Incremental Search for Counterexample-Guided Cartesian Abstraction Refinement

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In a Nutshell

- optimal classical planning
- $A^*$ search + abstraction heuristic
- counterexample-guided Cartesian abstraction refinement
- bottleneck: find shortest path
- incremental search: 1000x speedup

CEGAR

compute initial abstraction
until TERMINATE():
  find shortest path in abstraction
  if there is no path:
    return unsolvable
  find flaw in path
  if there is no flaw:
    return plan
  refine abstraction for flaw
return abstraction

Example Task

Abstraction Refinement

Incremental Search

- add/remove transitions
- increase/decrease weights
- fixed set of states

Two-Step Refinement

before splitting $v$

Copy $v$

prune transitions

Increase (Frigioni et al., 2000)

- increasing weights, removing transitions
- shortest path tree
- reconnect ancestor states, mark rest dirty
- run Dijkstra on dirty states

Time for Finding Shortest Paths

Solved Tasks Over Time