

Counterexample-guided Cartesian Abstraction Refinement

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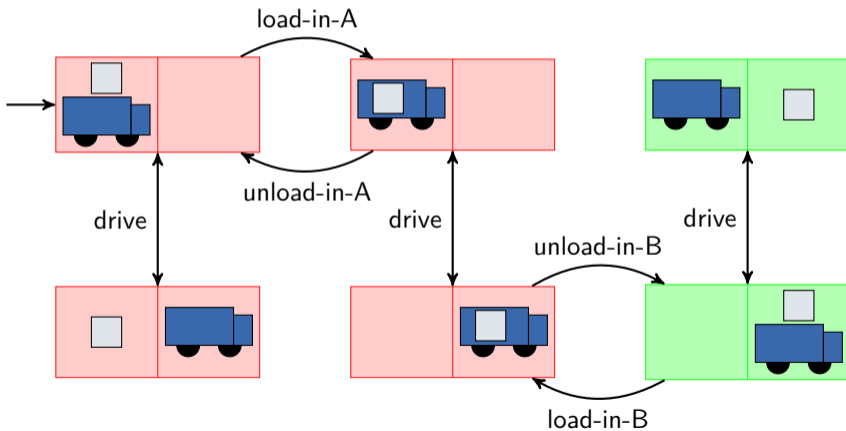
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Overview

