Model learning in strongly structured environments[1]

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Barbados 16/04/2009

[1]Based on the paper G. Bartók, Cs. Szepesvári and S. Zilles: *Active Learning of Group-Structured Environments.* ALT '08

Outline

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1. ~~Motivation~~
2. Different representations

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3. The learning model

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4. A not-so-promising theorem

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3. The learning model
4. A not-so-promising theorem
5. Examples of learnable models

- ~~Reinforcement Learning solution vs. Intuition~~

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  ~~Examples:~~

  - ~~*Learning to Acquire the Ball* (Fidelman, Stone)~~

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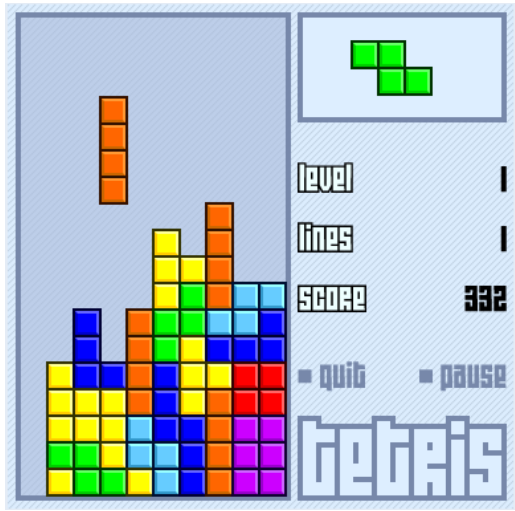

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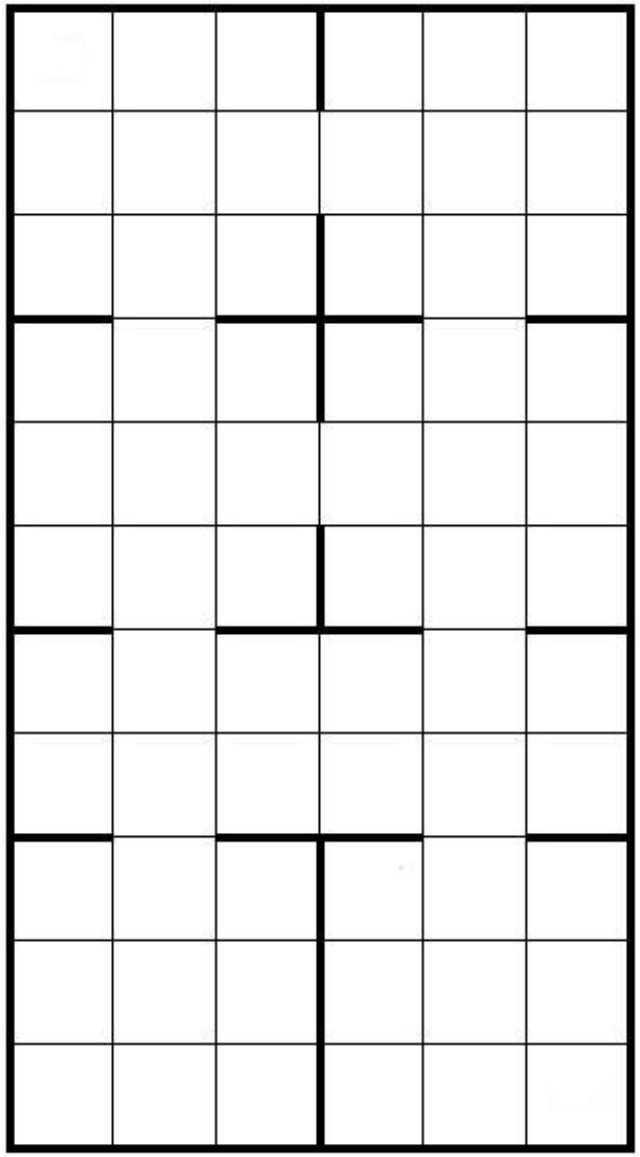
- ~~Representation: description of the model~~

Example 1

Example 1

- Two-dimensional gridworld



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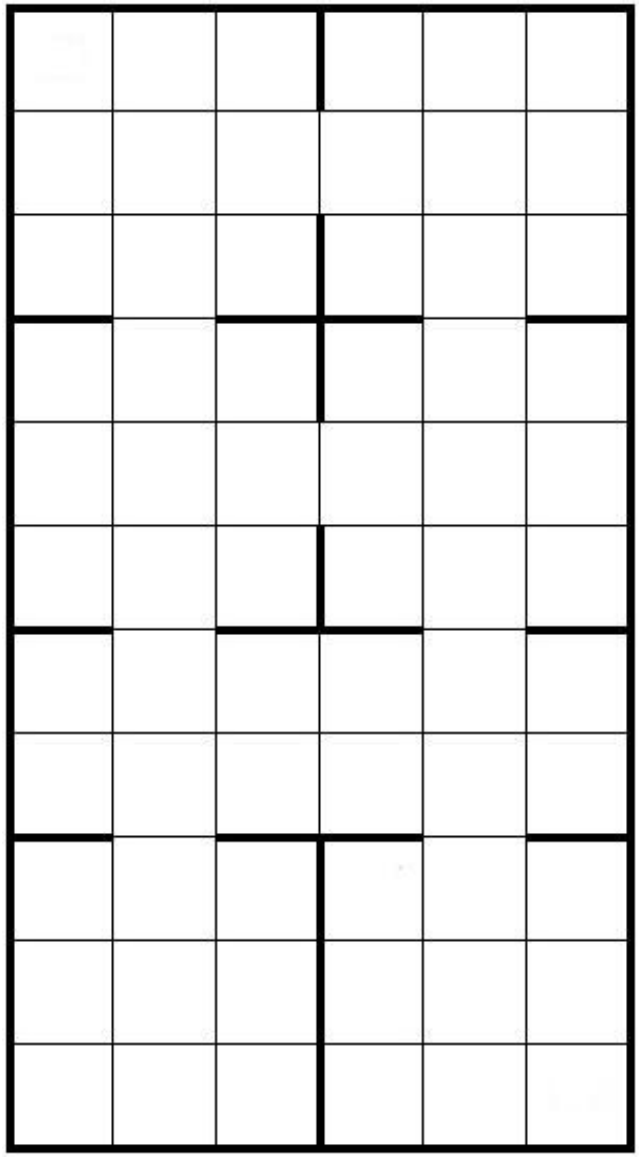
- Two possible representations:



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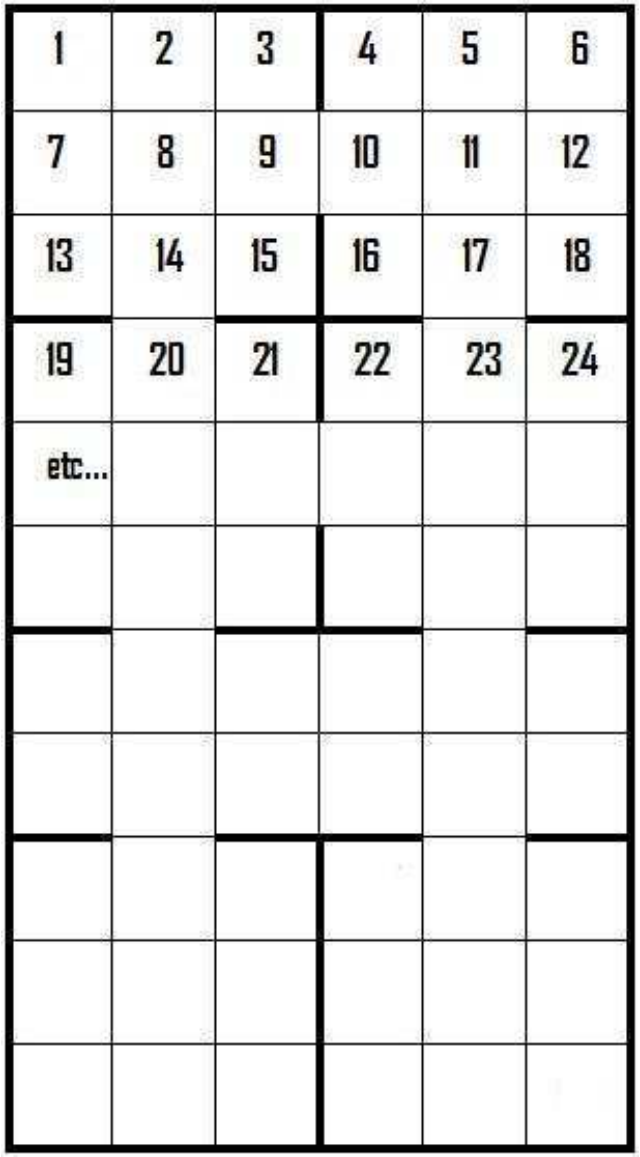

