Identifying Potential Conflicts between Norms in Contracts

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Abstract. Contracts formally represent agreements between parties and often involve the exchange of goods or services. In contracts, clauses define the behavior expected from parties in terms of deontic statements such as obligation, permission and prohibition. These normative clauses may contain conflicting deontic statements referring to the same party in the same context, producing inconsistencies in the normative structure of the contract. Our main contribution is an approach to detect potential conflicts between norms within contracts written in natural language. We use a rule-based approach and natural language processing, which result in promising empirical results. This constitutes a first step into automated processing of contracts in natural language.

1 Introduction

In social groups, interactions between members often follow some kind of regulation to minimize conflicting behaviors. These regulations often focus on the expected behavior of each member in the society, and, to ensure individuals follow a socially acceptable behavior, social regulations are enforced. Thus, based on the social structure, social members define a set of norms to guarantee that all participants act respecting a social consensus. Social norms also govern interactions in smaller groups, and are often present in social relationships involving agreements over products and services. A common way to formalize a set of norms applied to a certain agreement is through contracts. Contracts are semi-structured documents written in natural language, used in almost every existing formal agreement. Contracts define the parties involved in the agreement, relations among them and the behavior expected of each party within clauses. When written in natural language, contracts may use imprecise and possibly vague language to define parties, obligations and objects of its clauses, leading to contract inconsistencies. Such inconsistencies may create, in the long term, unforeseen legal problems for one or more of the involved parties. Check for inconsistencies is mostly performed by humans, possibly compromising reliability. Our main contribution is an approach that uses rule-based and natural language processing to detect potential conflicts between norms in contracts. The approach consists of an analysis of the contract and norm structures that allows us to identify the elements that constitute conflict between norms. We test our approach over a corpus of contracts and then separately evaluate each step in the process.

2 Background

A norm exists in a given social setting to the extent that individuals usually act in a certain way, being punished when perceived not to be acting in this way [1]. In a business context, norms are elements of a contract, also called clauses. A norm indicates what to expect from each party according to the contract definitions. Its structure is often formed by the subject (party) in which the norm is applied, a modal verb, and a consequent, which expresses the conditions that the norm is satisfied. Norms are represented using concepts from deontic logic, such as permission, obligation and prohibition. These concepts describe the type of restriction intended of a norm.

The aim in deontic logic is to describe what ought to be given a context. Thus, deontic logic and the theory of normative positions have strong relevance to legal knowledge representation and to the analysis and representation of normative systems [6]. A norm defined as a permission represents an act that is allowed to be performed. On the other hand, a norm defined as a prohibition characterizes an act that should not be performed. A prohibition can also be expressed using the negation of a permission. Therefore, an act not permitted constitutes a prohibition. Although these two concepts can express most existing norms, it is useful to be able to explicitly represent obligations. An obligation represents an act that must be performed, otherwise a punishment takes place. An obligation can also be represented as the negation of a permission to not act [13].

Using the deontic interpretation of a norm, one can identify whether two norms are in conflict. In international law, a conflict between two norms arises when "a party to two treaties cannot comply with its obligations in both treaties simultaneously" [5]. In such conflict, both norms indicate different actions to the same event, making compliance with both norms impossible, therefore invalidating them. Although this concept is prevailing in international law, Vranes [12] refines this definition characterizing 2 types of conflicts: (1) between permissions and obligations, and (2) between permissions and prohibitions. A conflict between a permission and an obligation arises when the party has the permission for a defined action and, simultaneously, the obligation for the same action. A conflict between a permission and a prohibition arises when the norms simultaneously permit and forbid the party to perform a certain action. Kollingbaum et al. [7] consider a norm conflict to be of type 2 by stating that a norm conflict is "an interference between permissions and prohibitions". It occurs when a norm allows the agent to perform an action, while another norm forbids the agent to perform the same action. Alternatively, a third type of conflict can arise if two different norm types regulate the same act [8], i.e. a certain same act is both obligatory and prohibited, permitted and prohibited, permitted and obligatory. In this work, the notion of conflicting norms refers to a pair of norms in which both norms are applied to the same party, describing behaviors semantically similar, but with opposite deontic meanings, i.e., permission and obligation or permission and prohibition.

