

Representation of Case Law as an Argumentation Framework

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Abstract. Since their introduction by Dung, Argumentation Frameworks have provided a fruitful basis for studying reasoning in defeasible contexts, including law. As yet, however, no realistic body of case law has been represented as an Argumentation Framework. In this paper we develop an Argumentation Framework of a much discussed body of case law, and draw attention to a number of questions concerning approaches to reasoning with cases in AI and Law that can be informed by this exercise.

1 Introduction

Since their introduction by [10] Argumentation Frameworks have provided a fruitful basis for studying reasoning in defeasible contexts. They have proved useful both to theorists who can employ them as an abstract framework for the study and comparison of non-monotonic logics, e.g. [8] and [9], and for those who wish to explore specific areas of reasoning where defeasibility is central. Law is such an area, and argumentation frameworks have been used to explore the resolution of conflicting norms, e.g., [13] especially when this is seen as a dispute between parties, e.g. [12], [15].

Despite the importance of much of this work, it has so far remained at the level of a theoretical approach: while its advantages have been argued, these have not as yet been illustrated by application other than to very simple “toy” examples. The approach thus remains promising, and awaits demonstration in a realistic context. Therefore in this paper we will represent a realistically sized body of actual case law as an argumentation framework. Our intention is to demonstrate the possibility of modelling case law in this way, to consider how such a model might be used, and to identify the insights that might be gained from seeing legal disputes as Argumentation Frameworks.

In section 2 we will summarise the basic ideas of Argumentation Frameworks. In section 3 we will introduce the case law we wish to model. Section 4 will very briefly consider what we shall count as an argument, and section 5 will present this body of case law as an Argumentation Framework. Section 6 will identify a number of questions relating to systems that model reasoning with cases.

2 Dung’s Argumentation Framework

Dung’s idea is to represent arguments as abstract entities, whose role is determined solely by their relation to other arguments. No attention is paid to the internal structure of arguments. Arguments interact through the *attacks* relation. Roughly, we may consider an argument to attack another if it leads to a contradictory conclusion, or to the negation of one of the premises

of the attacked argument, presents an exception to a default rule, or casts doubts on whether the conclusions follow from the premises. The essential idea is that an argument and its attacker cannot both be accepted.

A formal definition of an Argumentation Framework, and the central notions concerning Argumentation Frameworks, is given as Definition 1.

Definition 1. An Argumentation Framework (AF) is a pair $AF = \langle X, A \rangle$, where X is a set of arguments and $A \subset X \times X$ is the attack relationship for AF . A comprises a set of ordered pairs of distinct arguments in X . A pair $\langle x, y \rangle$ is referred to as “ x attacks y ”.

For R, S , subsets of X , we say that

- (a) $s \in S$ is attacked by R if there is some $r \in R$ such that $\langle r, s \rangle \in A$.
- (b) $x \in X$ is *acceptable* with respect to S if for every $y \in X$ that attacks x there is some $z \in S$ that attacks y (i.e. z , and hence S , defends x against y).
- (c) S is *conflict free* if no argument in S is attacked by any other argument in S .
- (d) A conflict free set is *admissible* if every argument in S is acceptable with respect to S .
- (e) S is a *preferred extension* if it is a maximal (with respect to set inclusion) admissible set.

A useful way to picture an AF, to which we will appeal on occasion, is as a directed graph with arguments as vertices and edges representing the attacks relation.

The key question to ask about an AF is “which arguments should I accept?”. Clearly a set of accepted arguments should be conflict free, since otherwise I have a reason to reject the attacked argument. Moreover the set of arguments should be admissible, since otherwise I have reason to reject the indefensible member. While I may be content to accept an admissible set of arguments, I can, if it is not a preferred extension, accept further arguments. Only when I have a preferred extension can I not extend my position. Thus, given an AF, if I wish to decide whether to accept an argument, I should determine the preferred extension, and see whether the argument in question is in it. In some cases this will not be a problem: the preferred extension may be unique. Unfortunately, this is not the case in general. In fact, if the graph of the AF contains a cycle with an even number of vertices, the preferred extension may not be unique (see [6] for a proof). Consider, for example, a four-cycle, $a \rightarrow b \rightarrow c \rightarrow d \rightarrow a$. Here both $\{a, c\}$ and $\{b, d\}$ will be preferred extensions. Moreover, if the graph contains a cycle of odd length, it may be empty (consider an AF comprising just a three cycle, for example). Where there are multiple preferred extensions an argument is said to be *sceptically acceptable* if it is in *every* preferred extension, and *credulously acceptable* if it is in *at least one* preferred extension. If the argument framework contains no cycles, there is a polynomial time algorithm to determine the preferred extension ([6]), but in the general case determining credulous acceptance is NP-complete and determining sceptical acceptance is $\Pi_2^{(p)}$ -complete (see [11] and [3]). Thus Argumentation Frameworks offer an attractive way of deciding which arguments should be accepted in a dispute with conflicting arguments, and have yielded some interesting technical results. Can they be used in practice to model legal disputes? This depends on the ability to represent such a dispute as an AF in a plausible way. In the following sections we will explore this question.