- 1 CEGAR algorithm
- 2 Evaluation
- 3 Ongoing research

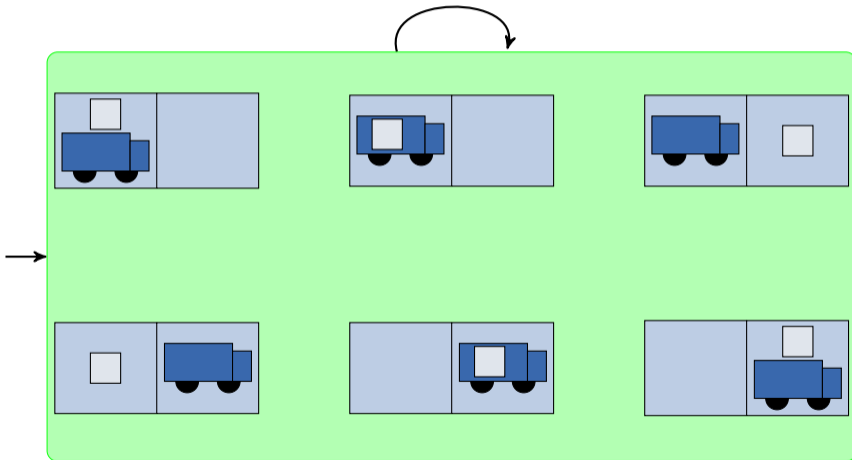
CEGAR algorithm

Classical planning

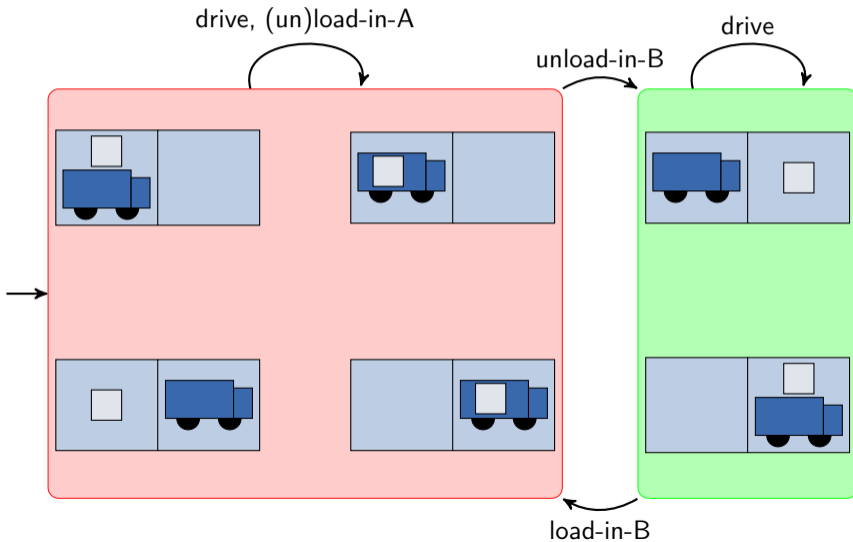


Example refinement

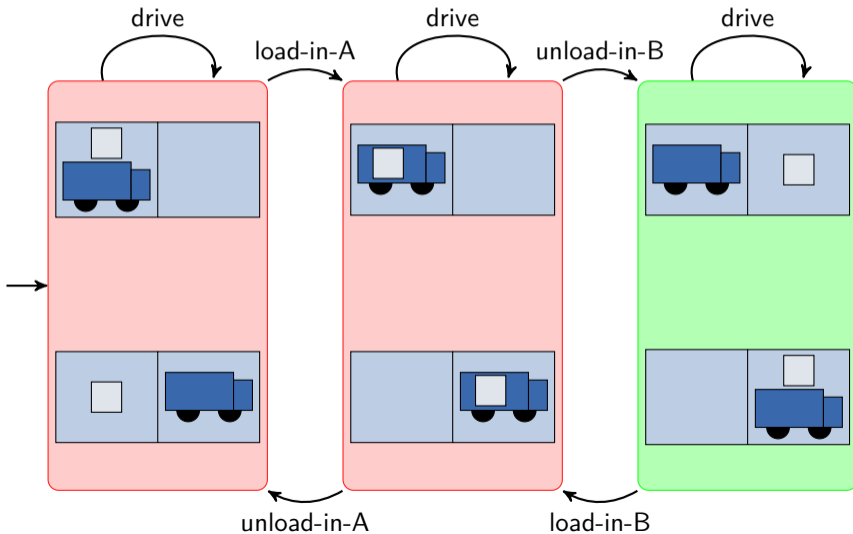
drive, (un)load-in-A, (un)load-in-B



Example refinement



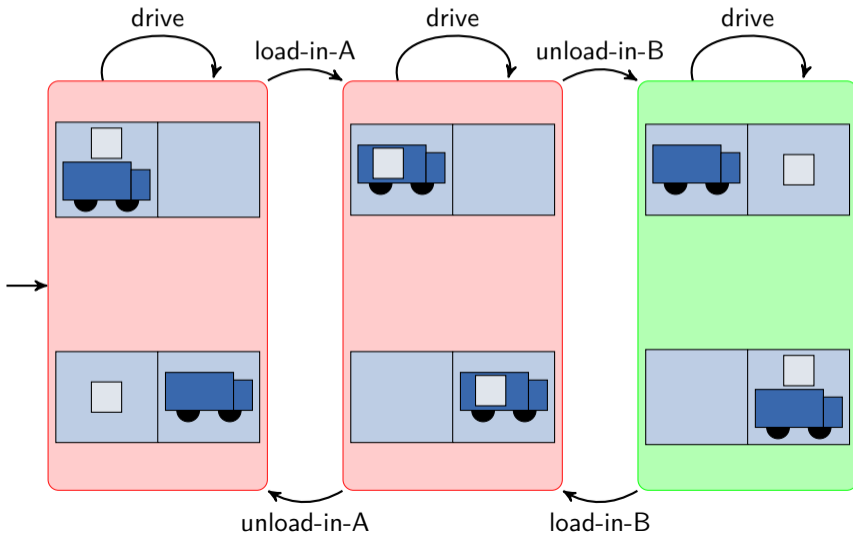
Example refinement



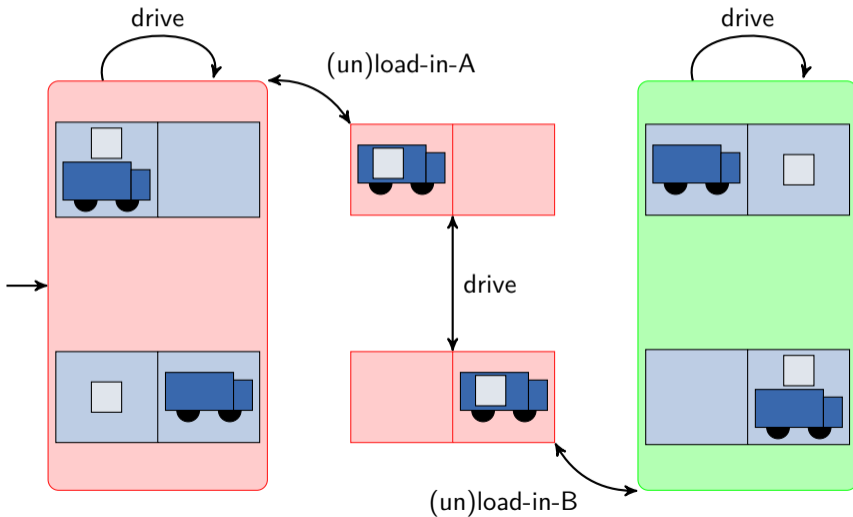
Background

- Relation to other classes of abstractions?

Pattern database



Cartesian Abstraction



Classes of abstractions

- **Pattern databases**
Refinement at least doubles number of states
- **Cartesian abstractions**
Allow fine-grained refinement
- **Merge-and-shrink abstractions**
Preimage of abstract states not efficiently computable

Evaluation

Experiments

Setup

- 30 minutes, 2 GB
