Argumentation Frameworks for Legal Reasoning

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ABSTRACT

Unexplored issues in argumentation frameworks for modeling legal disputes refer to confidence levels of the facts on the case, represented as arguments, and the number of facts that support another ones, in order to specify the notion of acceptability of arguments. This paper discusses two argumentation frameworks, which consider such issues.

Keywords

legal reasoning, argumentation framework

1. INTRODUCTION

Argumentation frameworks (AFs) are models of reasoning based on the comparison of arguments and counter-arguments followed by the selection of the most reasonably acceptable of them. Legal disputes is a promising domain where argumentation frameworks can be applied.

The usefulness of AFs is that they have a very abstract notion of argument which allows them to accommodate the plurality of possible argumentation schemes. The most classical AF was proposed by Dung [3], where arguments interact through the attacks relation. Based on this notion, Bench-Capon [2] relates strengths of arguments in the dispute to the social values promoted by their acceptance, represented as audiences.

In this paper, we propose two alternative AFs, which consider the confidence of the arguments – Strength based Argumentation Framework (S-VAF) – and the number of supporters – Voting based Argumentation Framework (Voting-VAF). Both proposed frameworks are based on the VAF by Bench-Capon, in order to consider the notion of different audiences. The S-VAF allows different hypothetic reasoning on the different strength of each argument. With Voting-VAF is possible to aggregate the idea of consensus, i.e., showing that the more often an argument is agreed on, the more chances for it to be valid.

1.1 Strength-based Argumentation Framework

The *strength* represents the confidence associated to an argument. In a S-VAF, it is important to distinguish the difference between *values* and *strengths*. There are different types of parties involved in the dispute. Each part represents an *audience*, with different preferences between the *values* that it promotes. The *values* are used to determine the preference between the different audiences. Moreover, each part generates arguments with a *strength* (degree of certainty), based on the confidence that it has in the argument. So, the VAF was extended in order to define a new notion of argument acceptability which combines *values* (related with the part's preference) and *strength* (confidence degree of an argument)[1]. A S-VAF has the following main definitions:

Definition 1 A Strength based Argumentation Framework (S-VAF) is a 6-tuple *(AR, attacks,V,val,P,valS)* where *(AR,attacks,V,val,P)* is a value-based argumentation framework, and *valS* is a function which maps from elements of AR to real values from the interval [0,1] representing the *strength* of the argument.

Definition 2 An argument $x \in AR$ defeats$_a$ (or *successfully attacks*) an argument $y \in AR$ for audience a if and only if $attacks(x,y) \wedge ((valS(x) > valS(y)) \vee (\neg\ valpref(val(y),val(x)) \wedge (\neg\ (valS(y) > valS(x)))))$.

An attack succeeds if (a) the *strength* of the attacking argument is greater than the *strength* of the argument being attacked; or if (b) the argument being attacked does not have greater preference value than attacking argument (or if both arguments relate to the same preference values) and the *strength* of the argument being attacked is not greater than the attacking argument.

1.2 Voting-based Argumentation Framework

The previously described frameworks still fail at rendering the fact that sources of arguments often agree on some argument, and that this agreement can be meaningful. In such frameworks, the number of supports of an argument is not taken into account. In some situations, such idea must be considered, showing that the more often an argument is agreed on, the more chances for it to be valid (i.e., aggregating the idea of consensus).

In the following, the VAF is adapted to consider the level of consensus between the sources of the arguments, by introducing *voting* into the definition of successful attacks. We

[1]If our criterion was based only on the *strength* of the arguments, a Preference Based Argumentation Framework could be used [1]

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first describe the notion of *support* which enables arguments to be counted as defenders or co-attackers during an attack:

Definition 1 A *Voting-based Framework* (Voting-VAF) is a 7-tuple *(AR,attacks,supports,V,val,P,str)* where (AR, attacks,V,val,P,str) is a S-VAF, and *supports* is a (reflexive) binary relation over *AR*. *supports* and *attacks* are disjoint relations.

The voting is used to determine whether an attack is successful or not. Our first proposal opts for a simple voting scheme, where the number of supporters decides for success — as done in the *plurality voting system*.

