

Motivation

Tutorials are an important part of a player's first experience with a game. However, they are often overlooked due to time and resource constraints [1]. AI has the potential to automatically generate tutorials for players [2]. Existing work can generate levels designed to teach players an arbitrary game mechanic [3].

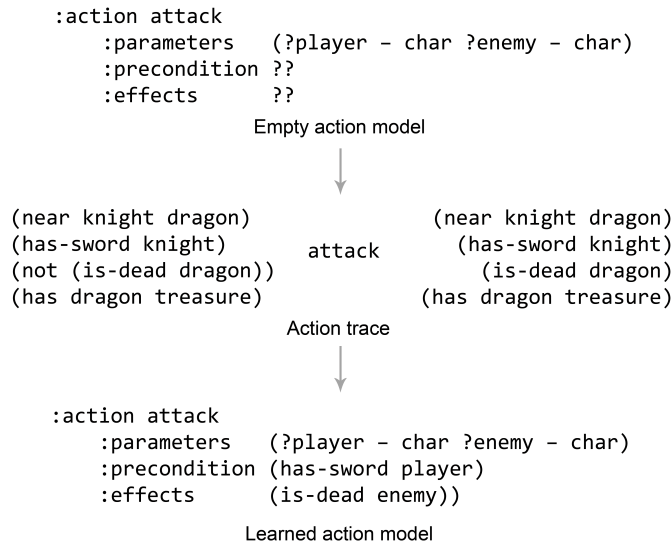
Knowing which game mechanics a player is knowledgeable about can help us select which mechanics to generate training levels for.

Objectives

1. To design a rule-based model which can capture the player's knowledge of a game's mechanics
2. To learn this model automatically from the player's interaction with the game

Action Model Learning

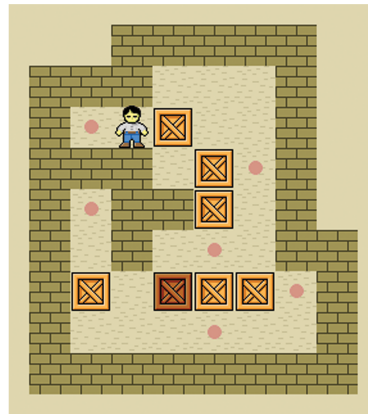
It is the problem of reconstructing the preconditions and effects of all actions in a classical planning domain, given a sequence of actions taken in the domain, and the resulting intermediate states.



Methodology

Sokoban

We use Sokoban as our target domain. Sokoban is a simple tile-based puzzle game which involves pushing blocks onto goal tiles. The domain has a total of 3 actions, which correspond to mechanics in the game.



Player Model

We select a PDDL format domain file to represent a player's knowledge of game mechanics, with each action corresponding to a mechanic in the game. PDDL is more human-interpretable compared to parameter-based models like neural networks.

Action Trace Generation

We use the FastDownward [5] planner to generate solution logs for two instances of a Sokoban domain. Both the domain and instances were developed by us. We obtain 2 solutions, which we convert into action traces automatically using a Python script.

Experiment

We run FAMA across all action traces to produce a corresponding action model.

Results

We use the evaluation scheme presented in [4] to evaluate our action model. For each mechanic, we report the precision and recall.

	M_1		M_2	
	p	r	p	r
move	0.25	0.43	1.00	0.43
push	1.00	0.73	1.00	0.73
drop	0.12	0.30	0.26	0.67

The lowest precision and recall scores are for the *drop* action, which indicates we should generate levels to teach that mechanic first.

Impact

1. Novel application of action model learning to player modelling.
2. Interpretable player model design for knowledge of mechanics
3. Human-centred personalized tutorial generation

References

[1] Sheri Graner Ray. 2010. Tutorials: Learning to play. http://www.gamasutra.com/view/feature/134531/tutorials_learning_to_play.php.

[2] Green, Michael Cerny, et al. "Press Space to Fire": Automatic Video Game Tutorial Generation." *Thirteenth Artificial Intelligence and Interactive Digital Entertainment Conference*. 2017.

[3] Green, Michael Cerny, et al. "Generating levels that teach mechanics." *Proceedings of the 13th International Conference on the Foundations of Digital Games*. ACM, 2018.

[4] Aineto, Diego, Sergio Jiménez Celorrio, and Eva Onaindia. "Learning action models with minimal observability." *Artificial Intelligence* 275 (2019): 104-137.

[5] Helmert, Malte. "The fast downward planning system." *Journal of Artificial Intelligence Research* 26 (2006): 191-246.