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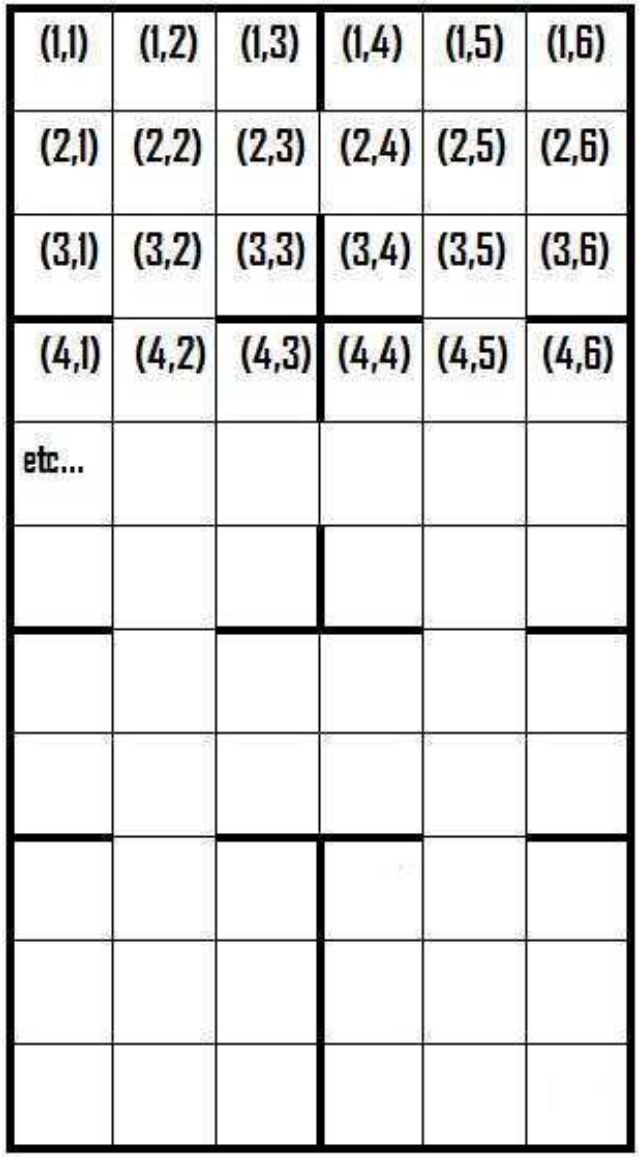

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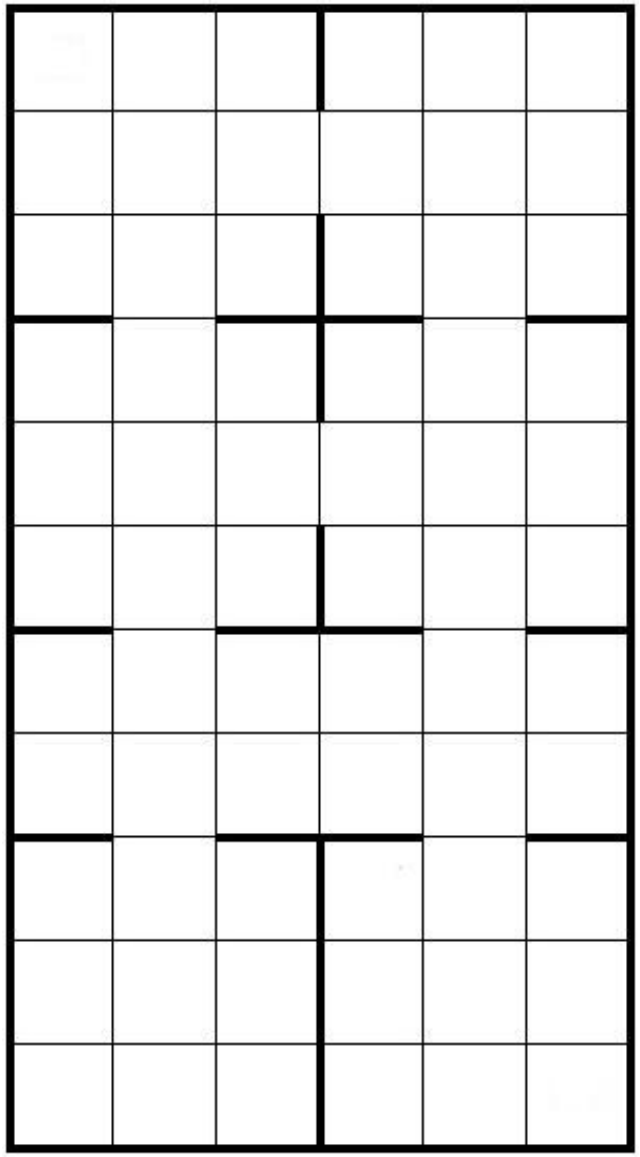

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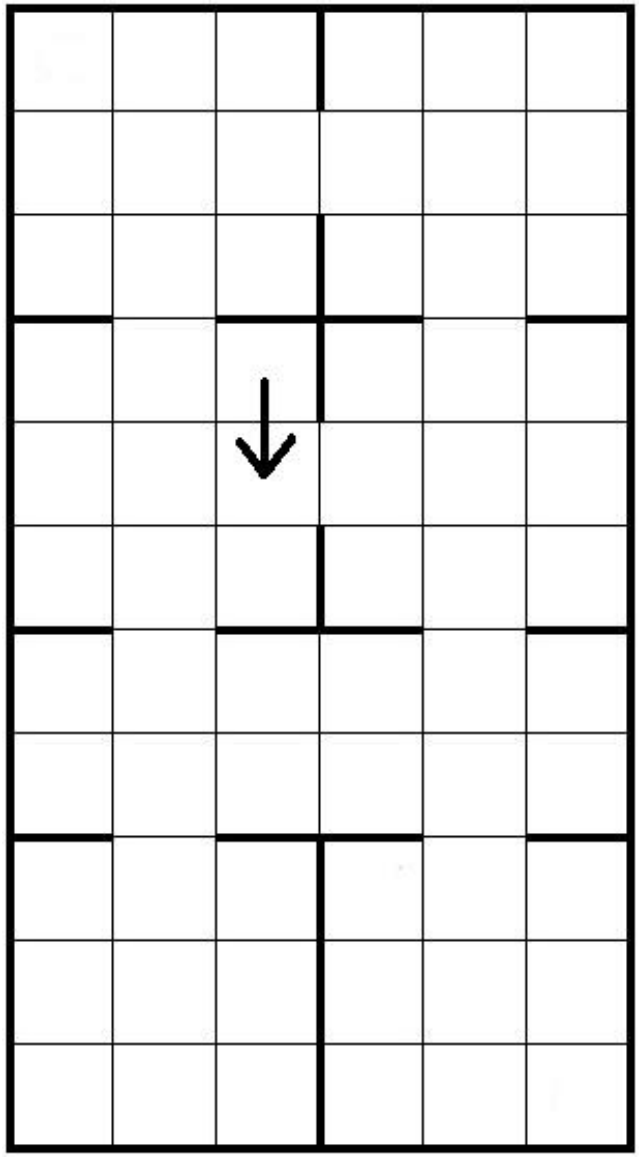
- Which one is better?
- Coordinates help to describe the actions



