CONTRAST: Computing Tradeoffs among Normative Multiagent System Specifications

Özgür Kafalı, Nirav Ajmeri and Munindar P. Singh

Department of Computer Science
rkafali@ncsu.edu

August 30, 2016
Submission Details

- Thirty-First AAAI Conference on Artificial Intelligence (AAAI-17)
  http://www.aaai.org/Conferences/AAAI/aaai17.php
- Deadline: September 14, 2016
- 6 pages + 1 page for references
- Supplementary material
Approach & Contributions

- Formal approach for comparing normative multiagent system (nMAS) specifications
- Understand tradeoffs among liveness (something good happens) and safety (nothing bad happens)
- Normative specification includes authorizations, (practical and dialectical) commitments, and prohibitions

Contributions
- Formalize tradeoffs between liveness and safety using nMAS elements
- Develop an approach for comparing nMAS
- Propose design patterns based on norm strength, and prove that they increase liveness or safety
- Propose metrics for measuring liveness and safety, and perform experiments using constraint logic programming
Tradeoffs

Liveness

Optimal specifications

Enhanced

Ideal

More live

Safer

Safety

Gain

Boost

Loss

Diminished

Suboptimal

Tradeoff

Ideal tradeoff

Enhanced tradeoff

Optimal

Suboptimal

Diminished

Loss

Gain

Ideal

Safer

More live

Optimal

Suboptimal

Diminished

Gain

Loss

Ideal

Safer

More live
Experiments

- Experiments using constraint logic programming

Liveness score = \frac{\text{supported procedures}}{\text{all procedures}}

Safety score = 1 - \frac{\text{procedures by outside physicians}}{\text{supported procedures}}

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>Liveness score</th>
<th>Safety score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suboptimal</td>
<td>Enhanced</td>
</tr>
<tr>
<td>Regular practice</td>
<td>0.19</td>
<td>0.19</td>
</tr>
<tr>
<td>Medical emergency</td>
<td>0.10</td>
<td>0.73</td>
</tr>
<tr>
<td>Server failure</td>
<td>0.00</td>
<td>0.21</td>
</tr>
</tbody>
</table>
IJCAI Reviews

Scores:
- Before rebuttal: +1  +1  +1  +3
- After rebuttal: -1  +1  -1  +1

Main criticism:
- Computational complexity (design time approach, tractable for practical problems)
- Comparison of proposed metrics with the literature
- Formalization (fewer definitions, more focused)
Accepted as short paper (withdrawn)

Main criticism:

- Norm semantics
- Domain (only one example to demonstrate approach)
- Relevance to verification literature