3 A Body of Case Law

For our example we will consider the wild animal cases introduced to AI and Law by [7], and much discussed in recent years (e.g. [5], [4] and several papers in *Artificial Intelligence*

and Law Volume 10 1-3). Here, as well as the three central cases described in [7], we will consider some additional cases.

The facts of the chosen cases are:

Keeble v Hickergill (1707). This was an English case in which Keeble owned a duck pond, to which he lured ducks, which he shot and sold for consumption. Hickergill, out of malice, scared the ducks away by firing guns. The court found for Keeble.

Pierson v Post (1805). In this New York case, Post was hunting a fox with hounds. Pierson intercepted, killed and carried off the fox. The court found for Pierson.

Young v Hitchens (1844). In this English case, Young was a commercial fisherman who spread a net of 140 fathoms in open water. When the net was almost closed, Hitchens went through the gap, spread his net and caught the trapped fish. The case was decided for Hitchens.

Ghen v Rich (1881). In this Massachusetts case, Ghen was a whale hunter who harpooned a whale which subsequently was not reeled in, but was washed ashore. It was found by a man called Ellis, who sold it to Rich. According to local custom, Ellis should have reported his find, whereupon Ghen would have identified his lance and paid Ellis a fee. The court found for Ghen.

Conti v ASPCA (1974). In this New York case, Chester, a parrot owned by the ASPCA, escaped and was recaptured by Conti. The ASPCA reclaimed Chester from Conti. The court found that they were within their rights to do so.

New Mexico vs Morton (1975) and *Kleepe vs New Mexico* (1976). These cases concerned the ownership of unbranded burros normally present on public lands, which had temporarily strayed off them.

We will consider the arguments advanced in these cases when we come to consider their representation as an AF. First, however, we must discuss what we shall take as an argument.

4 What Counts as an Argument?

Dung is entirely silent about the internal structure of arguments. All that his framework requires in that arguments be capable of attacking one another. If we are to use the approach in practice, however, there are a number of possibilities:

- We could take an argument as being like a proof in a defeasible logic.
- We could put forward a highly structured view of arguments, such as the schema of [14].
- We could use special purpose arguments, such as those found in HYPO (e.g. [2]) and its descendants such as CATO [1].

Whilst all these approaches have a history in AI and Law, and have been used with some success, we choose not to commit to any of them at present. To do so would be over constraining in that we would need to bend any argument we wished to represent into one of these forms, and so lose the advantages of Dung's high degree of abstraction. All we will require initially is that an argument have a conclusion, and, possibly, a reason for that conclusion. Arguments will attack one another if their conclusions are in conflict, or if the conclusion of the attacker indicates that the reason does not hold, or if it suggests that the reason is no reason for the conclusion. These criteria, however, do not seem sufficient. Consider the trite example of the arguments "Kerry can fly because she is a bird" and "Kerry cannot fly because she is a kiwi". Here, although we have contradictory conclusions, we would naturally say that the second argument attacks the first, but not *vice versa*. Sometimes, therefore I shall represent

what might in logic be considered a mutual attack as an attack in one direction only, when it seems clear that this is how the arguments are intended. By giving ourselves this amount of freedom, we should be able to construct the most natural representation possible. Once we have done so, we can consider whether the notions of argument described above can be found in the representation.

5 Representing the Cases as an AF

In this section we will build our AF. Our method will be to consider each case in turn. From the decision we will identify the arguments deployed and the attacks between them. Space precludes restating the arguments and drawing the corresponding graph after each case. The reader may find it useful to refer to Table 1 which gives the full set of arguments, and Figure 1 which gives the full AF for all the cases.

