Learning Dirichlet Priors for Affordance Aware Planning

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Goal

Previous Work: provide a planner with domain specific knowledge in order to solve extremely complex, previously unsolved tasks.

Proposal: Learn this knowledge through scaffolding to remove dependence on expert.

Background

OO-MDP

Affordances

"What [the environment] offers [an] animal, what [the environment] provides or furnishes, either for good or ill"

- J.J. Gibson, 1977

Formalism:

$$\Delta_i = \langle p, g \rangle \longmapsto \{\lambda\}$$

p = predicate on states
g = lifted goal description
λ = subset of OO-MDP Actions

Minecraft

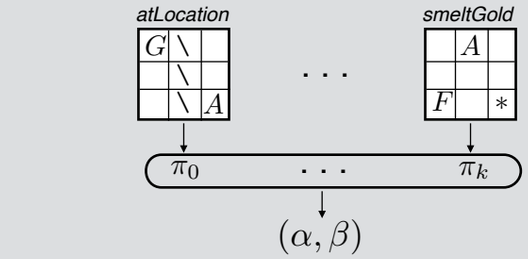
<pics>

Learning

Goal: For each state, for each affordance, learn how useful each action is

<pics>

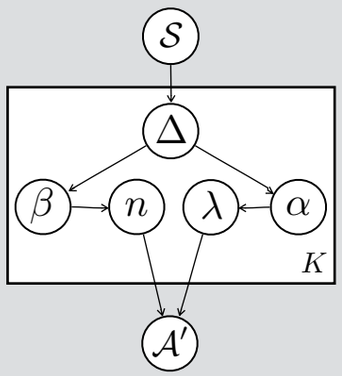
Scaffolding:



Distributions:

$$\Pr(\lambda \mid \alpha) = Dir(\alpha)$$
$$\Pr(n \mid \beta) = DirMult(\beta)$$
$$\Pr(\mathcal{A} \mid n, \lambda) = \Pr(\lambda \mid \alpha) \cdot \Pr(n \mid \beta)$$

Graphical Model:



$\mathcal{S}$ = OO-MDP State
Δ = Affordance
α = Action Counts
β = Action Set Size Counts
λ = Distribution on Actions
n = Distribution on Action Set Size
$\mathcal{A}'$ = Pruned Action set

Results

Bellman Updates Per Converged Policy

	World 1	World 2	World 3	World 4
No Affordances				
Expert Afordances				
Learned Affordances				

Related Work

Logic Based Methods

Action Pruning

Heuristics

References

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