HANDLING PREFERENCES IN ARGUMENTATION FRAMEWORKS WITH NECESSITIES

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Abstract: Argumentation theory is a promising reasoning model which is more and more used to solve various key problems in artificial intelligence. Most of the developments in this domain are based on extended versions of Dung argumentation frameworks (AFs). In this paper, we propose an argumentation model that extends Dung AFs by two additional aspects : a necessity relation that represents a particular positive interaction between arguments and a preference relation that allows to represent arguments that do not have the same strength.

1 MOTIVATION

In argumentation theory, handling preferences is motivated by the fact that in real contexts, arguments are often different in strength. Regardless of the source and nature of the information about preferences, in Dung style model, a main concern in the different proposed approaches lies in solving possible conflicts between preferences and attacks. Intuitively, the problematic case is that of critical attacks arising when an argument attacks another one while the former is less preferred than the second. Most of existing approaches of preference-based argumentation like (Amgoud and Cayrol, 2002), (Bench-Capon, 2003) and (Modgil, 2009) suggest to merely remove the critical attacks. A main drawback of these approaches is the possibility to tolerate extensions that are not conflict-free with respect to the initial attack relations. To overcome this limit, the approach in (Amgoud and Vesic, 2010) (Amgoud and Vesic, 2011), that we will call here the repairing-based approach, suggets to inverse the direction of any critical attack. The underpining idea is to keep the incompatibility between the arguments involved in the attack while respecting the explicit information about their preferences.

On the other hand, some works have been devoted to extend Dung's model in order to represent the idea of support as a positive interaction between arguments. (Cayrol and Lagasquie-Schiex, 2005) proposes the bipolar argumentation frameworks (BAFs) by adding an explicit support relation to Dung AFs. In (Cayrol and Lagasquie-Schiex, 2010) methods to turn BAFs into Dung meta AFs are proposed. A main drawback of this approach is that the new proposed semantics do not guarantee admissibility. (Boella et al., 2010) introduces the so-called deductive supports and proposes a meta framework which ensures admissibility of extensions. (Brewka and Woltran, 2010) proposes abstract dialectical frameworks (ADFs), a powerful generalization of Dung AFs to formalize the concept of proof standards. The acceptability semantics are redefined by adapting the Gelfond/Lifshitz reduct used in logic programs (LPs). (Nouioua and Risch, 2011) starts from the idea that the exact meaning of the support is essential to determine its possible interactions with the attack relation. It considers the case where *a* supports *b* means that *a* is necessary for *b*. This specialization allows to generalize the acceptability semantics in a natural way that ensures admissibility. The aim of this paper is to extend Dung AFs to take into account both necessity and preference relations between arguments. To do so, a first concern will be to understand how necessities and preferences should interact. Then, on the light of this understanding, the repairing-based approach will be adapted to the case of AFs with necessities (AFNs).

Section 2 represents a background that recalls the main ideas of the preference-based AFs (we present namely the repairing-based approach) as well as the argumentation frameworks with necessities (AFNs). In section 3 we present a new method to construct a Dung meta AF from an AFN. We show in section 4 how to use this new method to generalize the repairing-based approach to the case of preference-based AFNs. In section 5, we conclude and discuss some perspectives of future work.

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2 BACKGROUND

2.1 Preferences in Dung's AFs : The Repairing-based Approach

A Dung AF (Dung, 1995) is a pair $F = \langle A, R \rangle$ where A is a set of arguments and R is a binary attack relation over A. A set $S \subseteq A$ attacks an argument b iff there is $a \in S$ such that $a\ R\ b$. S is *conflict-free* iff there is no $a, b \in S$ such that $a\ R\ b$. The $\subseteq$-maximal conflict-free subsets of A are called *naive extensions* (Bondarenko et al., 1997) and represent a first manner to construct sets of acceptable arguments. Many other acceptability semantics have been proposed in (Dung, 1995). We focus in this paper on one of them, the stable semantics : S is a *stable extension* iff S is conflict-free and $\forall a \in A \backslash S, S\ R\ a$.

