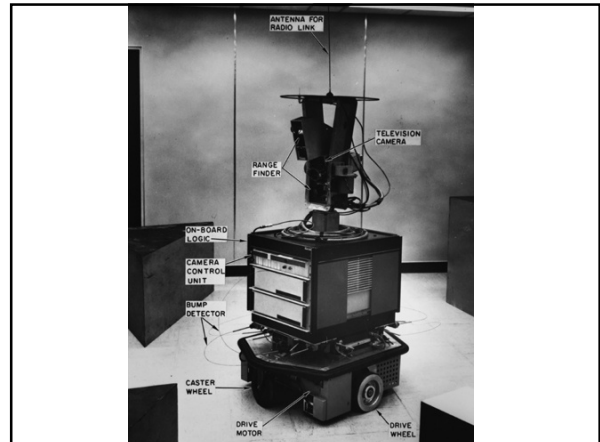


Advanced Search: STRIPS and Property Space representation

Day 1 of Advanced Search

Material in part from <http://www.cs.cmu.edu/~awm/tutorials>



Property Space Representation

- Reasoning about sets of states in lieu of individual states
 - Relevance
 - Computational tractability
 - Conditional applicability

Property Space Representation

- Literals as properties identifying a subset of the set of all states S
 - Relevance can now be context-specific to the property being considered
 - So, properties are **partitions**
 - Intersection denotes arbitrary subsets

Property Space Representation

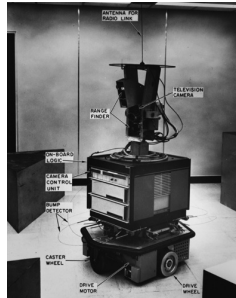
- Planning/Search transforms to reasoning about properties
 - How do actions impact properties describing current conditions of the world?
 - Challenge example: Making French Toast

STRIPS

Stanford Research Institute Problem Solver

- A simplified property-based planning representation and solver
- $\langle P, O, I, G \rangle$
 - P properties or conditions
 - O operators of form $\langle \text{preconditions}, \text{postconditions} \rangle$
 - I initial conditions (initial state set)
 - G goal conditions (goal state set)
- BlocksWorld example on board
- Extensions: variable introduction

Shakey.. the movie



Shakey

HARDWARE

2-wheel differential drive with two casters
whiskers, camera, optical rangefinder
transmission of TV signal off-board
computer!

Shakey

5 layers:

- 1) robot – PDP-15
- 2) LowLevelActions: (LISP) (roll) (tilt) (iristo)
- 3) Intermediate Level Actions (push) (go to) – contain error-handling to some degree!
- 4) STRIPS planner: construction of sequences of ILA's
- 5) PLANEX (plan executor)

STRIPS

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- Limitations? (discussion)
- Property Space representation revisited: explicit uncertainty management has become more prevalent, but properties have power!

Example in Blocks World

- Literals that describe partitions of state space:

- Table(a) block a is touching the table
- On(a,b) block a is on top directly of b
- Clear(b) block b has no blocks atop it

Example of an initial condition:

<table(a), on(b,a), clear(b)>

Blocks world: operators

- Actions are defined in terms of transformation of properties, or literals.
- stack(a,b) – stack a onto the top of b
- This only works under certain conditions because of the robot's "limitations" so:
 - Preconditions for stack(a,b)
 - table(a), clear(b), clear(a)
 - Postconditions for stack(a,b)
 - on(a,b), not (table(a)), not(clear(b))

The Midterm Returns

- Average: 80
- Standard deviation: 13
- Top score: 103
- Advice...