First consider *Keeble*. The basic contention of *Keeble* is that he had a right to the ducks (which we here generalise to *animal*), and that Hickergill had prevented him from exercising this right. This is argument (A). Hickergill must attack this argument, which he can do by saying that *Keeble* had no right to the animals since he was not in possession of them (B). He might cite as an authority Justinian, who said “pursuit alone vests no property or right for the huntsman”. *Keeble* may respond in one of two ways. He could argue that he is in pursuit of his livelihood, and that he should be free to do so without interference, especially since his activity is socially useful in providing food for others (F). This argument is what seems to persuade Berman and Hafner in [7]. Here the attack effectively says the reason advanced in B is no reason for its conclusion. Alternatively *Keeble* could argue that he possesses the animals through his possession of the land on which he would, in the absence of interference, find them (C). This was felt decisive in the discussion of *Keeble* found in *Pierson v Post*. Hickergill may attack this latter argument by pointing out that the ducks were wild animals, and were not confined to *Keeble*’s land (D). To this *Keeble* may respond that he had made efforts to attract the ducks through the use of decoys, and his efforts promised, in the absence of interference, success (E). That is, although the ducks could be scared away, it was reasonable for the owner of the pond to expect ducks to be there, and so was something he could expect to enjoy in consequence of owning the pond. In the resulting AF, the preferred extension is {A,C,E,F}, a straightforward win for *Keeble*.

Consider next *Pierson v Post*. Let us begin with the opinion of Tompkins, who stated the decision. The argument seems again to begin with A, attacked by B. But now neither C nor F is available to Post. Post’s claim must therefore be that his pursuit – his effort promising success – was sufficient to give him a right to the fox. Effectively, therefore, he is attacking B with E. Against this Tompkins cites Justinian (as mentioned above), which we will introduce as I. Were the animal taken (J), this would defeat I, but this was not so. Tompkins then considers another authority, Puttendorf, who says that a “beast mortally wounded or greatly maimed, cannot be fairly intercepted”. He appears to think this (K) would defeat I, but again it is not available on the facts. He therefore concludes that I defeats E, and hence B is available to defeat A. He then considers what degree of pursuit would be enough to defeat I, agreeing with Barbeyrac that “actual bodily seizure” is not necessary (L), but interpreting this as meaning that bringing the animal within certain control is required. He then dismisses as irrelevant both *Keeble*, where the pursuer owned the land (C), and certain other cases where the interceptor owned the land, and so the pursuer might be trespassing (H), countered by the land being open (Q). He gives as his reason for requiring “certain control”, that he wishes to provide an interpretation which is clear and certain (P).

There was also a dissenting opinion, given by Livingston. He first dismisses Justinian as

Table 1: Arguments in the Wild Animal Cases

ID	Argument	Attacks	Cases
A	Pursuer had right to animal		All
B	Pursuer not in possession	A,T	All
C	Owens the land so possesses animals	C	Keeble NM, Kleepe
D	Animals not confined by owner	C	All
E	Effort promising success made to secure animal made by pursuer	B,D	All
F	Pursuer has right to pursue livelihood	B	Keeble Young,Ghen
G	Interferer was trespassing	S	None
H	Pursuer was trespassing	F	None
I	Pursuit not enough (JUSTINIAN)	E	Pierson, Young
J	Animal was taken (JUSTINIAN)	I	None
K	Animal was mortally wounded (Puffendorf)	I	None
L	Bodily seizure is not necessary (Barbeyrac), interpreted as animal was brought within certain control (TOMPKINS)	I	Young
M	Mere pursuit is not enough(TOMPKINS)	E,O	All
N	Justinian is too old an authority (LIVINGSTON)	J	All
O	Bodily seizure is not necessary (Barbeyrac), interpreted as reasonable prospect of capture is enough (LIVINGSTON)	I,M	Pierson
P	Reasonable prospect does not give enough certainty (TOMKINS)		All
Q	The land was open	G,H,C	All except Keeble
R	Socially useful activities are to be encouraged (LIVINGSTON)		All
S	Defendant in competition with the plaintiff	E,F	Young, Ghen
T	Competition was unfair	S	Young Ghen
U	Not for courts to regulate competition	T	All
V	The iron holds the whale is an established convention of whaling,	B,U	Ghen
W	Owners of domesticated animals have a right to regain possession	B	Conti
X	Unbranded animals living on land belong to owner of land	D	NM, Kleepe
Y	Branding establishes title	B	None
Z	Physical presence (straying) insufficient to confer title on owner	C	Kleepe