We mean here by repairing-based approach the works presented in (Amgoud and Vesic, 2010) (Amgoud and Vesic, 2011) which renew and extend the initial approach proposed in (Amgoud and Cayrol, 2002) for preference-based AFs in order to overcome a common limit of most of existing approaches, which is the possibility to obtain extensions that are not conflict-free. To do so, the repairing-based approach inverses the direction of critical attacks instead of removing them. Formally, this version of preference-based AFs is defined as follows :

Definition 1. A preference-based AF (PAF) is a tuple $\Lambda = \langle A, R, \geq \rangle$ where $\langle A, R \rangle$ is a Dung AF and $\geq \subseteq A \times A$ is a preorder. The stable extensions of Λ are the stable extensions of the repaired framework $\langle A, Att \rangle$ where $Att = \{(a,b) | a\ R\ b\ and\ not\ (b > a)\} \cup \{(b,a) | a\ R\ b\ and\ (b > a)\}$.

In addition to repairing attacks, a second role of the preference relation is to compare subsets of A.

Definition 2. Let S be a set of objects and $\geq \subseteq S \times S$ be a preorder. The democratic relation $\geq_d \subseteq 2^A \times 2^A$ based on $\geq$ is defined as follows : $\forall X_1, X_2 \subseteq A, X_1 \geq_d X_2$ iff $\forall x_2 \in X_2 \setminus X_1, \exists x_1 \in X_1 \setminus X_2\ such\ that\ x_1 > x_2$.

A rich PAF is a PAF equipped with a refinement relation $\geq_d$ used to select the best extensions.

Definition 3. A Rich PAF is a tuple $\tau = \langle A, R, \geq, \geq_d \rangle$ where $\langle A, R, \geq \rangle$ is a PAF and $\geq_d \subseteq 2^A \times 2^A$ is the democratic relation based on $\geq$ called a refinement relation. Let Ψ be the set of stable extensions of the PAF $\langle A, R, \geq \rangle$. The refinement relation $\geq_d$ is used to select the best elements of Ψ : $Max(\Psi, \geq_d) = \{\psi \in \Psi |\ \nexists \psi' \in \Psi\ s.t.\ \psi' \geq_d \psi\ and\ not\ (\psi \geq_d \psi')\}$.

2.2 AFs with Necessities

The AFNs (Nouioua and Risch, 2011) extend Dung AFs by a support relation having the meaning of necessity. Let us present briefly their main ideas.

Definition 4. An AFN is a tuple $\Gamma = \langle A, R, N \rangle$ where A is a set of arguments, R is a binary attack relation and N is a binary irreflexive and transitive relation, called the necessity relation. For two arguments $a, b \in A$, $a\ N\ b$ means that a is necessary for b, i.e. if b is accepted then a must have been accepted.

The irreflexive and transitive nature of N excludes any risk to have a cycle of necessities. Indeed, such cycles are undesirable because they correspond to a kind of fallacy (begging the question). Notice that one may easily generalize the following results to an arbitrary necessity relation, by just filtering out the extensions containing cycles of necessities. Let us now define the key notions of coherence and strong coherence used in redefining the extensions for AFNs.

Definition 5. Let $\Gamma = \langle A, R, N \rangle$ be an AFN and $S \subseteq A$. S is coherent iff S is closed under N^{-1}, i.e. $\forall a \in S, \forall b \in A,\ if\ b\ N\ a\ then\ b \in S$. S is strongly coherent iff it is coherent and conflict-free (w.r.t R).

Let us now define the naive and stable extensions :

Definition 6. Let $\Gamma = \langle A, R, N \rangle$ be an AFN and $S \subseteq A$. S is a naive extension of Γ iff S is a $\subseteq$-maximal strongly coherent subset of A. S is a stable extension of Γ iff S is strongly coherent and $(\forall a \in A \setminus S)\ either\ S\ R\ a\ or\ ((\exists b \in A \setminus S)\ such\ that\ b\ N\ a)$.

A first couple of results that hold for AFNs are given by the following propositions 1 and 2 :

Proposition 1. Naive extensions of an AFN are independent from the directions of attack links.

Proposition 2. Any stable extension of an AFN is a naive extension. The inverse is not true.

