

MUS_tICCa: MUS Extraction with Interactive Choice of Candidates (Tool Paper)

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Interactive MUS Extraction

A Weakness of Current MUS Extraction Technology

- MUS extraction tools are black boxes which return some arbitrary MUS
- no information about the search space, MUSes are difficult to compare

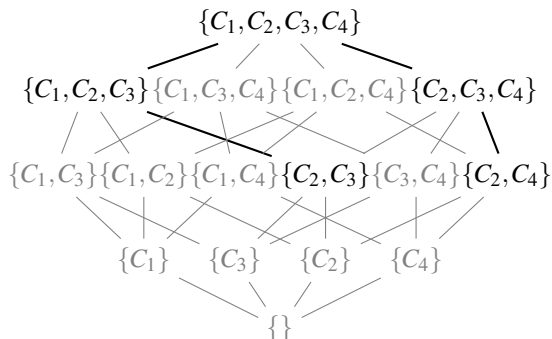
The Idea

- explicitly visualize the search space as part of the powerset lattice
- allow the user to manually execute reduction steps

Advantages

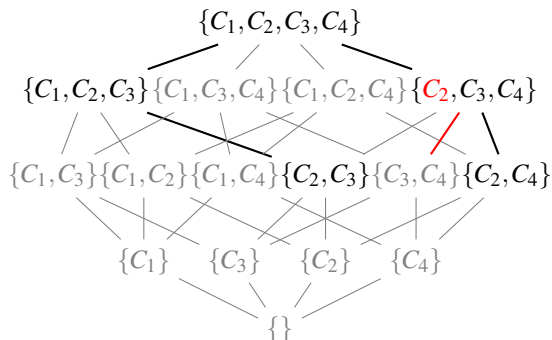
- we receive a good impression of search space structure
- experts can prioritize reduction attempts according to their domain knowledge in order to **extract several interesting MUSes and compare them**
- we can exploit synergies between different branches of the search space exploration by systematically sharing criticality information

Sharing criticality information



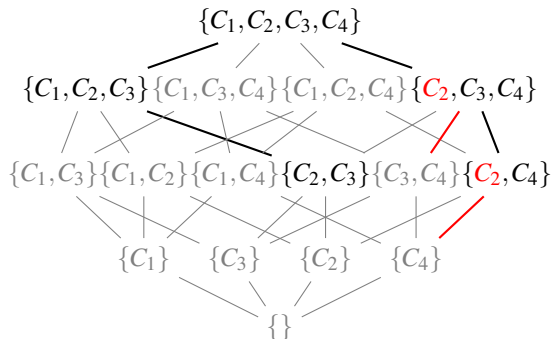
- powerset lattice of $\{C_1, C_2, C_3, C_4\}$
- **black** edges / subsets already explored

Sharing criticality information



- powerset lattice of $\{C_1, C_2, C_3, C_4\}$
- **black** edges / subsets already explored
- let C_2 be **critical** in $\{C_2, C_3, C_4\}$

Sharing criticality information



- powerset lattice of $\{C_1, C_2, C_3, C_4\}$
- **black** edges / subsets already explored
- let C_2 be **critical** in $\{C_2, C_3, C_4\}$
- downward propagation via explored edges: C_2 **critical** in $\{C_2, C_4\}$ as well
- lose information: e.g. criticality of C_2 in $\{C_2, C_3\}$

MUSTICCa

Instance US 7

Reduction graph

Automated Reduction

Start a new reduction agent at the selected US

Basic heuristics: descending index heuristic

Signal color: Change

Clause set refinement: ☒

Model rotation: ☐

Autarky reduction: ☐

Start

Reduction agents

Change	descending index heuristic from US of size 47 terminated in a MUS of size 34 after 34 (34) SAT reductions and 3 (3) UNSAT reductions.	Hide	Remove
Change	descending index heuristic from US of size 46 terminated in a MUS of size 34 after 34 (34) SAT reductions and 12 (12) UNSAT reductions.	Hide	Remove
Change	ascending index heuristic from US of size 47 terminated in a MUS of size 36 after 36 (36) SAT reductions and 11 (11) UNSAT reductions.	Hide	Remove

Current US

```

3812: (-37,-36)
3813: (-56,-36)
3820: (-38,-36)
3822: (-54,-36)
3922: (-55,54)
3949: (-51,46,96,119,453,454,455,798)
3974: (-52,37)
4026: (-221,37)
4052: (-53,37)
4077: (-57,56)
4103: (-38,48)
4997: (-347,-346)
5162: (-96)
5282: (-119)
5284: (-453)
5285: (-454)
5291: (-455)
5293: (-798)
5346: (-252)
5384: (-256)
5388: (-171)
6131: (-38,41,45,46,52,53,55,57,221)
6176: (183,215)
6177: (36,183)
6178: (36,38)
6184: (-728)
6197: (-346,-183,-41,-36,32,63,96,171,252,256,276,347)
6203: (-346,-215,-41,-36,32,63,96,171,252,256,276,347)
6208: (-346,-183,-45,-36,32,46,63,96,171,252,256,276,
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The End

- JAR release and user's manual available at

`algo.inf.uni-tuebingen.de/?site=forschung/sat/MUSTICCa`

- source code available at

`kahina.org`

- much more information in

Dellert, J.: Interactive Extraction of Minimal Unsatisfiable Cores Enhanced By Meta Learning. Diplomarbeit, Universität Tübingen (2013)

Thank you for your attention!