3 Detecting Potential Conflicts Between Norms in Contracts

To fulfill the task of identifying potential conflicts between norms we propose three subtasks. First, we identify, among the contract's clauses, which ones are norms. Then,

we extract the parties of the contract, since we assume that conflicting norms refer to the same party in the same context. Finally, we identify the deontic meaning (permission, prohibition, and obligation) of each norm and divide the norms according to the party to which they are applied. Then, we calculate the semantic similarity between the norms with the same party.

A contract is a semi-structured document, so we can divide it into two main components: a header and a set of clauses. The header contains information about the parties used along the contract. We use this information, which is often located in an opening paragraph, to detect parties. An example of such a paragraph can be seen in Example 1[1].

Example 1. THIS AGREEMENT is made by and **between** Lucent Technologies Inc., a Delaware corporation, acting through its Microelectronics Group, having an office at Two Oak Way, Berkeley Heights, New Jersey 07922 ("Lucent") **and** CD Radio Inc., a Delaware corporation, having its principal place of business at 2175 K Street NW, Washington, DC, 20037 ("CD Radio").

A party may receive either an abbreviation or a nickname that appears within the contract. This element is often described along with the party description. In the previous example, we can identify the abbreviations surrounded by double quotes and parenthesis. Since the sequence of words from "**between**" to "**and**" describes the first party, and the sequence from "**and**" to the end of the sentence describes the second party, we use a rule-based approach to extract the parties and their abbreviations from the header. In this work we deal with contracts that contain at most two parties, which is the prevailing format we found. We analyzed 206 contracts from the contract corpus used by Gao and Singh [3] and identified that 78% of the contracts presents the structure with two parties described in the contract header.

The set of clauses in a contract determines what each party must comply with along the duration of the contract. Norm clauses are often directed to one or more parties, likewise they may describe an expected behavior from the agreement itself. In order to identify sentences that constitute norms in contracts written in natural language, we use simple rules that extract them. For this task, we consider contract sentences to be of two exclusive types: norm sentences and non-norm (common) sentences. A norm sentence usually follows a well-defined 4-component structure: one or more named parties, a modal verb, an indexing number or letter, and a behavior description. An example of a norm sentence in a contract is[2]: "**9.** The **Commission must** first attempt to resolve an industrial dispute by conciliation.".

Conversely, common sentences have a different structure, such as: "The Code Participants are parties to a Dispute within the meaning of clause 8.2 of the Code.". Common sentences in a contract often have an identifier and finish with varying punctuation marks other than the period. These sentences seldom have modal verbs and often have a different structure than norm sentences.

[1] Extracted from http://contracts.onecle.com/sirius/lucent.ic.1998.04.24.shtml.

[2] Both examples of norm and common sentence were extracted from the Australian Contract Corpus. [2]

In this work, we consider a list with six modal verbs, named: may, can, must, ought (to), will, and shall. We use a rule-based approach that considers such modal verbs to decide whether a contract sentence is a norm sentence.

To test our approach of norm detection, we used contracts from the Australian contract corpus [2]. We manually created two sets of sentences from 93 contracts, the first set with 200 norm sentences, and the second set with 200 common sentences. As a first result, we obtained 79% of precision, 98% of recall, and 87% of F-measure in this task.

With norms and parties identified, we establish which norms are related to each party. This process is made by analyzing each norm and identifying the party appearing in it. On the end of this analysis we obtain two norm sets, each one related to one of the parties.

In order to identify a norm pair that constitutes a potential conflict, we investigate the deontic meaning of each norm, using linguistic knowledge on modal verbs. Through the deontic meaning we identify whether a norm is either a permission, an obligation or a prohibition. We perform such identification mapping each modal verb to a deontic meaning. Steedman [10] maps MUST and MAY to obligation and permission, respectively. The remaining of modal verbs are mapped according to English grammar rules. Thus, we adopt the following mappings: CAN and MAY are mapped to permissions; MUST, SHALL, OUGHT, and WILL are mapped to obligations; the negation of any modal is mapped to a prohibition.

To identify a potential conflict between a pair of norms, we consider three types of conflict: a permission conflicting with an obligation, a permission conflicting with a prohibition, and an obligation conflicting with a prohibition. Since we have norms mapped to deontic meanings and two sets with norms applied to each party, we iterate through pairs of norms from each set in order to check for potential conflicts. Considering that the simple verification of the deontic meaning does not guarantee the detection of a potential conflict, we verify their context next. Both norms must be applied to the same context, i.e., describe the same expected behavior. Based on this requirement, we calculate the semantic similarity between norms.

