

Martin Diller, Adrian Haret, Thomas Linsbichler,
Stefan Rümmele, and Stefan Woltran

Institute of Information Systems, TU Wien, Vienna, Austria
{diller, haret, linsbich, ruemmele, woltran}@dbai.tuwien.ac.at

Bringing Together Two Fields

Abstract Argumentation

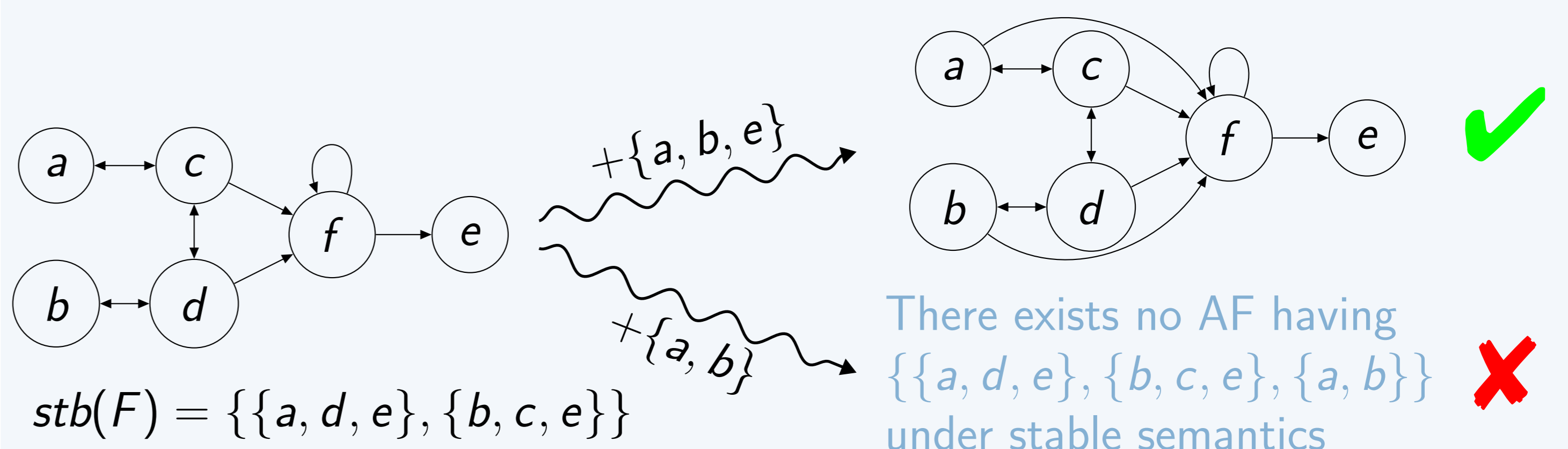
An argumentation framework (AF) is a pair $F = (A, R)$ where A is a set of arguments, and $R \subseteq A \times A$ is the attack relation representing conflicts. [3]
A semantics σ selects sets of jointly acceptable arguments, $\sigma(F) \subseteq 2^A$.
Stable semantics: $S \in stb(F)$, if S is conflict-free and attacks all $(A \setminus S)$.
 $\Sigma_\sigma = \{\sigma(F) \mid F \in AF_{\mathcal{A}}\}$ contains all sets of extensions realizable under σ . [4]

Belief Revision

The problem we tackle here is how to revise an AF when some new information is provided. By revision we mean an operation that incorporates the new information while bringing minimal change to the extensions of the original AF. To the best of our knowledge, this has first been considered for AFs explicitly in [1]. Our approach is inspired by recent work on belief revision in the Horn fragment of propositional logic [2].

Problem

Adding a new extension to an existing argumentation framework:



Our results apply to proper l-maximal semantics σ , i.e. for each $S \in \Sigma_\sigma$:

1. for all $S_1, S_2 \in \mathbb{S}$: $S_1 \subseteq S_2$ implies $S_1 = S_2$,
2. for all $\emptyset \neq S' \subseteq \mathbb{S}$: $S' \in \Sigma_\sigma$,
3. for all \subseteq -incomparable extensions S_1, S_2 : $\{S_1, S_2\} \in \Sigma_\sigma$.

Major semantics (stable, preferred, semi-stable, stage) are proper l-maximal.

Representation Result for Revision by a Propositional Formula

defining $\sigma(F *_{\sigma} \varphi) = \min([\varphi], \preceq_F)$ satisfies P*1 - P*6 given faithful, σ -compliant \preceq_F

Faithful assignments to σ -compliant rankings \preceq_F

Given semantics σ , a faithful assignment maps every AF F to a total pre-order \preceq_F on $2^{\mathcal{A}}$ such that, for any $E_1, E_2 \in 2^{\mathcal{A}}$ and $F, F_1, F_2 \in AF_{\mathcal{A}}$, it holds that:

- (i) if $E_1, E_2 \in \sigma(F)$, then $E_1 \approx E_2$,
- (ii) if $E_1 \in \sigma(F)$ and $E_2 \notin \sigma(F)$, then $E_1 \prec_F E_2$,
- (iii) if $\sigma(F_1) = \sigma(F_2)$, then $\preceq_{F_1} = \preceq_{F_2}$.