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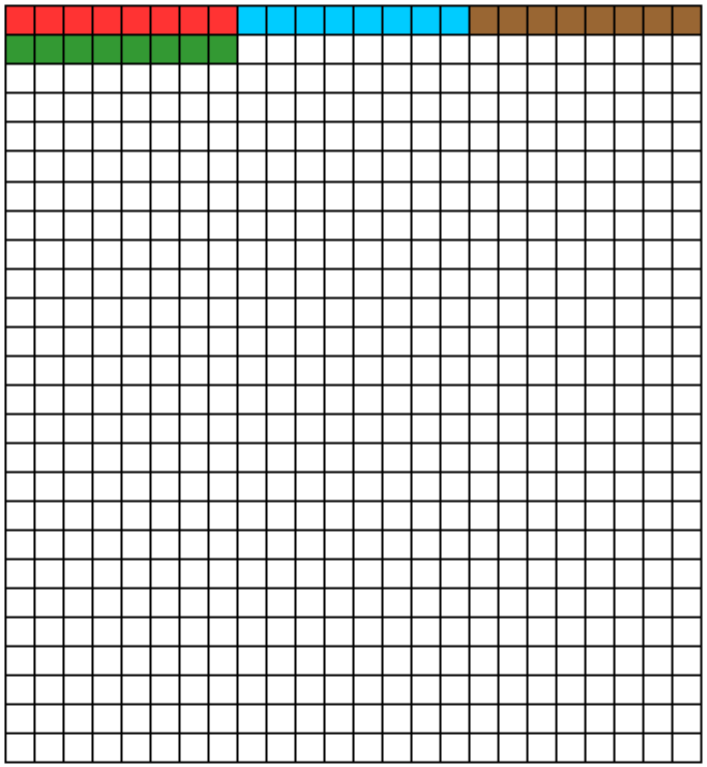

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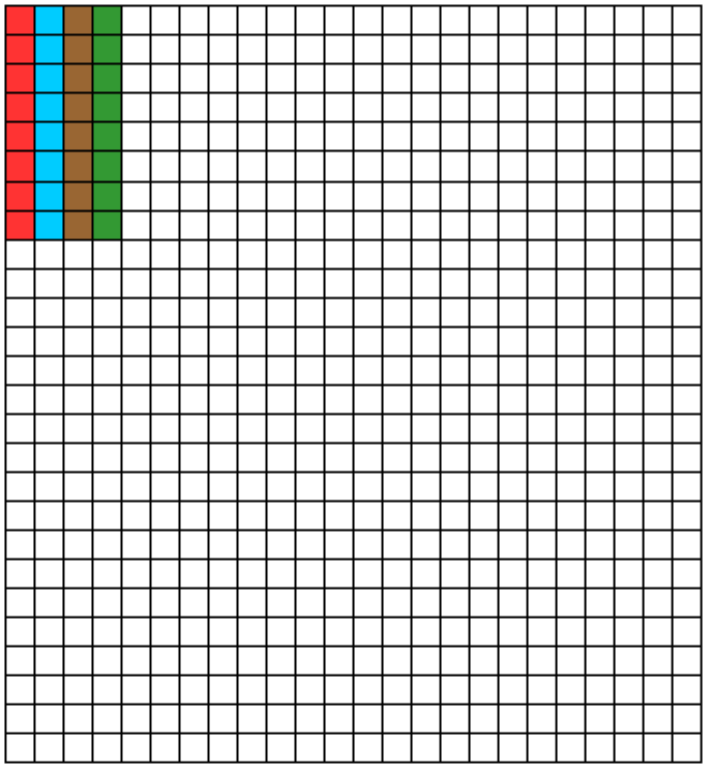

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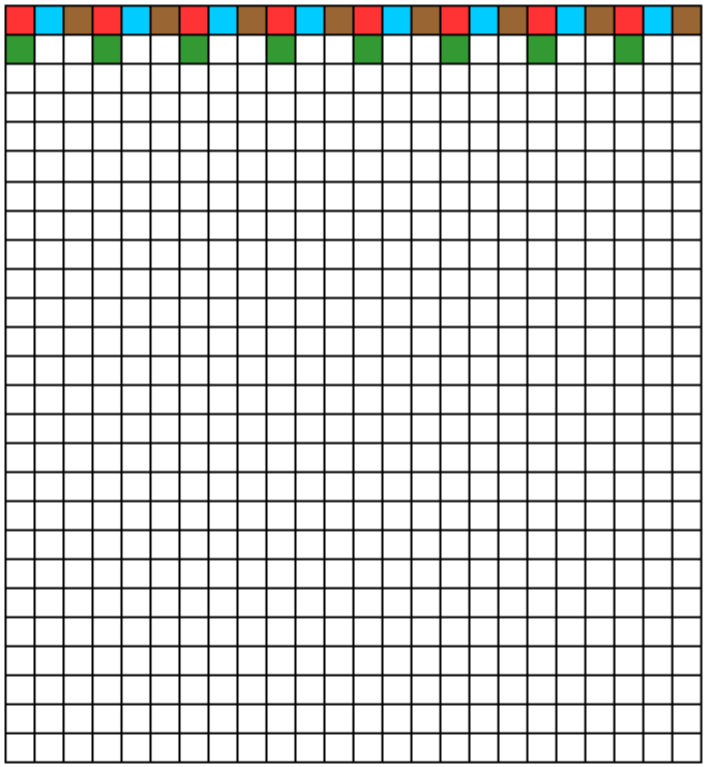

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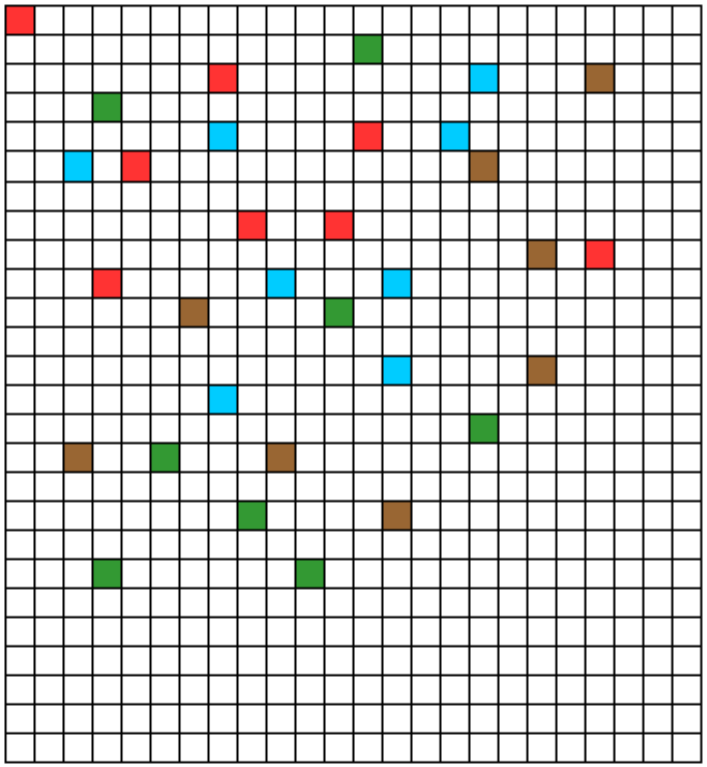

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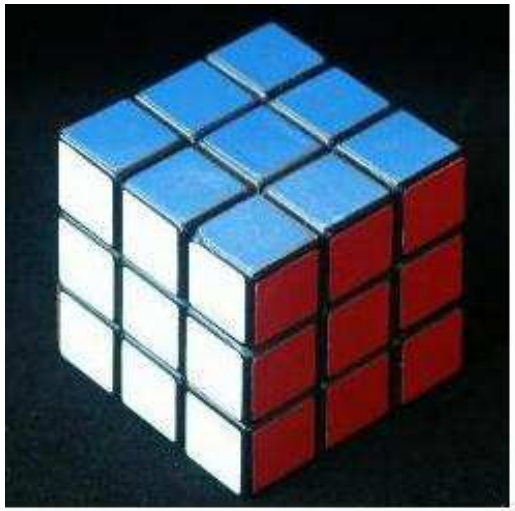

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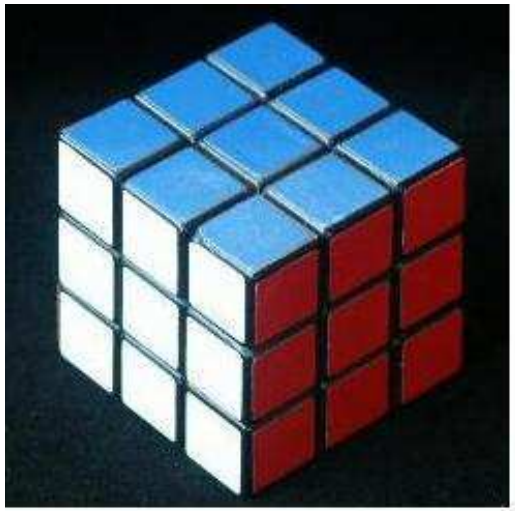

