Compliance checking in the Semantic Web: an RDF-based conflict-tolerant version of the Deontic Traditional Scheme

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AI applied to the legal sector, known as "LegalTech", aims at developing specialized search engines or specialized virtual assistants to handle legal information. These tools are able to quickly search information from legal documents such as legislation, case law, contracts, etc., fit to guide and monitor the preparation of legal cases or due diligence documents.

These tasks involve plenty of repetitive and mechanical operations that are often highly time-consuming, tedious, and error-prone when performed by humans. By automatizing these operations via AI, law firms will save time and resources and, consequently, enlarge their customer portfolio. On the other hand, the increasing adoption of systematic and assisted reporting methodologies will positively impact the society as a whole in that it will shorten legal and auditing proceedings.

Current LegalTech systems mostly use NLP to extract information from textual legal documents and Machine Learning (ML) to replicate legal decision-making, in order to assist and speed up the work of legal practitioners.

However, ML is based on statistical reasoning. Thus, it tends to behave like a "black box" unable to explain its decisions. ML trained on biased datasets tends to replicate the same biases on new inputs, thus leading to discriminatory outcomes such as refusing a loan due to race or gender.

In order to create transparent and responsible AI systems, recent research has been devoted to explainable AI (XAI). Although explainability does not prevent biases per se, it provides human-understandable explanations to determine whether discrimination occurred. XAI is particularly relevant in LegalTech, as the application of the law must be bias-free by definition.

Many approaches to XAI require domain experts to create symbolic representations such as ontologies or logical rules. Symbolic representations enable human-understandable forms of logical reasoning in place of the statistical inferences, or possibly in combination with them.

My ongoing research is devoted to research novel methods to represent symbolic legal knowledge in RDF and SHACL. This position paper focuses on my

main current research result on this topic, a paper currently under submission on the Semantic Web journal[1].

SHACL[2] is a W3C recommendation for validating RDF knowledge graphs. Although the official recommendation only focuses on validation, there are ongoing research initiatives to also use it for inference[3]; these initiatives will likely lead to new versions of the standard. My current research claims and provides evidence that validation and inference in SHACL are intimately related and, as such, they should be carried out together.

The approach presented in the paper mentioned above models in RDF and SHACL-SPARQL rules a novel conflict-tolerant version of the well-known Deontic Traditional Scheme[4]. The approach addresses two main limitation of current research in Deontic Logic: (1) most past literature in Deontic Logic only focuses on the *propositional* level, which make them interesting only from a theoretical perspective; (2) main approaches in Deontic Logic represent conflicts as inconsistencies, which does not seem to reflect our intuitions about them. The proposed approach is based on RDF, which has first-order expressivity and, therefore, interesting also from a practical/industrial perspective. In addition, it represents conflicts via special RDF properties among (reified) deontic statements, thus capturing our intuitions about them.

[1] https://www.semantic-web-journal.net/content/compliance-checking-semantic-web-rdf-based-conflict-tolerant-version-deontic-traditional
[2] https://www.w3.org/TR/shacl
[3] https://www.w3.org/TR/shacl-af
[4] https://plato.stanford.edu/Entries/logic-deontic/#TradScheModaAnal