Heuristic AND/OR Search for Solving Influence Diagrams

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SoCS 2020: The 13th Annual Symposium on Combinatorial Search
We present initial results of AND/OR search for influence diagrams guided by weighted mini-bucket heuristics.
Influence Diagram

Valuation Algebra for Influence Diagrams

Primal Graph

Pseudo-tree

AND/OR Search Space

Decomposition bounds from bucket tree
Experiment Results

<table>
<thead>
<tr>
<th>Instances</th>
<th>n, f, w, i</th>
<th>WMBE</th>
<th>OPT</th>
<th>AO</th>
<th>AOBB+MBE</th>
<th>AOBB+WMBE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA1-t5</td>
<td>130,180,20,10</td>
<td>98.4</td>
<td>96.6</td>
<td>81</td>
<td>60</td>
<td>13</td>
</tr>
<tr>
<td>SA1-t10</td>
<td>250,350,20,10</td>
<td>197.2</td>
<td>183.5</td>
<td>180</td>
<td>164</td>
<td>31</td>
</tr>
<tr>
<td>SA2-t5</td>
<td>190,265,30,15</td>
<td>147.5</td>
<td>139.7</td>
<td>998(m)</td>
<td>2218(m)</td>
<td>2062</td>
</tr>
<tr>
<td>SA2-t10</td>
<td>365,515,30,15</td>
<td>295.7</td>
<td>NA</td>
<td>1037(m)</td>
<td>2518(m)</td>
<td>3597(m)</td>
</tr>
</tbody>
</table>

- System Admin MDP 10,15 servers up to 5, 10-time horizons
- n: number of variables, f: number of functions, w: constrained induced width, i: i-bound for WMBE
- WMBE upper bound of optimal MEU, AO: time in seconds by AND/OR graph search
- AOBB+MBE: time in seconds by AND/OR branch and bound search with Mini-bucket heuristic
- AOBB+WMBE: time in seconds by AND/OR branch and bound search with Weighted mini-bucket heuristic

Conclusion

- AND/OR search with decomposition-based heuristic for solving influence diagrams.
- AOBB-WMBE improved search compared with AO or AOBB-MBE
- Future work: develop efficient search strategies and tighter variational bounds