Example 1. Consider the AFN $\Gamma = \langle A, R, N \rangle$ depicted in figure 1-(1) (attacks are represented by continuous arcs and necessities by dashed arcs). The strong coherent sets are : $\{a\}$, $\{a,b\}$, $\{c\}$ and $\{c,d\}$. Among them $\{a,b\}$ and $\{c,d\}$ are the naive extensions. $\{c,d\}$ is also stable because $A \setminus \{c,d\} = \{a,b\}$ and we have $\{c,d\}\ R\ a$ and $a\ N\ b$ but $a \in A \setminus \{c,d\}$. However, $\{a,b\}$ is not stable because $A \setminus \{a,b\} = \{c,d\}$ and we have neither $\{a,b\}\ R\ c$ nor $x\ N\ c$ for any $x \in \{c,d\}$.

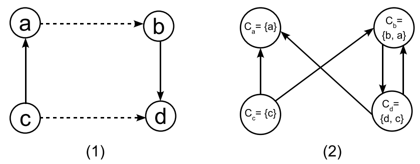

Figure 1: (1) An AFN, (2) The corresponding meta AF.

3 AFNs AS META AFs

In this section we present a new approach to turn any AFN into a meta Dung AF so that the usual Dung acceptability semantics may be applied. A similar approach has been proposed in (Cayrol and Lagasquie-Schiex, 2010) for BAFs where the so-called coalitions of arguments are used as meta arguments. Intuitively, a coalition of arguments is a $\subseteq$-maximal conflict-free subset of arguments connected with the support relation. For example, the system of figure 1-(1) has two coalitions : $\{a,b\}$ and $\{c,d\}$. Each of them is the unique element of a naive and stable extension of the meta AF. But in the result we expect, only $\{c,d\}$ must be stable. To obtain this result, we propose a new method to build new coalitions of arguments that we call here clusters. Intuitively, each argument gives rise to a cluster that contains all arguments that are necessary for it.

Definition 7. Let $\Gamma = \langle A,R,N \rangle$ be an AFN and an argument $a \in A$. the cluster corresponding to a is defined by : $C_a = \{a\} \cup \{b \mid b\ N\ a\}$.

Unlike (Cayrol and Lagasquie-Schiex, 2010), the definition of clusters takes into account the direction of the necessity arcs and it is not required that a cluster is conflict-free [1]. Then, a cluster attacks another if the former contains at least an argument that attacks (w.r.t R) an argument of the second :

Definition 8. Let $\Gamma = \langle A,R,N \rangle$ be an AFN. The Dung meta AF corresponding to Γ is $F_\Gamma = \langle \Delta, Att \rangle$ where Δ is the set of the clusters constructed from all the arguments of A ($\Delta = \{C_a | a \in A\}$) and Att is an attack relation defined by : $C_a\ Att\ C_b$ iff $\exists x \in C_a, \exists y \in C_b$ *such that* $x\ R\ y$.

The traditional acceptability semantics are then applied on the meta AF. The flattening of the resulting extensions gives the extensions under the same semantics of the original AFN. Proposition 3 formalizes this result for stable and naive semantics.

[1] Conflictual clusters lead to self attacked meta arguments that do not belong to any extension.

Proposition 3. Let $\Gamma = \langle A,R,N \rangle$ be an AFN and $F_\Gamma = \langle \Delta, Att \rangle$ the corresponding meta AF. If S is a stable (resp. naive) extension of Γ then $E = \{C_a | a \in S\}$ is a stable (resp. naive) extension of F_Γ. Inversely, if $E = \{C_{a_1}, \dots C_{a_n} | a_i \in A, C_{a_i} \in \Delta\}$ is a stable (resp. naive) extension of F_Γ then $S = \{a_1, \dots a_n\}$ is a stable (resp. naive) extension of Γ.

Example 1 (continued). The meta AF corresponding to the AFN Γ of figure 1-(1) is $F_\Gamma = \langle \Delta, Att \rangle$ such that $\Delta = \{C_a, C_b, C_c, C_d\}$ with: $C_a = \{a\}, C_b = \{b,a\}$, $C_c = \{c\}$, $C_d = \{d,c\}$ and Att is depicted in figure 1-(2). F_Γ has two naive extensions : $\{C_a, C_b\}$ and $\{C_c, C_d\}$ whose flattened forms $\{a,b\}$ and $\{c,d\}$ are the naive extensions of Γ. Only $\{C_c, C_d\}$ is a stable extension of F_Γ and it corresponds to the only stable extension of Γ : $\{c,d\}$.