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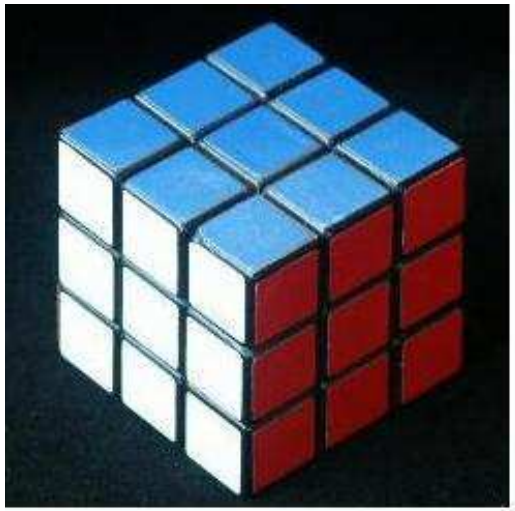

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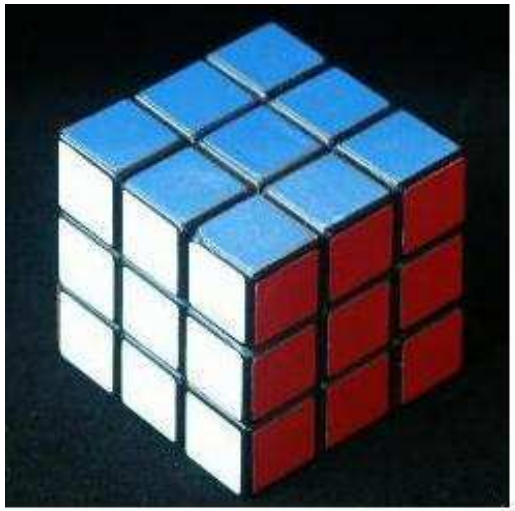

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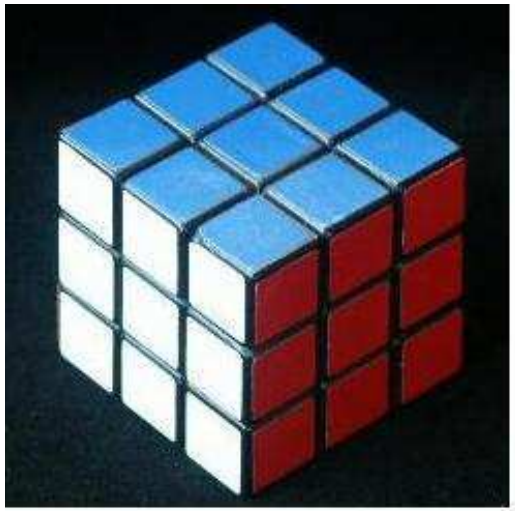

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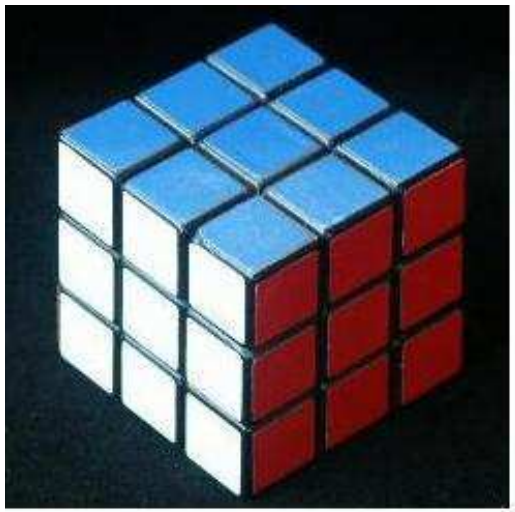

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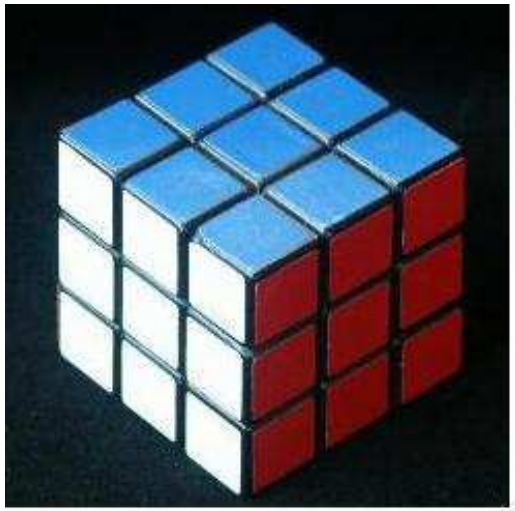

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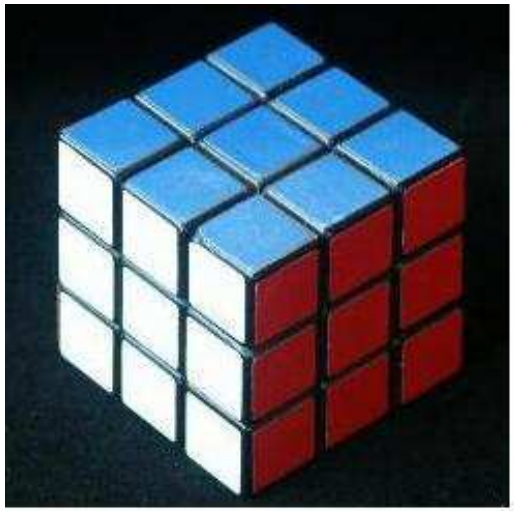
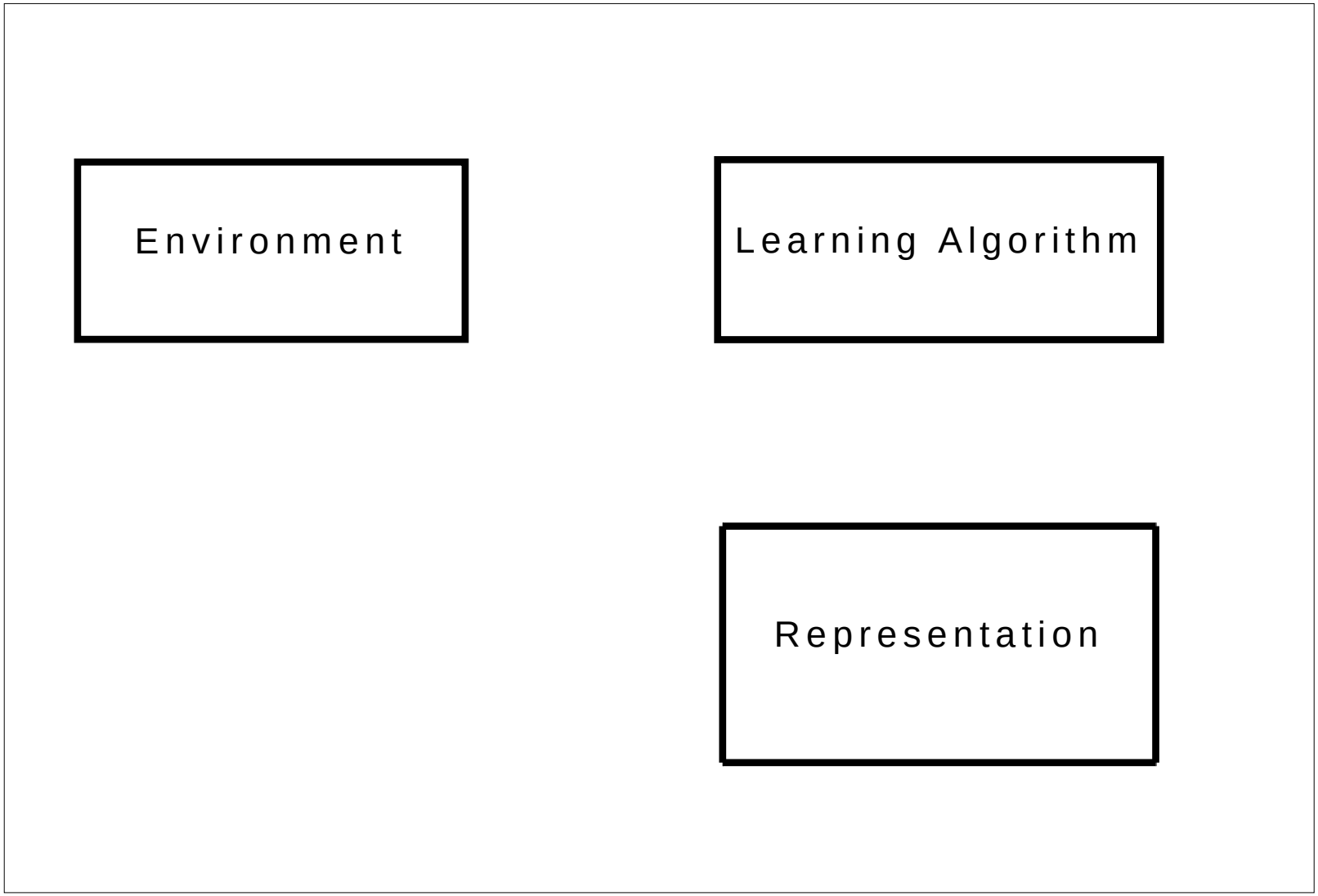