too old an authority (N) to allow the claim that the animal must be taken. Note, however, that this argument is attacked in this context by Tompkins independent endorsement of the principle in (M). He then admits difficulty in determining when pursuit should count as possession, but says that it should do so in this case, so as “to give greatest encouragement to the destruction of an animal so cunning and ruthless [as a fox]”. He claims agreement with Barbeyrac, saying that the statement that property in wild animals may be acquired provided the pursuer “have a reasonable prospect of taking” the beast (O). Note that this is an interpretation of Barbeyrac more favourable to Post than that given by Tompkins, which turns on the social utility of Post’s pursuit (R).

What can we say about the resulting AF? Arguments C,F,G,J,K and L do not apply on the facts and so can be removed. We then have two preferred extensions (resulting from the two-cycle formed by the mutual attacks of M and O). These are {B,I,D,M,Q}, endorsed by Tompkins and {A,E,N,O,Q} endorsed by Livingston. Thus the AF nicely captures the possibility of dissent, and the point at issue, whether the degree of pursuit in the case was enough to be counted as possession. Is there a rational way of deciding between them? This is where the need to consider purpose, the thrust of [7], becomes important. Each provides a reason for accepting their argument *in terms of the value promoted*, certainty in the case of Tompkins (P) and the desirability of encouraging hunters in the case of Livingston (R). The decision in this case means that that the attack of O on M is unsuccessful, and so we can conclude that O fails to defeat M because the value promoted by M is preferred. For a fuller exploration of the idea that values can render attacks unsuccessful see [3].

The remaining cases are rather less involved, since they do not involve pursuit, and rather turn on a single point. In the case of *Conti vs ASPCA*, the argument was advanced that a domesticated animal remains the property of its owner even when it escapes, and so possession is unnecessary to confer a right to the animal (W). The burros cases provide three arguments: that branding an animal establishes title (Y), rendering physical possession unnecessary; that unbranded animals belong to the owner of the land on which they live (Y), even if they are not confined, but that mere physical presence, such as straying onto a piece of land, does not confer title on the owner (Z).

The twenty-six arguments given in Table 1 and shown as an AF in Figure 1, capture, we believe, the main arguments considered in these cases, and the resulting AF provides a coherent explanation of their decisions. To use the framework to consider a new case, one would first remove any arguments which did not apply on the facts of the new case, and then compute the preferred extension. If the resulting preferred extension is not unique, it would be necessary to adduce further arguments to break the cycle generating the multiple preferred extension. This could involve the use of preferences between values, or taking a position on the role of the court.

6 Discussion

The analysis presented above shows that the Argumentation Framework formalism can provide a “pre-formal” reconstruction of the arguments deployed a sizeable body of case law. This is useful because we can be rather precise, even at what is essentially a coarse, natural language level. If we now wish to consider a computer system to generate arguments based on case law, we can use the AF as a means of evaluating its output. Does it generate all the arguments? Does it generate arguments not in the AF? I shall now pose a number of questions relating to past and potential systems modelling reasoning with legal cases. I hope in future work to explore these questions further, and believe that I will derive insight from the AF.

The Argumentation framework contains thirty three attacks. The attacks are not all of the same nature. In some cases a default rule seems to be employed, as in the attack of B on A where it seems to be suggested that if the pursuer is not in possession, by default he has no right to the animal. Other attacks seem to suggest the presence of an exception to the default rule, as in the attack of C on B. Other attacks seem rather to establish the negation of the conclusion, as for example the attacks of Q on G and H. Yet others, such as the attacks of J, K and L on I seem a matter of drawing some kind of line across a dimension. One interesting exercise would be to attempt to provide classifications of these attacks and to relate them to the approaches to argument mentioned in section 4. Can we find the argument moves used in HYPO and CATO? Can the framework be summarised as default theory? Can we superimpose Toulmin’s schema on the framework?

A second question concerns the extent to which the argumentation framework represents a body of cases or only a body of information derived from cases. Put another way, can we see reasoning with the AF as *reasoning with cases*, or only as the application of a body of information? Of course, the cases remain present as subgraphs within the AF, but they tend to be considered as a set of paths, rather than as whole. For example, in *Young* it doesn’t matter whether we consider Young’s pursuit of the fish close enough to establish title if we ignore the aspect of competition: the rationale for the decision is given on another path in the framework. This means that our intuition that Young’s case would have been strengthened if his pursuit was even closer is not met: this would be relevant only if it established that the competition was unfair. There is thus some tendency for the framework to suggest reasoning with portions of precedents rather than always considering the context established by the

complete set of facts. Is this desirable or not? If it is not desirable, can it be avoided?

