Acting and Planning Using Operational Models

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Planning
- Prediction + search
- To reach a goal or accomplish a task

Acting
- Performing tasks and actions in the real world
- Adapt to context, react to events
- Dynamic environment

Problem:
Are they consistent?

Planning Algorithm: RAEplan
Idea: Do rollout simulations of tasks and commands in a simulated environment
- Do several Monte Carlo rollouts
- Estimate the expected cost for every choice
- Choose the method with least expected cost

Actor
Example of Acting and Operational Models
- Task is find(r, ball)

Planning Stage
Acting Stage

Descriptive Models
What the actions do?

eg. PDDL actions
action: action-identifier
pre: test
effects: effect, effect, ...

Operational Models
How to perform the task?

method-name(arg, ..., arg,)
task: task-identifier
pre: test
body: computer program to generate commands and more tasks

RAE = Refinement Acting Engine

loop:
for every new task
Candidates ← (applicable method instances)
choose m from Candidates
create a refinement stack
like a program execution stack
initially with just task and m
add the stack to Agenda
for each stack in Agenda
Progress(stack)

Use RAEplan to make an informed choice

Acting Algorithm: RAE

Experimental Evaluation

Measure Efficiency = Inverse (to account for failures) of cost in four domains

Key
b = 1
b = 2
b = 3
b = 4

The maximum expected efficiency of the tasks increases with increase in rollouts in all four domains.

Conclusions
- Integration of acting and planning is achieved in a smooth and practical way
- RAEplan directly makes use of existing operational models for planning
- Simulating commands allows us to handle different types of state representations

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