Our Model



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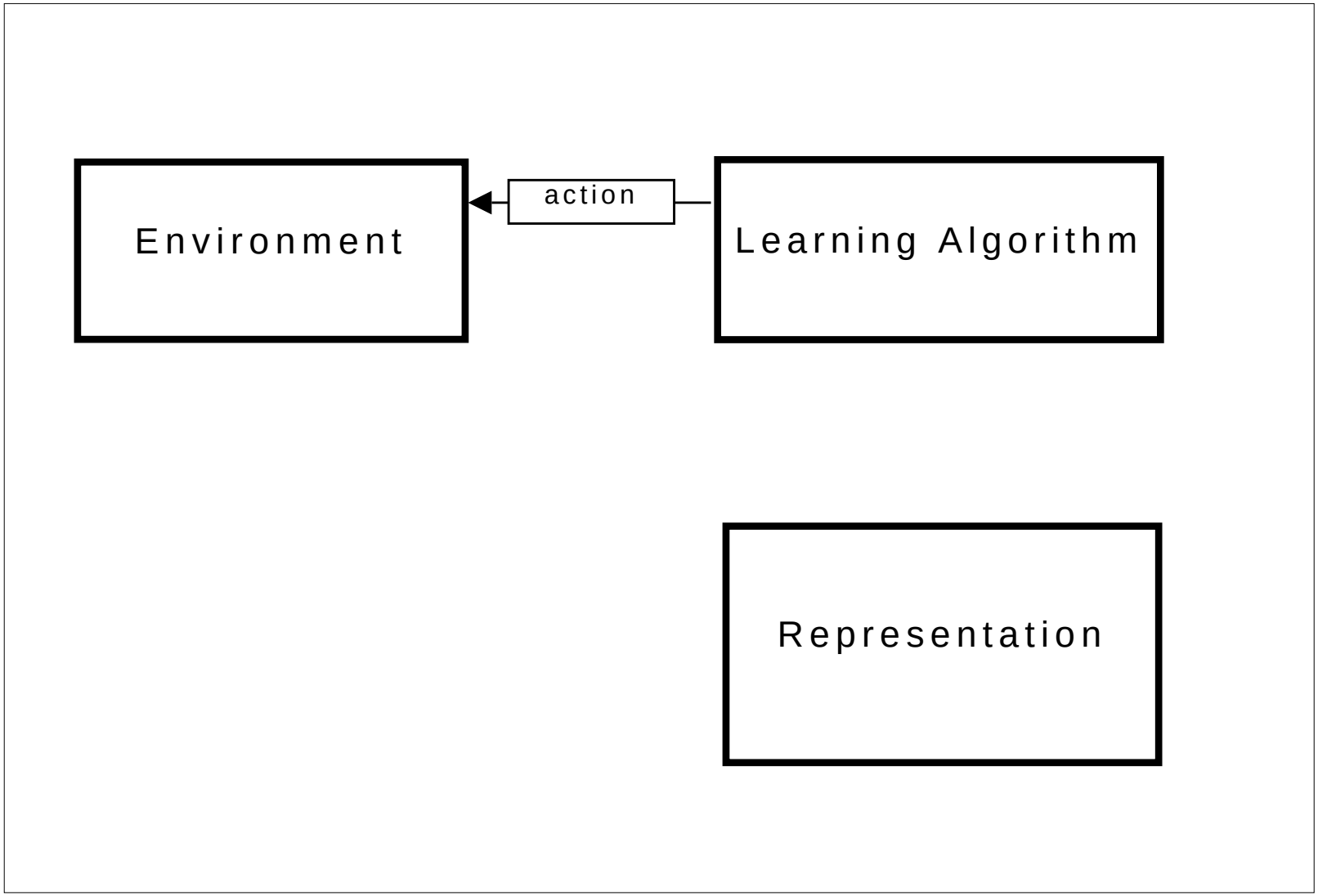

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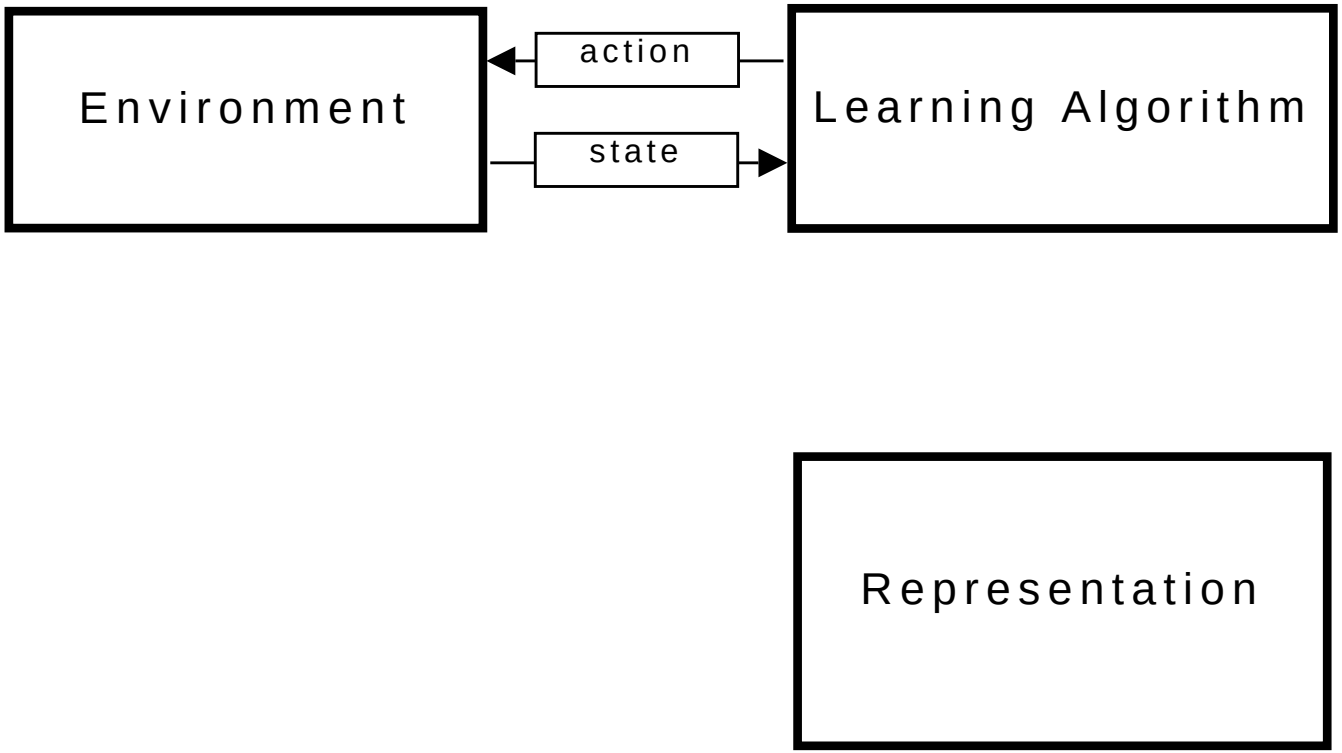
Environment
action
state
Learning Algorithm
Representation