4 PREFERENCES IN AFNs

We are now ready to analyze what happen when we put together the necessity relation and the information about preferences in a same framework. In particular we will give a generalization of the repairing-based approach to preference-based AFNs and for that purpose we will use the Dung meta Framework corresponding to an AFN that we discussed in the previous section. A preference-based AFN is defined simply by adding a preference relation to an AFN :

Definition 9. A preference-based AFN is defined by $\Sigma = \langle A,R,N,\geq \rangle$ where $\Gamma = \langle A,R,N \rangle$ is an AFN and $\geq \subseteq A \times A$ is a preference relation : $\geq$ is a (partial or total) preorder over the elements of A.

Handling preferences within Dung AFs is based on the idea that the very meaning of an attack hides an implicit preference of the attacker over the attacked argument. Additional information about explicit preferences is then treated by solving the possible conflicts arising from these two kinds of preferences, either by removing or inversing the critical attacks. Now, the question is to know what kind of interactions results from preferences and necessities and what are the appropriate treatments to capture them. A first idea that comes to mind is to see if the case of necessities can be handled in a similar manner as attacks, i.e., if a necessity relation hides a preference that may contradict an explicit preference. The answer is negative because in general we can find cases where an argument a is necessary for an argument b while b is considered as preferred to a and other cases where a

is necessary for b and a is preferred to b.

To propose a method for handling preferences in AFNs, let us turn to the meaning of a necessity relation. To accept an argument a, we have to accept all its necessary arguments. But since these necessary arguments may be more or less preferred than a, the initial preference of a becomes only a gross preference and its effective preference will depend on the preferences of all its necessary arguments. In other words, the effective preference of an argument a will correspond to the set of the initial preferences of all its necessary arguments in addition to its proper initial preference, i.e., the preferences of all the arguments of the cluster C_a. Then, the interaction between necessities and preferences will be captured by means of a new preference relation induced from the initial one and defined on sets of arguments.

4.1 Using a Meta PAF

From the previous analysis, the first idea is to turn a preference-based AFN into a meta PAF defined by the meta AF which corresponds to the AFN (without the preference relation) in addition to a new preference relation defined on the set of clusters. Different methods have been proposed in the literature for the use of a preference relation on single objects to induce a preference relation on sets of these objects. Among them we can find the democratic and the elitist relations. Unlike the elitist relation which privileges minimal sets (if $A \subset B$ then $A \geq B$) the democratic relation privileges the maximal sets (if $A \subset B$ then $A \geq B$). This represents an intuitive motivation for our choice to use the democratic relation to compare our clusters, since our aim will be to compute (naive and stable) extensions that are maximal sets verifying some conditions. The following definition describes how to turn a preference-based AFN into a meta PAF.

Definition 10. We turn any preference-based AFN $\Sigma = \langle A, R, N, \geq \rangle$ into the meta PAF $\Lambda = \langle \Delta, Att, \geq_d \rangle$ where $\langle \Delta, Att \rangle$ is the meta AF corresponding to $\langle A, R, N \rangle$ and $\geq_d \subseteq \Delta \times \Delta$ is the democratic relation based on $\geq$ (i.e. $\forall C_1, C_2 \subseteq \Delta, C_1 \geq_d C_2$ iff $\forall x_2 \in C_2 \setminus C_1, \exists x_1 \in C_1 \setminus C_2$ *such that* $x_1 > x_2$). If E is a stable (naive) extension of Λ then $S = \{a | C_a \in E\}$ is a stable (resp. naive) extension of Σ.

It is worth noticing that preferences play completely different roles when interacting with attacks and with necessities. Indeed, when the necessity relation is absent, preferences are directly used to repair the attack relation. However when the necessity relation is present we start first by using it to revise the preferences given initially as input in the framework. This corresponds also to a kind of reparation but here, it is the preference relation which is repaired using the information about necessities and not vice versa as in the case of attacks. Then, the revised preferences are used to repair the attack relation (between the clusters) as usual.

