The Complexity Landscape of Claim-Augmented Argumentation Frameworks

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A Claim-centric View in Argumentation

Instantiation-based Argumentation

- Start from a knowledge base (KB), which is potentially inconsistent;
- Construct arguments - arguments consist of claim and support;
- Relationship between arguments is analyzed;
- Abstract away from the contents of the arguments and only consider the remaining abstract argumentation framework (AF);
- Semantics for AFs deliver a collection of sets of arguments (“extensions”) which are understood as jointly acceptable;
- Re-interpretation in terms of their claims to restate problem in the domain of original setting.

Claim-augmented Argumentation Frameworks

A claim-augmented argumentation framework (CAF) is a triple (A, R, claim),

1. (A, R) is an AF with arguments A and attacks R ⊆ A × A.
2. claim: A → C assigns a claim to each argument.

- A CAF is well-formed if arguments with the same claim attack the same arguments.
- The concept of well-formedness is satisfied by many (but not all) instantiations.

Claim-centric Complexity Analysis

Given semantics σ, CAF CF = (A, R, claim), claim c ∈ C and C ⊆ C.

- Cred.: Does c ∈ C hold for at least one C ∈ σ(CF)?
- Skept.: Does c ∈ C hold for all C ∈ σ(CF)?
- Ver.: Does C ∈ σ(CF) hold?
- NExSF.: Does C # C for some C ∈ σ(CF)?

Semantics for CAFs

Inherited Semantics

- Idea: Evaluate underlying AF, interpret outcome in terms of claims (variant (1)).
- Given semantics σ, we define its inherited variant as σ(CF) = {claim(E) | E ∈ σ((A, R)')}.

Claim-level Semantics

- Idea: Shift steps in the evaluation from argument- to claim-level (variant (2)).
- Maximization of claim-sets (e.g., preferred semantics); and

- E defeats c (in CF) if E attacks every a ∈ A with claim(a) = c.

- We consider claim-level variants of preferred (cl-prf), naive (naive), stable (cl-stb), semi-stable (sem) and stage (stg) semantics.

- For well-formed CAFs, variants of preferred and stable semantics coincide.

Comparing Semantics

- Given AF-semantics σ, and a CAF CF = (A, R, claim),
- ConCAF: Does it hold that σ(CF) = cl-σ(CF)?

- The concurrence problem restricted to well-formed CAFs is denoted by ConCAF.

Complexity of ConCAF

<table>
<thead>
<tr>
<th>prf</th>
<th>naive</th>
<th>stb</th>
<th>sem</th>
<th>stg</th>
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<tbody>
<tr>
<td>Σ^1_2</td>
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Results that deviate from the corresponding AF results are blue; results that deviate from those with inherited semantics are underlined.

Arguments vs. Claim Acceptance

Skeptical Acceptance: Is a particular argument a / claim c covered by all extensions?

Example (ctd.)

Comparing argument-extensions {a, b, c}, {a', b, c}, claim-sets {a, b, c}, {a, b, c, c} (outcome of variant (1)); and claim-set {a, b, c} (cf. variant (2)), we observe that

- Argument b is skeptically accepted;
- Claims a are skeptically accepted wrt. both variants (1) and (2).
- A claim c is skeptically accepted wrt. variant (2).

Observation:

- Argument acceptance alone is insufficient to decide the acceptance of claims.
- Claim-acceptance depends on chosen claim-based evaluation method.

Main References