DALICC: Search and conflict detection using automatic reasoning and legal expert knowledge

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Abstract. We have developed a controlled vocabulary that extends ODRL's repertoire of actions. In coordination with legal experts, we have modeled several user licenses, rules of legal reasoning and relations to user-friendly queries using PoolParty Semantic Suite. The resulting knowledge graph enables an Answer Set Programming (ASP) reasoner to solve the tasks of search and conflict detection.

Introduction

Within the DALICC project (https://dalicc.net/) a repertoire of existing user licenses is being built. This is achieved by describing the legal terms and conditions of the licenses using the ODRL V2.1 (https://www.w3.org/ns/odrl/2/ODRL21) ontology. With this repertoire, two objectives can be realized: 1. Searching for licenses that satisfy certain user-input criteria, and 2. checking the legal compatibility of two or more licenses.

Modeling

In ODRL, licenses are modeled as entities of the Policy class. Every license consists of a set of permissions and prohibitions. Each permission/prohibition, in turn, concerns one or more Actions (for example, odrl:reproduce or odrl:modify) and, possibly, a set of duties that must be performed for the permission to be granted. So far, in this project we have undertaken three modeling tasks: 1) extension of the set of actions, 2) modelling of a dependency graph describing relationships between actions, and 3) description of relations between actions and answers to a questionnaire. These three tasks were performed using PoolParty Semantic Suite (https://www.poolparty.biz/).

The set of actions in ODRL is not sufficient to express all the conditions in the licenses we examined. Some of these licenses already provide RDF representations using other ontologies. For these two reasons, in DALICC we extended the set of actions to include those in the Creative Commons vocabulary

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(https://creativecommons.org/ns), as well others that the team's legal experts deemed necessary.

ODRL provides some predicates for describing the relation between actions, but they are not enough to decide, for example, if two actions contradict each other. Thus we added two more predicates to enable the legal experts to buid up graph that codifies relationships between actions using: owl:sameAs, odrl:implies, odrl:includedIn and dalicc:contradicts.

Search functionality is achieved via a user-friendly set of questions that can be answered by non-expert users. Encoding relationships between answers to them, and restrictions on actions was done with the use of four special relations: dalicc:needsPermission, dalicc:excludesPermission, dalicc:needsProhibition, dalicc:excludesProhibition. For example, if the user answers *yes* to the question *Do you want to sell your asset?*, then the returned licenses need to have the permission (needPermission) for the selling of the asset (odrl:sell).

Reasoning

Deciding whether a given license satisfies the restrictions set by the user in answering the questions can only be done if the relationship between actions are taken into account. For example, in the example above, any license containing the permission for royalty free distribution (dalicc:royaltyFree) can not be returned, since odrl:sell odrl:includedIn odrl:commercialize, and odrl:commercialize dalicc:contradicts odrl:royaltyFree.

Both the search and consistency check functionalities are performed by programs for an ASP reasoner, that of the Potassco suite (https://potassco.org/). ASP has been used before within the semantic web community [1], but to our knowledge this is the first example of it being employed for search tasks. In this case, the programs that the ASP solver works with consist of four parts: 1) the ODRL ontology semantics, 2) the descriptions of all modeled licenses, 3) the dependency graph described above and 4) a query. The query can be either a set of restrictions on the licenses (for the search use case), or the name of two licenses (for the consistency checking use case). It was necessary to develop a webservice to wrap the ASP solver to properly integrate it with a web application and with the resources already developed. While the graphs in question are too small for efficiency to be of importance, we consider that the interpretability of ASP programs, as opposed to convoluted SPARQL queries to be an advantage.

Acknowledgements DALICC is funded by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT) under the program "ICT of the Future" (https://iktderzukunft.at/en/) 11.2016 and 10.2018.

References

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