Example 2. Consider $\Sigma = \langle A, R, N, \geq \rangle$ where the AFN $\langle A, R, N \rangle$ is illustrated in figure 2-(1) and the preference relation is defined by : $a \geq b$, $c \geq d$.

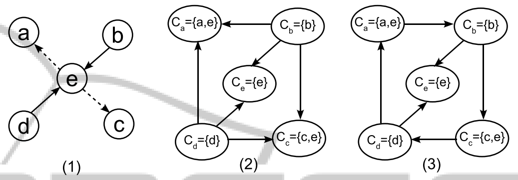

Figure 2: (1) A preference-based AFN, (2) The meta PAF before repairing (3) The meta PAF after repairing.

Following definition 10, we apply the following steps:

1. The set of clusters is $\Delta = \{C_a = \{a,e\}, C_b = \{b\}, C_c = \{c,e\}, C_d = \{d\}, C_e = \{e\}\}$ and the attack relation Att is defined by : $C_b\ Att\ C_a$, $C_b\ Att\ C_c$, $C_b\ Att\ C_e$, $C_d\ Att\ C_a$, $C_d\ Att\ C_c$, $C_d\ Att\ C_e$. Figure 2-(2) depicts the meta PAF before the reparation of Att. The democratic relation $\geq_d \subseteq \Delta \times \Delta$ based on $\geq$ is defined by : $C_a \geq_d C_a$, $C_a \geq_d C_b$, $C_a \geq_d C_e$, $C_b \geq_d C_b$, $C_c \geq_d C_c$, $C_c \geq_d C_d$, $C_c \geq_d C_e$, $C_d \geq_d C_d$, $C_e \geq_d C_e$.
2. The strict version $>_d$ of the relation $\geq_d$ is defined by : $C_a >_d C_b$, $C_a >_d C_e$, $C_c >_d C_d$, $C_c >_d C_e$. Thus, the critical attacks are $C_b\ Att\ C_a$ and $C_d\ Att\ C_c$. These attacks are then inversed and we obtain the repaired attack relation Def defined as follows : $C_a\ Def\ C_b$, $C_b\ Def\ C_c$, $C_b\ Def\ C_e$, $C_c\ Def\ C_d$, $C_d\ Def\ C_a$, $C_d\ Def\ C_e$. The resulting meta AF $\langle \Delta, Def \rangle$ is depicted in figure 2-(3).
3. The naive (and stable) extensions of $\langle \Delta, Def \rangle$ are $\{C_a = \{a,e\}, C_c = \{c,e\}, C_e = \{e\}\}$ and $\{C_b = \{b\}, C_d = \{d\}\}$. We deduce then that the naive and stable extensions of Σ are : $\{a,c,e\}$, $\{b,d\}$.

Now, let us give some properties for the extensions of preference-based AFNs. The first result is that preference-based AFNs represent a proper generalization of both AFNs and PAFs. Indeed, when the preference relation is reduced just to the reflexive relation, the extensions of the preference-based AFN coincide with that of the corresponding AFN (proposition 4) and when the necessity relation is absent, we obtain the same results of PAFs (proposition 5):

Proposition 4. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN where $\geq = \{(a,a) | a \in A\}$. The stable (resp. naive) extensions of Σ coincide with the stable (resp. naive) extensions of the AFN $\Gamma = \langle A, R, N \rangle$.

Proposition 5. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN where $N = \emptyset$ then, the stable (resp. naive) extensions of Σ coincide with the stable (resp. naive) extensions of the PAF $\Lambda = \langle A, R, \geq \rangle$.

The results of propositions 1 and 2 continue to hold for preference-based AFNs. Moreover, is expressed in terms of the preference relation :

Proposition 6. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN. Naive extensions of Σ are independent from the preference relation $\geq$ and correspond to the naive extensions of the simple AFN $\Gamma = \langle A, R, N \rangle$.

Proposition 7. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN. Any stable extension of Σ is a naive extension of Σ.

The following interesting corollary determines in some sense the role of preferences in an AFN.

Corollary 1. Adding or updating preferences in a AFN affects the selection function of stable extensions among naive extensions that remain unchanged.

