Relating Carneades with Abstract Argumentation

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Argumentation

1. Construct arguments in favour and against a statement,
2. Select the applicable arguments,
3. Determine whether the statement is acceptable.

Conceptual overview

Three models of argumentation:

<table>
<thead>
<tr>
<th>Structured</th>
<th>Structured</th>
<th>Abstract</th>
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<tbody>
<tr>
<td>Carneades</td>
<td>ASPIC⁺</td>
<td>Dung</td>
</tr>
<tr>
<td></td>
<td>translates to</td>
<td>translates to</td>
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Contribution:
- Adding a translation from Carneades to ASPIC⁺
- In effect translating Carneades to Dung

Carneades

Local proof standards, distinctive feature of Carneades:
- Each statement has an individual proof standard:
  
  \[ \text{standard}(\text{intent}) = \text{scintilla of evidence} \]
  
  \[ \text{standard}(\neg \text{intent}) = \text{preponderance of the evidence} \]
  
  \[ \text{standard}(	ext{murder}) = \text{beyond reasonable doubt} \]

Result: natural account of reasoning under burden of proof

Argument translation

Given assumptions = \{witness, liar, self–defense, kill\} and liar an exception of \( a_1 \):

\[ \text{witness} \quad \text{liar} \quad \text{self–defense} \quad \text{intent} \quad \text{kill} \]

\[ a_2 \quad a_1 \]

\[ \text{weight}(a) \leq \alpha \]

<table>
<thead>
<tr>
<th>witness</th>
<th>app</th>
<th>intent</th>
<th>arg</th>
<th>kill</th>
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<tr>
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\[ \neg \text{intent} \quad \text{murder} \]

Properties of the translation

Well-foundedness:
- Dung AFs corresponding to Carneades are cycle-free
- Well-founded ⇒ unique corresponding extension
- Allows for a generalisation to cycle-containing structures

Correspondence results:
- Applicable argument \( a \) in Carneades ↔ argument with conclusion \( \text{arg}_a \) in unique extension
- Acceptable statement \( p \) in Carneades ↔ argument with conclusion \( p \) in unique extension

Corresponding ASPIC⁺ argumentation system:
- Satisfies rationality properties
- Is able to model ambiguity-blocking behaviour in Dung's AF

Contributions

Gained insight:
- Local proof standards in Dung/ASPIC⁺
- Carneades as knowledge-based argumentation
- Formal correspondence results

Improvements for Carneades:
- Generalised Carneades to cycle-containing structures
- Rationality postulates proven
- ASPIC⁺ argument schemes in Carneades