Arguing about the existence of conflicts

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Context & motivation I

Dealing with Conflicts over Propositions

Conflicts are important in structured argumentation
$\rightarrow$ conflicts between formulae in the language
$\rightarrow$ foundation of the attack relation
! but they are fixed in the system

A motivating example: gender identity

- $\rightarrow$ Sue wants to compete in the woman's chess championship
- $\rightarrow$ Sue is legally a male, as proven by her passport
- $\rightarrow$ Sue claims to be bigender – i.e. she identifies as both male and female simultaneously
- $\rightarrow$ are male/female concepts in conflict – gender binarism –, or can the two concepts coexist according to the principle of self-determination?

Context & motivation II

Work Proposal

Three main steps:

(i) start from a structured argumentation framework (ASPIC+[Modgil and Prakken, 2014])

(ii) expand its definitions to deal with reasoning over conflicts

(iii) evaluate with Dung's semantics (grounded)

- adaptation of the mechanism presented in [Dung et al., 2019] for preferences
- preservation of the semantics of standard abstract argumentation

ASPIC$^+$ I

Argumentation System

An argumentation system is a quadruple AS$=< L, R, n, \rhd >$ where:

- L is a logical language;
- $R = R_s \cup R_d$ is a set of rules. R_d is a set of defeasible rules in the form $\phi_0, ..., \phi_n \Rightarrow \phi$, R_s is a set of strict rules in the form $\phi_0, \ldots, \phi_n \rightarrow \phi$, where $\phi_0, \ldots, \phi_n, \phi$ are well-formed formulae in the L language;
- n is a naming function of the form $n : R \mapsto L$
- $\rhd$ is a non-symmetrical conflict relation over $L \times L$.

ASPIC$^+$ II

Knowledge base

A knowledge base for an AS$=< L, R, n, \rhd >$ is a set $K \subseteq L$ consisting of two disjoint subsets K_s (the axioms) and K_p (the ordinary premises).

Argumentation theory

An argumentation theory is a tuple AT$=< AS, K >$ where AS is an argumentation system and K is a knowledge base in AS.

ASPIC$^+$ III

Argument

Starting from an argumentation theory AT$=< AS, K >$, an argument A is:

1. ϕ if $\phi \in K$ with: Prem(A)=$\{\phi\}$, Conc(A)=ϕ, Sub(A)=$\{\phi\}$, DefRules(A)=$\emptyset$, TopRule(A)=undefined
2. $A_1, \ldots, A_n \Rightarrow \psi$ if $A_1, \ldots, A_n$ are arguments s.t. $\exists$ a rule $r = Conc(A_1), \ldots, Conc(A_n) \Rightarrow \psi \in R_d$.
    - Prem(A)=$Prem(A_1) \cup \ldots \cup Prem(A_n)$,
    - Conc(A)=ψ,
    - Sub(A)=$Sub(A_1) \cup \ldots \cup Sub(A_n) \cup \{A\}$,
    - TopRule(A)=r,
    - DefRules(A)=$DefRules(A_1) \cup \ldots \cup DefRules(A_n) \cup \{r\}$
3. ...

ASPIC$^+$ IV

Direct Attack

An argument A directly attacks an argument B iff A directly undercuts, directly undermines or directly rebuts B where:

- A directly undercuts B iff $Conc(A) \triangleright n(TopRule(B))$;
- A directly rebuts argument B iff $Conc(A) \triangleright Conc(B)$ and $TopRule(B) \in R_d$;
- A directly undermines argument B iff $B \in K_p$ and $Conc(A) \triangleright B$

Attack

We say that argument A attacks argument B if A directly attacks $B' \in Sub(B)$.

ASPIC$^+$ V

Abstract argumentation framework

Let AT be an argumentation theory $< AS, K >$. An abstract argumentation framework defined by AT, is a tuple $< \mathcal{A}, \rightsquigarrow >$ where:

- $\mathcal{A}$ is the set of all arguments constructed from AT;
- for any arguments X and $Y \in \mathcal{A}$, $X \rightsquigarrow Y$ iff X attacks Y

Global overview

(i) conflict relation is a fixed part of the argumentation system

- → attacks determined by conflicts between the conclusion of the attacking argument and a premise, rule name, or conclusion of the directly attacked argument

(ii) we want to make the conflict relation dynamic, allowing arguments to argue for or against the existence of conflicts

- → framework containing both the arguments arguing on conflicts and arguments whose admissibility is influenced by these conflicts

(iii) Three changes are required:

- ! object language
- ! arguments generation
- ! attacks generation

ASPIC adjustments I

Conflict-based argumentation language

Given an argumentation language L we define a argumentation language for reasoning with conflicts L_c as the smallest argumentation language $L_c = L \cup \{conf(\psi, \phi) | \psi, \phi \in L_c\} \cup \{attA \mid A$ is constructible with any set of rules over $L_c\}$.