- 15 minutes refinement

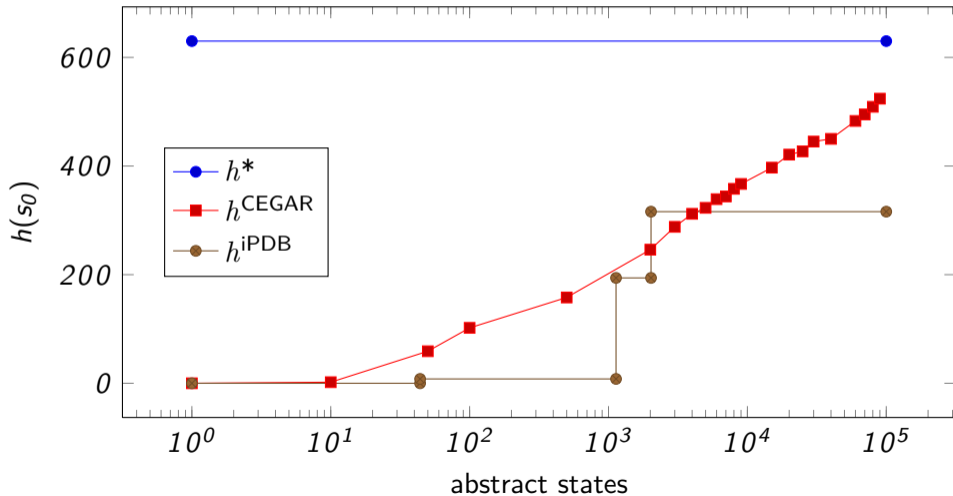
Experiments

Results

Coverage	h^0	h^{iPDB}	$h_1^{m\&s}$	$h_2^{m\&s}$	h^{CEGAR}
elevators-08 (30)	11	20	1	12	16
miconic (150)	50	45	50	74	55
mprime (35)	19	22	23	11	27
mystery (30)	18	22	19	12	24
...
Sum (1116)	397	450	391	449	441
Worse than h^0	0	30	68	40	1

Experiments

Results – $h(s_0)$ on transport #23



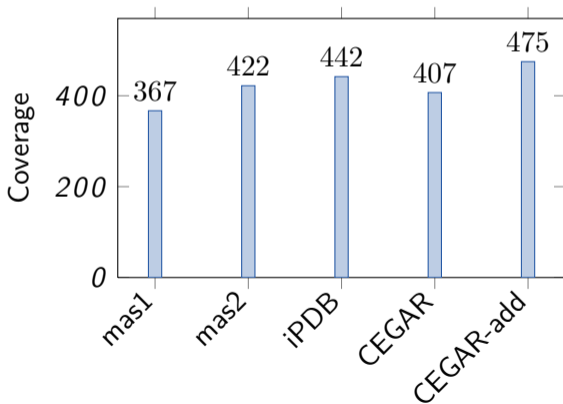
Ongoing research

Current work

- Break all optimal solutions
- Additive abstractions (AAAI-LBP 2013)

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Future work

- How to select flaws?
- Better termination criterion for refinement loop

Conclusion

- CEGAR for classical planning
- New admissible heuristic
- Robust performance

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