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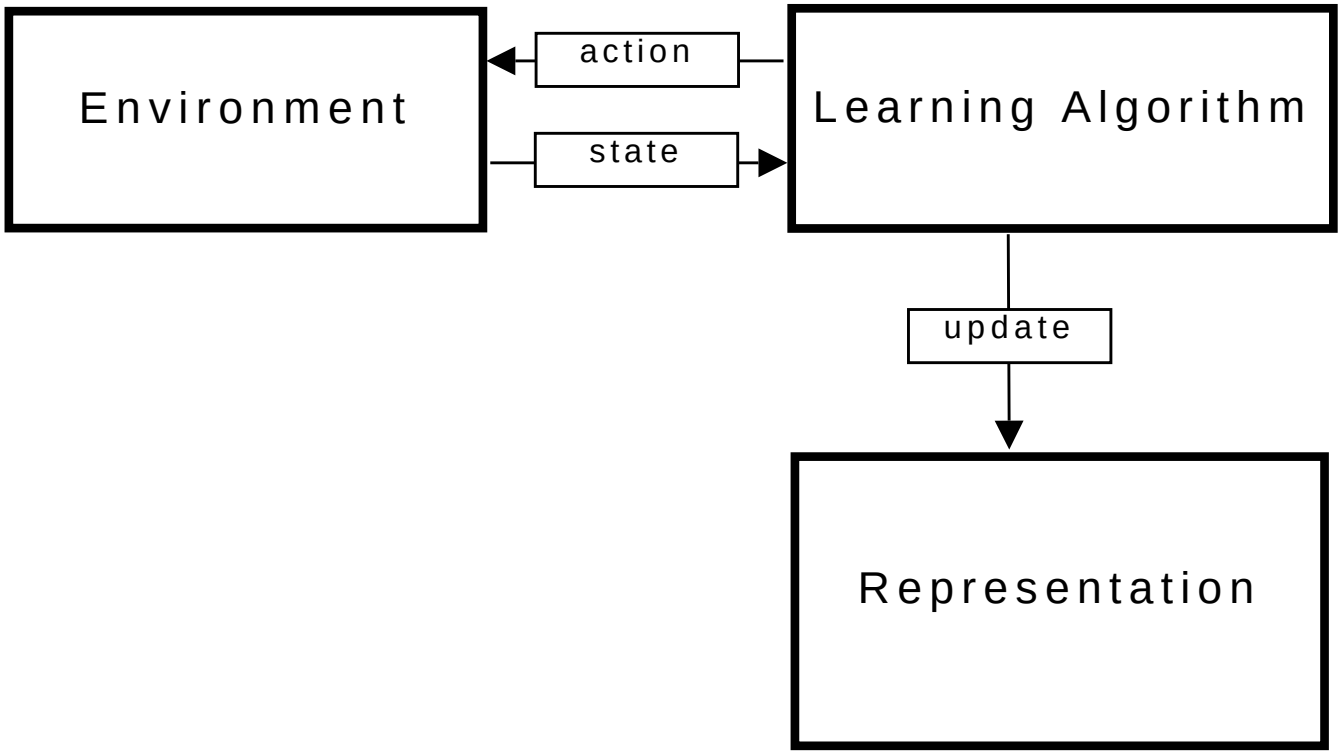
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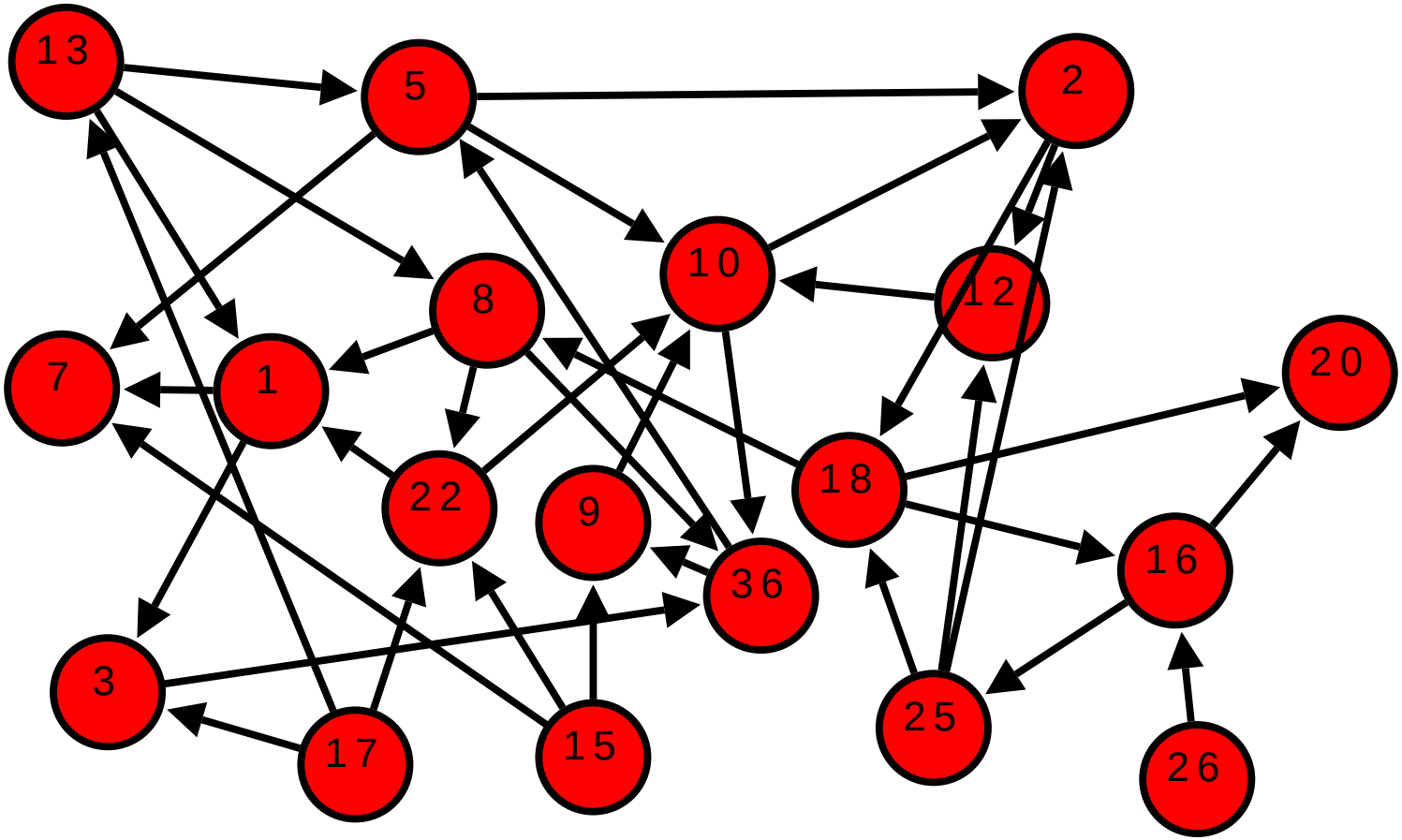
An environment