Definition 2 In a Voting-VAF an argument a ∈ AR defeats$_{aud}$ an argument b ∈ AR for audience aud if and only if attacks(a,b) ∧ (|{x | supports(x,a)}|>| {y | supports(y,b)}| ∨ (|{x | supports(x,a)}|=|{y | supports(y,b)}| ∧ valpref$_{aud}$(val(a),val(b)))).

2. CASE STUDY

In order to explain the use of the proposed model in a practical legal case, we consider two parties, P1 and P2, that try to arrive to a resolution about a conflicting transit situation. The cars driven for the respective parts had been shocked, and the dispute involves to analyze the most likely culprit. Consider the following arguments, representing the facts in such situation. For the audience P1:

- A: P1 says that he heard the clock of the Church to give to the 00:00, some time after P1 had passed the red signal.
- B: P1 says that the clock of the Church is always correct.
- C: P1 says that he saw P2 to pass red signal before 00:00.

For the audience P2:

- D: P2 says that in his clock, it already had passed 5 minutes of the 00:00 when he passed the red signal.
- E: P2 says that he did not violate any law, because it is allowed to pass the red signal to help somebody or if it had passed of the 00:00.
- F: P2 says that he had passed the signal because he was going to the hospital with his sister.

Considering the different strengths of the arguments, it means, for instance, that for the arguments E and B, the respective part has certainty in such arguments (strength = 1.0); for the arguments A and C, P1 is not complectly sure about the correctness of his affirmations; and for the arguments D and F, P2 is not complectly convincing because he tries not to be condemned.

Analyzing the results produced by the different frameworks (set of globally acceptable arguments): (1) VAF: A, B, C, F; (2) S-VAF: A, B, C, E, F; and (3) Voting-VAF: A, B, C, E, F. Distinct arguments, specially from VAF and the proposed frameworks, are selected as globally acceptable. Such results change completely the position attributed to the situation. Using VAF, the argument E is not acceptable, so P2 must be culprit. For the S-VAF and Voting-VAF, the argument E indicates that P2 must be absolved.

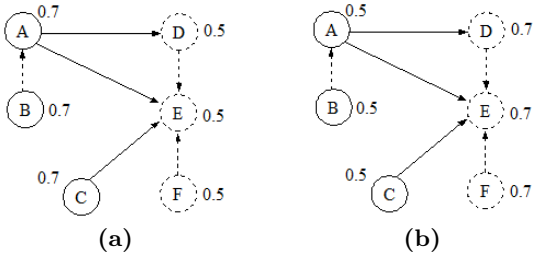

Figure 1: (a) Scenario 1; (b) Scenario 2.

2.1 Hypothetic Reasoning

With S-VAF it is possible to have different results based on hypothetic reasoning on the strength of each argument. So, different scenarios for a situation can be specified. Consider, for instance, two scenarios: *Scenario 1* (Figure 1) – P1 is more trustworthy than P2, and the arguments of him have bigger strengths than the strengths of the arguments of P2; *Scenario 2* (Figure 1) – P2 is more trustworthy than P1, and the arguments of him have bigger strengths than the strengths of the arguments of P1.

From these scenarios, the following sets of acceptable arguments are obtained. Scenario 1 – Audience 1: A, B, C, F; Audience 2: A, B, C, F; Globally acceptable arguments: A, B, C, F. Scenario 2 – Audience 1: A, B, C, D, E, F; Audience 2: A, B, C, D, E, F; Globally acceptable arguments: A, B, C, D, E, F.

According to the different levels of confidence, distinct positions in the situation can be achieved. For instance, considering that P1 has higher levels of confidence on the facts that he presents, it is supposed that such arguments can successfully attack the corresponding counter-arguments.

3. FINAL REMARKS AND FUTURE WORK

This paper proposed two argumentations frameworks to model disputes in the legal domain, S-VAF and Voting-VAF. While the S-VAF allows different hypothetic reasoning on the different strength of each argument, the Voting-VAF allows to aggregate the idea of consensus. The applicability of the models was showed using a case study, where the different frameworks generated different sets of acceptable arguments, allowing to analyze different perspectives of the dispute. As future work we plan to specify the features of specific situations where each proposed model is more suitable to be applied to.

4. REFERENCES

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