We propose an algorithm that, based on the smallest norm in the norm pair, compares each element in a norm with its equivalent in the other norm. We compare the semantic similarity between individual words in the corresponding strings. This comparison is performed through the use of the Wu and Palmer WUP measure [14], which uses the Wordnet lexical database[3]. The WUP measure calculates the similarity between two words based on the depth of the senses in the taxonomy and that of their most specific ancestor. The final score is divided by the mean of the two norm sizes.

Given two norm consequences w and q, where w_i and q_i are words in the i^{th} position in each norm consequent; lw and lq the length of w and q respectively; a WUP measure that returns a value between 0 and 1 according to the semantic similarity between two words; and sl the smaller length between w and q, consider Equation 1, which shows how the semantic similarity between two sentences is calculated.

$$semantic\_similarity = \frac{2}{(lw + lq)} \sum_{i=0}^{sl} \text{WUP}(w_i, q_i) \tag{1}$$

[3] http://wordnet.princeton.edu

Since our algorithm returns a value between 0 and 1, we define a threshold of 0.7 that allows us to consider a norm pair similar enough to be considered a potential conflict. This threshold is based on the empirical results we have obtained, which shows that similarities below 0.7 indicate disconnected norms. Thus, a norm pair with semantic similarity above the threshold and conflicting deontic meanings is considered a potential conflict. Figure 1 illustrates the architecture of our approach.

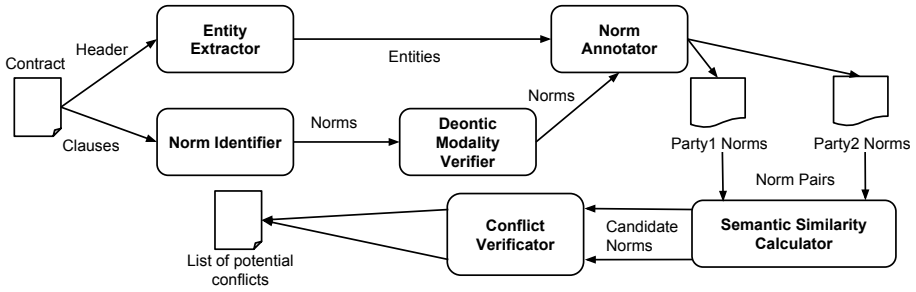

Fig. 1. Architecture of the proposed solution for the detection of potential conflicts between norms

4 Related Work

Gao and Singh [4] created a mechanism for extracting and classifying norms in contracts. Using a modal verb filter and then extracting a feature vector, they use a classifier to extract norms from contracts. Although our norm identification mechanism is conceptually similar, unlike these efforts, which focus on extracting specific information from contracts, we go further and identify potential conflicts between contract clauses (norms).

Figueiredo and Silva [9] present an algorithm for identifying conflicts between norms within multi-agent systems formalized using the Z specification language. Likewise, Vasconcelos *et al.* [11] developed a mechanism to identify normative conflicts for multi-agent systems, based on a formal representation of norms with constraints, presenting formal definitions of normative conflicts and defining how they can be resolved.

Figueiredo and Silva's work present an important algorithm for normative conflict detection using first-order logic. They use Z language to formalize some conflict types. A similar approach is used by Vasconselos *et al.* [11], which uses first-order logic to resolve norm conflicts. They use different algorithms for detecting and solving conflicts. In our work we want to detect normative conflicts as well, the difference is in the nature of the dated used for this task.

These works deal with similar approaches, such as information extraction and conflict detection. Our approach, however, deals with contracts written in natural language. To detect such conflicts we use a series of natural language processing techniques and a contract corpus.

5 Future Work and Conclusions

In this work we present an approach to identify potential conflicts between contractual norms. We create a norm identifier, an entity extractor, and an algorithm to calculate the semantic similarity between norm consequences. The approach is a small step towards the automation of contract analysis, which is currently made by humans, and thus prone to errors. Although, our results are still preliminary, primarily due to the fact that we are still creating a gold standard for comparison (a very laborious process), our first experiments show promising results. For future work, we want to test our approach in a corpus that contains real world conflicts, and then compute performance measures, such as precision, recall, and F-measure.

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