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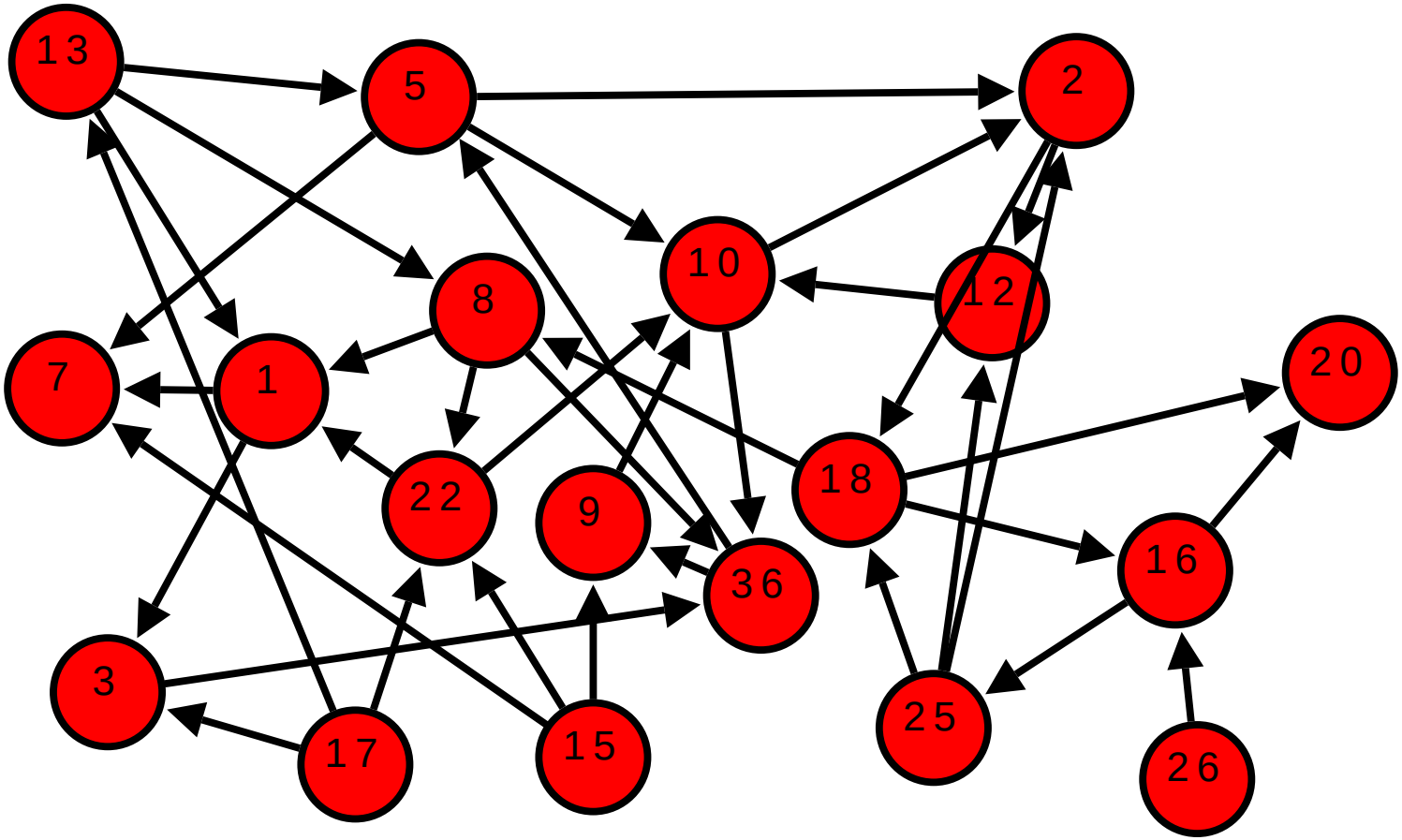
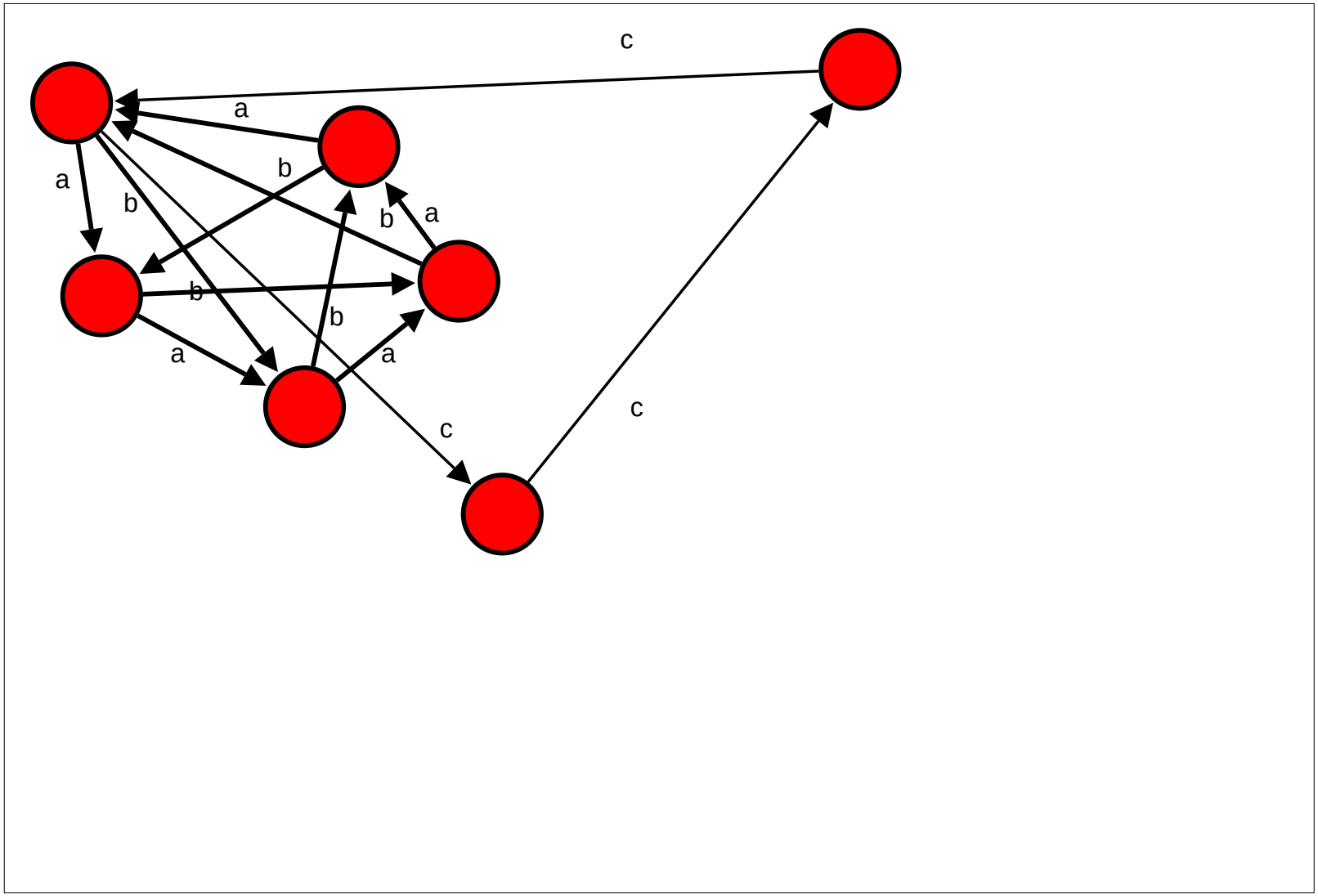


Can we learn the environment without visiting every state?

Example



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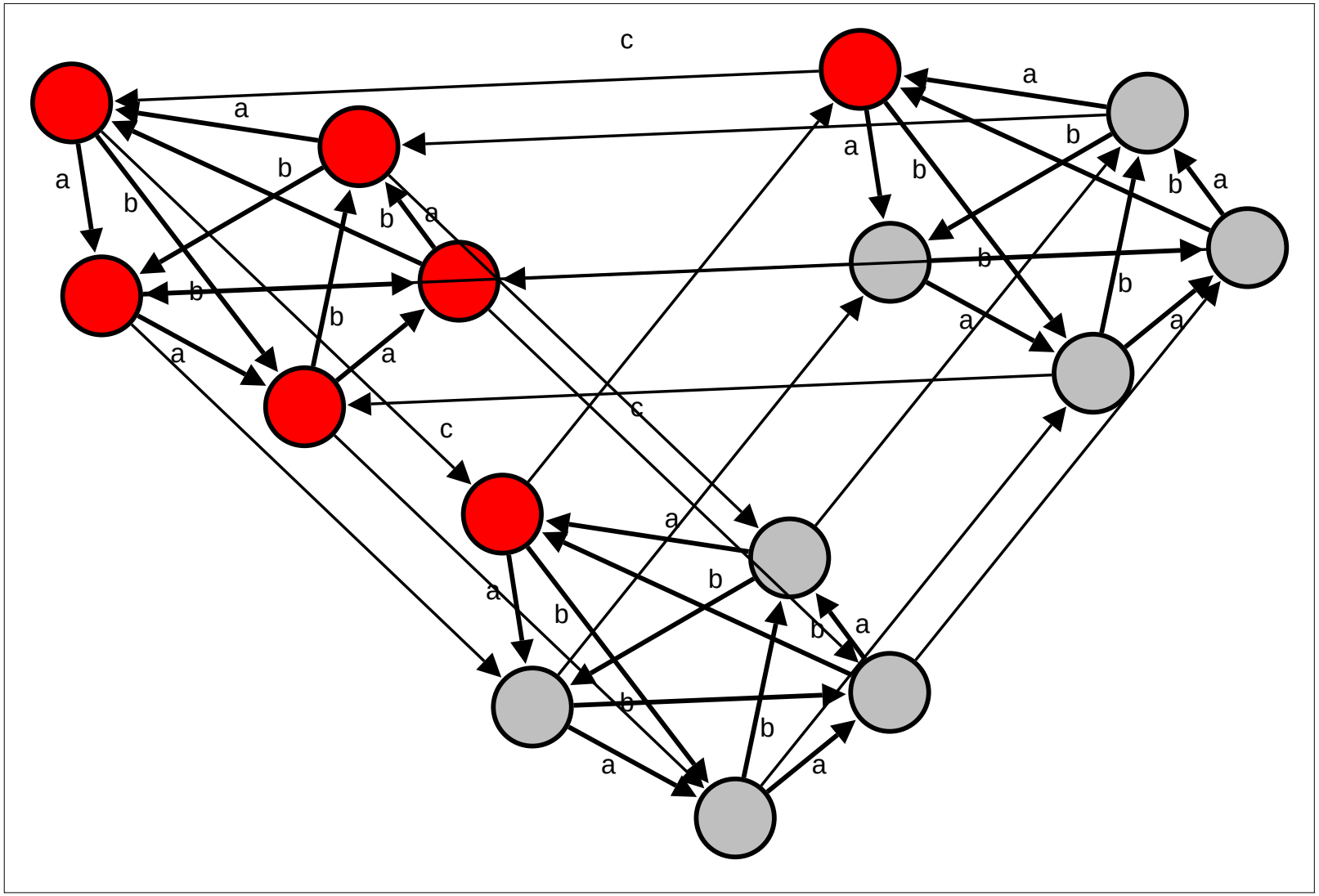