- *conf* predicates express the conflict between language elements

ASPIC adjustments II

Conflict-based direct attack argument

A conflict-based direct attack argument X stating that argument W, based on conflict argument W', attacks argument Z, has the form $W, W' \Rightarrow att(Z)$ where:

- $Conc(W) = \phi$, $Conc(W') = conf(\phi, \psi)$ and
  - $n(TopRule(Z)) = \psi$ and $TopRule(Z) \in R_d$, or
  - $Conc(Z) = \psi$ and $TopRule(Z) \in R_d$ or
  - $Conc(Z) = \psi$ and $Z \in K_p$

Conflict-based attack

A direct attack argument $W, W' \Rightarrow att(Z)$ attacks any argument Z' such that $Z \in Sub(Z')$.

ASPIC adjustments III

Conflict-based Argumentation Framework

Given an argumentation theory AT$=<< L_c, R, n, \emptyset >, K >$ with L_c being a conflict-based argumentation language, the conflict-based argumentation framework of AT is the tuple $< \mathcal{A}_1 \cup \mathcal{A}_2, \rightsquigarrow >$ where:

- $\mathcal{A}_1$ is the set of all standard arguments constructed from AT;
- $\mathcal{A}_2$ is the set of all direct attack arguments constructed from AT and A_1;
- $X \rightsquigarrow Z$ iff X attacks Z according to the conflict-based attack definition

Gender Example I

We use the following abbreviations:

- Champ = Sue can compete in the women's chess championship
- FWoman = Sue is bigender and identifies herself also as a woman
- PMan = Sue's passport identifies her as a man
- Aut = Every person has the right to self-determine their gender
- GBin = Every person's gender is determined by their birth sex, either male or female

Gender Example II

Let us consider the theory where R_d

$r1: \ Gbin \Rightarrow conf(Man, Woman);$
$r2: \ Gbin \Rightarrow conf(Woman, Man);$
$r3: \ PMan \Rightarrow Man;$
$r4: \ FWoman \Rightarrow Woman;$
$r5: \ Woman \Rightarrow Champ$

with the following facts in K_p

$FWoman,\ PMan,\ GBin,\ conf(Aut, Gbin)$

$K_s = \emptyset,\ R_s = \emptyset.$

Gender Example III

$$
\begin{aligned}
&A0 &:\ & \texttt{FWoman}\\
&A1 &:\ & \texttt{PMan}\\
&A2 &:\ & \texttt{GBin}\\
&A3 &:\ & \texttt{conf(Aut, GBin)}\\
&A4 &:\ & A2 \Rightarrow_{r1} \texttt{conf(Man, Woman)}\\
&A5 &:\ & A2 \Rightarrow_{r2} \texttt{conf(Woman, Man)}
\end{aligned}
$$

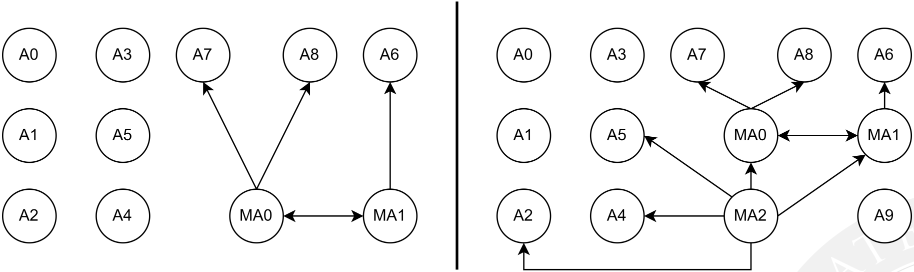
$$
\begin{aligned}
&A6 &:\ & A1 \Rightarrow_{r3} \texttt{Man}\\
&A7 &:\ & A0 \Rightarrow_{r4} \texttt{Woman}\\
&A8 &:\ & A7 \Rightarrow_{r5} \texttt{Champ}\\
&MA0 &:\ & A6,\ A4 \Rightarrow \texttt{att(A7)}\\
&MA1 &:\ & A7,\ A5 \Rightarrow \texttt{att(A6)}
\end{aligned}
$$

Gender Example IV

The case is evaluated again with the new information: $K'_p = \{Aut\} \cup K_p$.
Two new arguments are obtained:

$$
\begin{aligned}
\text{A9} &: \ \texttt{Aut} \\
\text{MA2} &: \ \text{A9},\ \text{A3} \Rightarrow \texttt{att(A2)}
\end{aligned}
$$

Gender Example V



Extension (left): $\{A0, A1, A2, A3, A4, A5\}$
Extension (right): $\{A0, A1, A3, A6, A7, A8, A9, MA2\}$

Future work

Further analysis w.r.t. the themes of:

- additional semantics
  - ! complete, preferred, ...
- integration with other approaches
  - $\rightarrow$ conditional preferences
  - $\rightarrow$ nested rules
- implementation

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