4.2 Using a Meta Rich-PAF

As pointed out in (Amgoud and Vesic, 2010) (Amgoud and Vesic, 2011), a further role of the preference relation consists in inducing a refinement relation to compare sets of arguments. This allows to compare the extensions obtained under a given semantics. Following the same principle, we associate to a preference-based AFN a meta Rich-PAF which adds to the meta PAF defined in the previous section a refinement relation defined on sets of clusters. We use the democratic relation based on $\geq_d$.

Definition 13. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN and $\Lambda = \langle \Delta, Att, \geq_d \rangle$ be the corresponding meta PAF. We define the refinement relation $\triangleright \subseteq 2^{\Delta} \times 2^{\Delta}$ as the democratic relation based on $\geq_d$, i.e., $\forall \xi_1, \xi_2 \subseteq \Delta, \xi_1 \triangleright \xi_2$ iff $\forall c_2 \in \xi_2 \setminus \xi_1, \exists c_1 \in \xi_1 \setminus \xi_2$ *such that* $c_1 >_d c_2$, (*i.e.* $c_1 \geq_d c_2$ *and not*$(c_2 \geq_d c_1)$).

Once the refinement relation is defined, it is easy to define the meta Rich-PAF corresponding to a preference-based AFN as follows:

Definition 14. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN. We define the corresponding meta Rich-PAF by $\tau = \langle \Delta, Att, \geq_d, \triangleright \rangle$ where $\langle \Delta, Att, \geq_d \rangle$ is the corresponding meta PAF and $\triangleright$ is a refinement relation (in the sense of definition 13).

Now, among the stable extensions of the meta PAF, only the maximal ones w.r.t the refinement relation $\triangleright$ are chosen as extensions of τ.

Definition 15. Let $\Sigma = \langle A, R, N, \geq \rangle$ be a preference-based AFN and $\tau = \langle \Delta, Att, \geq_d, \triangleright \rangle$ be the corresponding meta Rich-PAF. The stable extensions of Σ seen as a rich PAF (we will call them rich-stable extensions) are the elements of $Max(\Psi, \triangleright)$ (the maximal elements of Ψ with respect to $\triangleright$) where Ψ is the set of flattened forms of the stable extensions of the meta PAF $\Lambda = \langle \Delta, Att, \geq_d \rangle$.

Notice that we have not distinguished also the rich-naive extensions (i.e., the maximal naive extensions w.r.t refinement relation $\triangleright$) because they simply coincide with the rich-stable extensions.

Example 2 (continued). Let us take again the preference-based AFN Σ of example 2. We have seen that the corresponding meta PAF has two extensions : $\{C_a, C_c, C_e\}$ and $\{C_b, C_d\}$. It is not difficult to check that the comparison between these two extensions w.r.t to the refinement relation $\triangleright$ gives : $\{C_a, C_c, C_e\} \triangleright \{C_b, C_d\}$ and we have not $\{C_b, C_d\} \triangleright \{C_a, C_c, C_e\}$. Thus the only stable extension of the corresponding meta Rich-PAF is : $\{C_a, C_c, C_e\}$ and $\{a, c, e\}$ is then the unique rich-stable extension of Σ.

5 DISCUSSION

This paper has shown how to handle information about preferences in a kind of bipolar Dung style framework where the support relation has the particular meaning of necessity. The precise meaning of the support relation allowed to specify how information about preferences should be taken into account. The main idea in this context was to distinguish in a sense two levels in representing preference. The first level is the input level corresponding to the input preference relation. The second level which is the effective one, considers that the effective preference of an argument depends on the preferences of all the arguments it requires, since accepting an argument imposes to accept all its necessary arguments regardless their quality. Based on this analysis, the paper proposed an extension of different results of the repairing-based approach to the case of AFNs.