A pre-order \preceq is σ -compliant if for every consistent formula φ it holds that $\min([\varphi], \preceq) \in \Sigma_\sigma$.

Revision postulates

- (P*1) $\sigma(F *_{\sigma} \varphi) \subseteq [\varphi]$.
- (P*2) If $\sigma(F) \cap [\varphi] \neq \emptyset$ then $\sigma(F *_{\sigma} \varphi) = \sigma(F) \cap [\varphi]$.
- (P*3) If $[\varphi] \neq \emptyset$ then $\sigma(F *_{\sigma} \varphi) \neq \emptyset$.
- (P*4) If $\varphi \equiv \psi$ then $\sigma(F *_{\sigma} \varphi) = \sigma(F *_{\sigma} \psi)$.
- (P*5) $\sigma(F *_{\sigma} \varphi) \cap [\psi] \subseteq \sigma(F *_{\sigma} (\varphi \wedge \psi))$.
- (P*6) If $\sigma(F *_{\sigma} \varphi) \cap [\psi] \neq \emptyset$ then $\sigma(F *_{\sigma} (\varphi \wedge \psi)) \subseteq \sigma(F *_{\sigma} \varphi) \cap [\psi]$.

$*_{\sigma}$ satisfying P*1 - P*6 gives rise to faithful, σ -compliant \preceq_F

Representation Result for Revision by an Argumentation Framework

defining $\sigma(F *_{\sigma} G) = \min(\sigma(G), \preceq_F)$ satisfies A*1 - A*6 + Acyc given l-faithful \preceq_F

l-faithful assignments to rankings \preceq_F

Given semantics σ , an l-faithful assignment maps every AF F to an l-total pre-order \preceq_F on $2^{\mathcal{A}}$ such that, for any \subseteq -incomparable $E_1, E_2 \in 2^{\mathcal{A}}$ and $F, F_1, F_2 \in AF_{\mathcal{A}}$, it holds that:

- (i) if $E_1, E_2 \in \sigma(F)$, then $E_1 \approx E_2$,
- (ii) if $E_1 \in \sigma(F)$ and $E_2 \notin \sigma(F)$, then $E_1 \prec_F E_2$,
- (iii) if $\sigma(F_1) = \sigma(F_2)$, then $\preceq_{F_1} = \preceq_{F_2}$.

Revision postulates + Acyc

- (A*1) $\sigma(F *_{\sigma} G) \subseteq \sigma(G)$.
- (A*2) If $\sigma(F) \cap \sigma(G) \neq \emptyset$, then $\sigma(F *_{\sigma} G) = \sigma(F) \cap \sigma(G)$.
- (A*3) If $\sigma(G) \neq \emptyset$, then $\sigma(F *_{\sigma} G) \neq \emptyset$.
- (A*4) If $\sigma(G) = \sigma(H)$, then $\sigma(F *_{\sigma} G) = \sigma(F *_{\sigma} H)$.
- (A*5) $\sigma(F *_{\sigma} G) \cap \sigma(H) \subseteq \sigma(F *_{\sigma} f_{\sigma}(\sigma(G) \cap \sigma(H)))$.
- (A*6) If $\sigma(F *_{\sigma} G) \cap \sigma(H) \neq \emptyset$, then $\sigma(F *_{\sigma} f_{\sigma}(\sigma(G) \cap \sigma(H))) \subseteq \sigma(F *_{\sigma} G) \cap \sigma(H)$.
- (Acyc) If for $0 \leq i \leq n$, $\sigma(F *_{\sigma} G_{i+1}) \cap \sigma(G_i) \neq \emptyset$ and $\sigma(F *_{\sigma} G_0) \cap \sigma(G_n) \neq \emptyset$ then $\sigma(F *_{\sigma} G_n) \cap \sigma(G_0) \neq \emptyset$.

$*_{\sigma}$ satisfying A*1 - A*6 + Acyc gives rise to l-faithful \preceq_F

Future Work

- ▶ Extend results to semantics which are not proper l-maximal.
- ▶ Identify operators based on σ -compliant rankings for specific semantics σ .
- ▶ Extend insights to a broader theory of belief change within fragments.
- ▶ Apply findings to other belief change operations, e.g. iterated belief revision.
- ▶ Take the syntactic form of the AF into account.

References

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