Defeasible Logic for Normative Reasoning

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Abstract

To tutorial will guide the attendees through the theoretical and practical development of a computationally oriented logic (defeasible logic) that proved successful in applications in the legal domain.

1 Introduction and Background

Legal Informatics has gained traction in the recent years with a growing number of legal-tech startups. However, most of the applications these startup are based on technology that is not really state of the art in the research field and only a few of them are based on legal reasoning.

Reasoning with and about norms received attention the Knowledge representation area in the last ten years or so (there are regular stream of papers in conference on Autonomous Agents and artificial intelligence), as well as dedicated conferences.

Similarly, many new logics and systems have been advanced to model legal reasoning. However, most of the work pay little or no attention to modelling of real norms and real normative systems, and how to use logical systems for real life application in the legal domain. A notable exception to this is Defeasible Logic.

Defeasible logic is a simple, flexible and efficient rule based formalism. Over the year we have successfully applied it to many aspects of legal reasoning, from negotiation [10], to modelling of contracts [3, 5], normative agents [6], norm dynamics [7, 8], business process compliance [13, 9, 12]. Some of the application resulted in application that have been successfully tested with industry scale applications [4]. Furthermore, several systems that have been applied to some ares of legal reasoning have been proved to be fragments or variants of Defeasible Logic (see [1, 11]). Finally, defeasible logic is use in a EU H2020 project on Mining and Reasoning with Legal text (http://www.mirelproject.eu) and it is used in the Regulation as a Platform and Digital Legislation project funded by the Australian Federal Government (https://digital-legislation.net, https://raap.d61.io), leading to the encoding of several Australian Acts and other legislative instruments.

The aim of the course is to provide a comprehensive introduction of theoretical foundation of defeasible logic and its variants, and to guide the attendees through the development of the logic for applications in the legal domain. The various phases of the development and will be illustrated with real life example and demonstrated with the help of applications using defeasible logic as its underlying reasoning engine. The tutorial will provide access to the online tools created in the Regulation as a Platform and Digital Legislation projects.

The course can be offered as either a foundational course or as an introductory course.

2 Outline

The outline below includes the topic to be presented. Each topic will be introduced using real life examples from existing Act and Legal Documents. I will explain what are the challenges in modelling such examples and the legal concepts and principles behind it, and I am going to show how to model in a conceptually sound way using Defeasible Logic. Also, a set of computer tools will be made available for demonstration purposes during the course.

1. Introduction to Legal Reasoning
2. Basics of Defeasible Logic
    - Intuition of the logic
    - Language
    - Proof Theory
    - Algorithms
    - Variants (e.g., ambiguity propagation vs ambiguity blocking, team defeat)
3. Defeasible Deontic Logic
    - Modelling Constitutive and Prescriptive Norms
    - Obligations and Permissions
    - Contrary-to-duty and compensatory obligations
4. Application: Business Process Compliance
    - Modelling Business Processes
    - Types of Obligations
    - Compliance Architecture and Algorithms

3 Resources

At this stage the main resources/publications are

- Guido Governatori and Antonino Rotolo. "Logics for Legal Dynamics". In: *Logic in the Theory and Practice of Lawmaking*. Ed. by Michał Araszkiewicz and Krzysztof Płeszka. Legisprudence Library 2. Springer, 2015. Chap. 12, pp. 323–356
- Shazia Sadiq and Guido Governatori. "Managing Regulatory Compliance in Business Processes". In: *Handbook of Business Process Management 2nd edition*. Ed. by Jan vom Brocke and Michael Rosemann. 2nd ed. Vol. 2. International Handbooks on Information Systems. Berlin-Heidelberg: Springer, 2015. Chap. 11, pp. 265–288
- Guido Governatori. "Practical Normative Reasoning with Defeasible Deontic Logic". In: *Reasoning Web 2018*. Ed. by Claudia d'Amato and Martin Theobald. LNCS 11078. Cham: Springer International Publishing, 2018

4 Organisation

The tutorial is meant to be for practitioners in legal informatics, reg tech start-up staff, and researchers in AIL. Given the aim of the tutorial and the material to be presented the tutorial is better to be organised over a full day, with parts (lectures) for the different topics separated by coffee-breaks and lunch.

Similar tutorials and courses have been offered, at ECAI 2016 (Tutorial on "MIning and REasoning with Legal Documents (MIREL)", European Conference on Artificial Intelligence, Den Hague, The Netherlands, 29 August 2016), as lectures in the LEX Summer School (2016) and Lecture in the Reasoning Web Summer School (2018). In those cases, the tutorial/lectures had over 25 participants. Furthermore, it is going to be offered in a course at the Law School of the University of Queensland in January 2019.

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