What of abstract factors, as used in CATO? Certainly some arguments, such as B and E seem to function as “route centres”. Is this a sign that we have an abstract factor?

In the case decisions typically several arguments are raised, even though they do not apply on the facts. The discussion of what, short of bodily seizure, would count as close enough in *Pierson*, and the use of the fact of the open land to dismiss some past cases as irrelevant, also in *Pierson*, are examples. Does this point to the need to pose hypotheticals (a leading motivation in HYPO)? Or can they be ignored as not significant in determining the outcome, as was done in [5]?

Quite a number of arguments seem concerned with arguing about the degree to which something must be established in order to count as satisfied. This is bound up with the last point, and could suggest something like reasoning with dimensions/factors, or could suggest a default rule with a number of candidate exceptions.

A major determinant of the shape of the framework applied to a case is which arguments are held to be applicable to that case. Does this relate to the applicability of dimensions, which has been construed as the *presence of factors* in CATO and other work? Or should we stress the notion of preconditions for dimensions to apply, as found in HYPO?

Hard cases appear to be those where the applicable framework contains cycles. In the above cases cycles were resolved in two ways: once through a relative ordering on the values promoted by the arguments involved, which seems to correspond with [7]. In the other case the cycle was resolved by the introduction of argument U which represented a view of their role taken by the court. Note that the availability of this argument depends on the jurisdiction (and current legal climate, possibly even the disposition of the judges). In [5] this second cycle was resolved by using values. The effect of this was to assume that where the parties were in competition, these factors would be cancelled out. This might be seen as “hard coding” the refusal of the court to arbitrate as to unfair competition, and would thus require a different handling of *Ghen*.

The choice of dimensions/factors/attributes to describe cases is important. In previous discussions of these cases, different views have been taken. [7] gave five factors: possession, open land, own land, plaintiff earning livelihood and defendant in competition with plaintiff. [5] omitted open land, and substituted defendant pursuing livelihood for defendant in competition with plaintiff. [4] suggested that land ownership should be seen as a single dimension with own land and open land as points on it. The argumentation framework developed in this paper possibly supports [7] in that all their five factors can be identified with arguments in the AF. In particular S is much better expressed in terms of competition rather than in terms of the defendant pursuing his livelihood. On the other hand the role of open land is to exclude certain potential red herrings, and can be safely omitted from any positive explanation of the decisions. Open land and owned land seem best separated (*pace* [4]) since they appear in different lines of argument. None the less, land ownership might be best represented as a dimension since different degrees of ownership might have different implications for ownership of the animals on the land in potential cases not included in the set under discussion. Perhaps the most interesting point here is that the AF can provide a rationale for choices as to which terms to use in describing the cases that seem somewhat arbitrary in the previous discussions.

In order for the AF to determine a new case it must be considered in some sense “complete”. Yet the landmark cases discussed above each contributed a new argument to the AF. These new arguments are used to create cycles or extend losing paths by a party that dislikes the decision from the current AF; they can be used to break cycles to resolve hard cases; they can add points on a dimension where the facts do not exactly match a precedent. This poses

some problems for a computational account: it is simply implausible to imagine that all these possibilities could be anticipated (think of *Ghen* for example). This being so, must we see the role of such a tool as limited to structuring the discussion? Of course this does not matter in an educational setting such as that in which CATO was deployed: there the stock of cases is always available, and so a complete set of descriptive terms can be constructed. Similarly most other experiments have been based on a fixed body of cases, ensuring that the representation will be adequate for the “new” cases, although more theoretical work has emphasised the need for a dynamic component.

Finally the arguments and attacks seem quite varied. Can we expect a single account to accommodate them all, or should we rather expect to be forced to use a battery of different techniques?

In this paper we have presented a body of case law as an Argumentation Framework. The main contribution of the paper is to show that this is possible, and that realistic case law can be presented in this way, so as to remove the suspicion that such frameworks are of merely theoretical interest. Having done this, a number of questions arise about approaches to reasoning with legal cases, which serve both to point to strengths and weaknesses in these previous approaches and to provide insight into the relation between these approaches. Further exploration of these questions will be the subject of future work.

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