

CS 730/730W/830: Intro AI

Beyond STRIPS

Hierarchy

Beyond STRIPS

- Comparison
- Extensions
- Setting
- Break

Hierarchy

Beyond STRIPS

Comparison

Beyond STRIPS

■ Comparison

■ Extensions

■ Setting

■ Break

Hierarchy

Forward: states

- + state known: strong heuristic, expressivity
- – irrelevant states

Backward: sets of states

- + relevant states
- – partial states: larger space, weaker heuristic, expressivity

Partial-order: plans

- + small space
- +/– least commitment
- – poor heuristics

STRIPS Extensions

Beyond STRIPS

■ Comparison

■ Extensions

■ Setting

■ Break

Hierarchy

negated goals: no problem with CWA

disjunctive precondition: for regression, just branch

conditional effects: for regression, if we need the effect, plan
for the condition

universal preconditions and effects: just ground goals and
preconditions

Beyond STRIPS

■ Comparison

■ Extensions

■ Setting

■ Break

Hierarchy

STRIPS assumes static, deterministic world, discrete time, single discrete actions.

1. time, resources
2. concurrent actions
3. abstraction: hierarchical planning
4. uncertainty: eg, disjunctive effects
5. temporally extended goals
6. execution monitoring, replanning
7. continuous state
8. multiple (self-interested) agents

Break

Beyond STRIPS

- Comparison
- Extensions
- Setting

■ Break

Hierarchy

- asst 8
- asst 9 Tue Apr 7
- wildcard vote Thu Apr 2

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- HGN Example
- DAO
- Class Outline
- EOLQs

Hierarchy

The Many Forms of Hierarchy

Beyond STRIPS

Hierarchy

■ Hierarchy

■ HTNs

■ HTN Example

■ HGNs

■ HGN Example

■ DAO

■ Class Outline

■ EOLQs

- task decomposition/refinement
- actions = goals for lower level
- actions = restrictions for lower level
- actions = heuristic for lower level

Hierarchical Task Networks

Beyond STRIPS

Hierarchy

■ Hierarchy

■ HTNs

■ HTN Example

■ HGNs

■ HGN Example

■ DAO

■ Class Outline

■ EOLQs

- states, tasks, methods, actions
- actions: preconditions, effects
- methods: preconditions, subtasks
- 'goal': complete decomposition into primitive actions

downward refinement: high-level guaranteed to refine into legal primitives

planning is semi-decidable, plan verification is NP-hard

SHOP2 planner

HTN Example: Logistics

Beyond STRIPS

Hierarchy

■ Hierarchy

■ HTNs

■ HTN Example

■ HGNs

■ HGN Example

■ DAO

■ Class Outline

■ EOLQs

actions: Drive, Load, Unload

method:

MovePackageByTruck(p,s,d, t)

pre: At(p,s)

post: At(p,d)

subtasks: Drive(t, s), Load(p,t,s), Drive(t,d), Unload(p,t,d)

Hierarchical Goal Networks (IJCAI, 2013)

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- HGN Example
- DAO
- Class Outline
- EOLQs

- operators as in STRIPS
- goal network: partially-ordered set of DNF formulas over literals
- method: preconditions and subgoals. postconditions are last subgoal.
- subgoal: conjunction of literals

planner branches on:

- progressing state using applicable actions
- 'decomposing' problem using applicable methods
applicable in state and relevant to goal

methods are only for search guidance!

HGN Example: Logistics

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- **HGN Example**
- DAO
- Class Outline
- EOLQs

actions: Drive, Load, Unload

method:

MovePackageByTruck(p,s,d, t)

pre: At(p,s)

subgoals: At(t, s), In(p,t), At(t,d), At(p,d)

Example: Dragon Age: Origins

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- HGN Example
- **DAO**
- Class Outline
- EOLQs

Class Outline

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- HGN Example
- DAO
- Class Outline
- EOLQs

1. search: heuristics, CSPs, games
2. knowledge representation: FOL, resolution
3. planning: STRIPS, MDPs
4. learning: supervised, unsupervised
5. uncertainty: particle filters, HMMs

Beyond STRIPS

Hierarchy

- Hierarchy
- HTNs
- HTN Example
- HGNs
- HGN Example
- DAO
- Class Outline

■ EOLQs

- What question didn't you get to ask today?
- What's still confusing?
- What would you like to hear more about?

Please write down your most pressing question about AI and put it in the box on your way out.

Thanks!