have not sufficiently explored how lawyers argue about *why* and *how* the presence or absence of certain facts in a case affect the decision. This standard of 'sufficiency' shall be understood as the capacity of the models and formalisms we develop to interface with related technologies to construct an intelligent application for the purpose of increasing the productivity of its user in a task related to arguing with legal cases. Aside from abundant work in legal theory and methodology, AI&Law researchers have made considerable efforts to include teleology into formal models of legal argumentation. The necessity for a system's capacity to reason substantively about teleology has been explained initially by Berman & Hafner [10] and has since been tackled in various ways. CATO introduced a hand crafted factor hierarchy to generate more complex arguments. IBP grouped factors into issues. Factors can also be associated with values [12] to make their presence and absence from cases more informative. Theory construction uses an abstract ordering of values to prioritize rules with which new cases can be decided. Such an ordering can also steer inference in value-based argumentation frameworks [6]. Recently, values have been further examined in the practical reasoning setting [5] and with regard to rule-based argumentation with thresholds [8]. Also, our work on the value judgment formalism [11] uses argumentation with values and effects on them to enhance the representation of purposive reasoning about the impact of facts and legal rules.

Beyond Factors: Exploring the Building Blocks of Value-Based Reasoning

Recent AI&Law work on argumentation with values [7] has established connections between formal models and US Supreme Court Jurisprudence (i.e. legal practice) as well as legal theory work [13], respectively. AI&Law's contribution, however, must be significantly more granular and practical than existing legal theory formalisms (such as, e.g., Alexy's work on argumentation with cases [2]) and at the same time enable practitioners to use legal expert systems to their benefit. In other words, the next generation of work on legal argumentation with cases should ideally be both computational (as opposed to purely representational) and suitable for an empirical evaluation of its achievements. I see the next step towards such a contribution in decomposing argumentation with values into its functional elements at a greater level of granularity than

current representations. Designing factor-based systems (or comparable knowledge representations) involves significant domain expertise in both encoding the factors as well as interrelating them in a meaningful way to allow for the desired level of teleological reasoning capability. It appears to be a more promising goal to explore, implement and evaluate formalisms based on patterns of value-based reasoning across legal domains and strive to assemble a vocabulary compatible with that of general purpose knowledge representations or semantic extraction from natural language. For example, in our most recent work on the value judgment formalism [11], we model argumentation about the relevance of fact patterns in cases by identifying their effects in the domain of discourse and connecting them to values. We thereby describe the relevance of legal concepts in a more general vocabulary and open up the representation towards general causal, temporal and agent-based reasoning as well as a contextual balancing of values. The needed knowledge is still immense, but may be more modular as well as easier to maintain and extend. Conceptually similar recent work exists in value-based argumentative practical reasoning [5].

Empirical Evaluation of Inference Capacity

While the correctness of predicting case outcomes can be evaluated in a straightforward way, there are no established evaluation metrics for the generation of intelligent arguments in AI&Law. The lack of data corpuses exacerbates the difficulty of developing suitable systems and conducting informative experiments. However, it should be a fruitful endeavor to discuss which inference capacity the field is striving for. Which kinds of systems do we want to build? How would their inference look like? How would a prototype be evaluated? At the same time, it will be worth to work on specifying the precise needs that a knowledge base would need to fulfill in order to allow productive system development. What kinds of ontologies would be needed? What else is necessary? Does it need to be perfect or is some degree of error tolerable? Exploring these questions may provide guidance for further developments, allow for interchange with other areas of AI and help gradually introduce a notion of empirical validity into the field.

Conclusions

In this paper, I have argued that research on modeling legal argumentation with cases in AI&Law has reached the point where a significant advancement towards a practical contribution is best facilitated if (1) representation of and argumentation with values and purposes are explored in greater detail, and (2) if these efforts are guided by a commitment to implementation and empirical evaluation. I look forward to seeing more work focusing on developing and evaluating more fine-grained representations of cases, facts, values and their interaction so that we can move closer towards systems capable of autonomously generating intelligent legal arguments with cases.

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