The ideas developed in this work remain valid in the context of Dung style argumentation frameworks where no assumption is made on the structure of arguments. However, an entire body of work on argumentation is based on structured arguments and a variety of attack relations. This body includes abstract argumentation systems (Vreeswijk, 1997), defeasible logic programming (Simari and Loui, 1992) (Garcia and Simari, 2004), defeasible logic (G. Governatori and Billington, 2004), logical-based argumentation (Besnard and Hunter, 2008), logic-programming based argumentation system (Prakken and Sartor, 1997) and recently the ASPIC system (Caminada and Amgoud, 2007), (Prakken, 2010), (Prakken, 2011). In all these approaches arguments are structured and represent deductive or defeasible inferences. Thus the notion of support is already present in such approaches as an internal mechanism in the argument itself. It would be interesting to study the possible links between these kinds of supports and our necessity relation. We want in particular to check if our necessity relation can be seen as an abstraction of these kinds of supports and if it is the case, to define methods allowing to see the argumentation approaches based on structured arguments as instantiations of AFNs. Also, working on arguments with structures may lead to revise some of the basic hypotheses of the present work. For example, it may limit the cases where the interaction between preferences and attacks is handled simply by inversing the directions of critical attacks. Consequently, in presence of necessities, even if we keep the idea that the effective preference of an argument depends on the preferences of all their required arguments, the handling of the resulting attacks between clusters of arguments would require a revision that takes into account the structures of arguments.

REFERENCES

Amgoud, L. and Cayrol, C. (2002). A reasoning model based on the production of acceptable arguments. *Annals of Mathemathics and Artificial Intelligence*, 34:197–216.

Amgoud, L. and Vesic, S. (2010). Handling inconsistency with preference-based argumentation. In *4th International Conference on Scalable Uncertainty Management (SUM'10)*, pages 56–69.

Amgoud, L. and Vesic, S. (2011). Two roles of preferences in argumentation frameworks. In *11th European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty (ECSQARU11)*, pages 86–97.

Bench-Capon, T. (2003). Persuasion in practical argument using value based argumentation frameworks. *Journal of Logic and Computation*, 13(3):429–448.

Besnard, P. and Hunter, A. (2008). *Elements of Argumentation*. The MIT Press, London, 2nd edition.

Boella, G., Gabbay, D., Torre, L. V. D., and Villata, S. (2010). Support in abstract argumentation. In *3rd International Conference on Computational Models of Argument*, pages 40–51.

Bondarenko, A., Dung, P., Kowalski, R., and Toni, F. (1997). An abstract, argumentation-theoretic approach to default reasoning. *Artificial Intelligence*, 93:63–101.

Brewka, G. and Woltran, S. (2010). Abstract dialectical frameworks. In *International Conference on the Principles of Knowledge Representation and Reasoning (KR10)*, pages 102–111.

Caminada, M. and Amgoud, L. (2007). On the evaluation of argumentation formalisms. *Artificial Intelligence*, 171:286–310.

Cayrol, C. and Lagasquie-Schiex, M. (2005). On the acceptability of arguments in bipolar argumentation frameworks. In *Eighth European Conference on Symbolic and Quantitative Approaches to Reasoning with Uncertainty*, pages 378–389.

Cayrol, C. and Lagasquie-Schiex, M. (2010). Coalitions of arguments: A tool for handling bipolar argumentation frameworks. *Int. J. Intell. Syst*, 25(1):83–109.

Dung, P. (1995). On the acceptability of arguments and its fundamental role in nonmonotonic reasoning, logic programming and n-person games. *Artificial Intelligence*, 77(2):321–357.

G. Governatori, M. Maher, G. A. and Billington, D. (2004). Argumentation semantics for defeasible logic. *Journal of Logic and Computation*, 14:675–702.

Garcia, A. and Simari, G. (2004). Defeasible logic programming: an argumentative approach. *Theory and Practice of Logic Programming*, 4:95–138.

Modgil, S. (2009). Reasoning about preferences in argumentation frameworks. *Artificial Intelligence*, 173:901–934.

Nouioua, F. and Risch, V. (2011). Argumentation frameworks with necessities. In *5th International Conference on Scalable Uncertainty Management (SUM-2011)*.

Prakken, H. (2010). An abstract framework for argumentation with structured arguments. *Argument and Computation*, 1:93–124.

Prakken, H. and Sartor, G. (1997). Argument-based extended logic programming with defeasible priorities. *Journal of Applied Non-classical Logics*, 7:25–75.

Prakken, S. M. . H. (2011). Revisiting preferences and argumentation. 14:1021–1026.

Simari, G. and Loui, R. (1992). A mathematical treatment of defeasible argumentation and its implementation. *Artificial Intelligence*, 53:125–157.

Vreeswijk, G. (1997). Abstract argumentation systems. *Artificial Intelligence*, 90:225–279.