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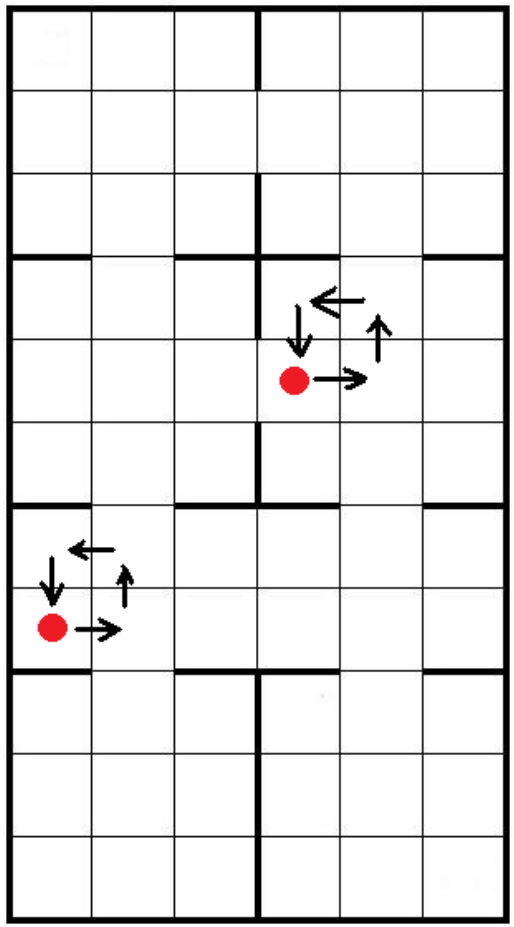

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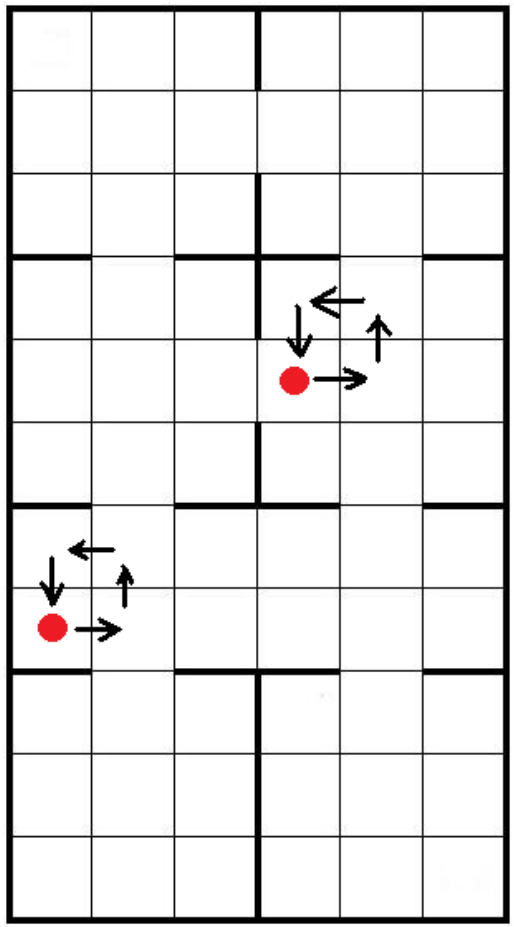
- Makes *generalization* possible



Efficient Learning

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A class $\mathcal{C}$ of groups is efficiently learnable with respect to a set P of presentations, if:

- After N iterations the learning algorithm stops and returns a decision procedure which is consistent with the target group $\mathcal{G}$
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Theorem

The class of all finite groups is **not** *learnable efficiently with respect to the set of all possible presentations.*

Efficiently learnable permutation games

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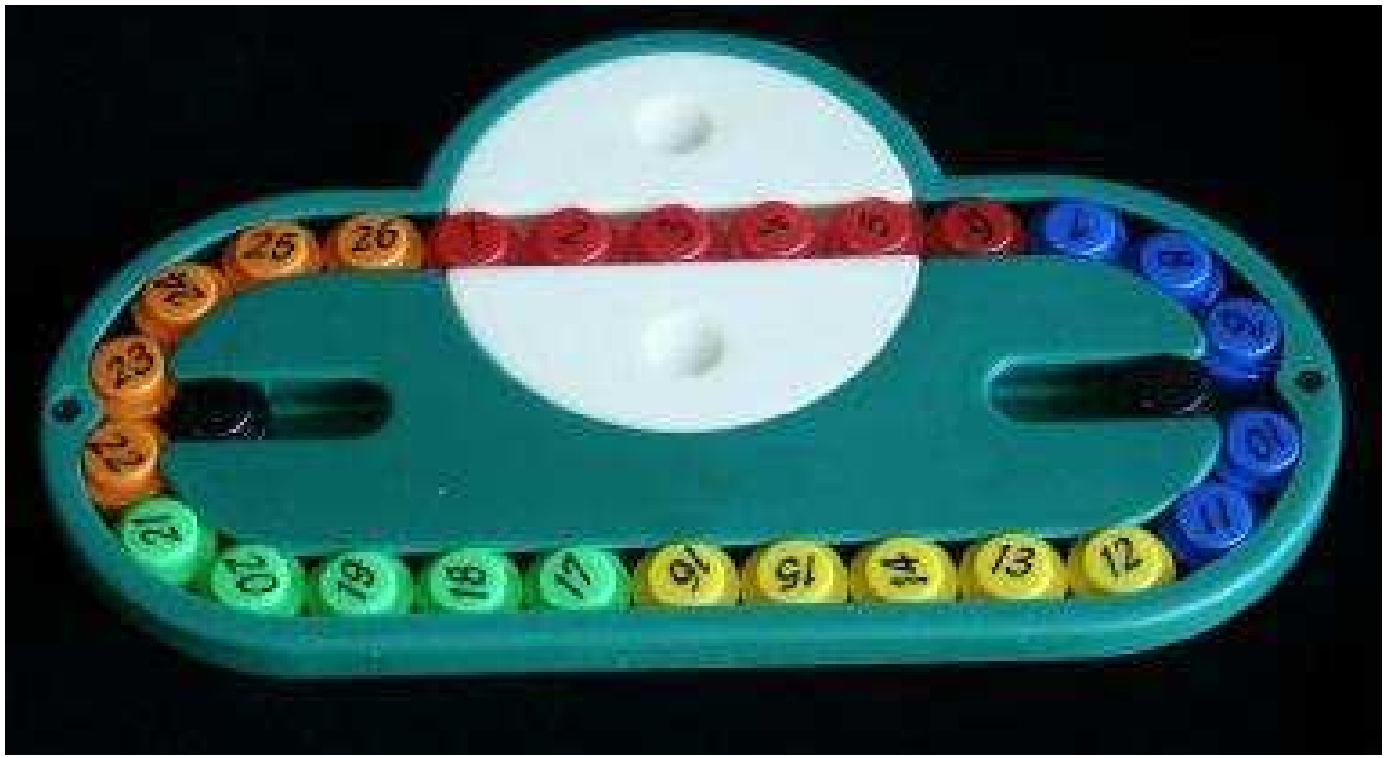
- Topspin



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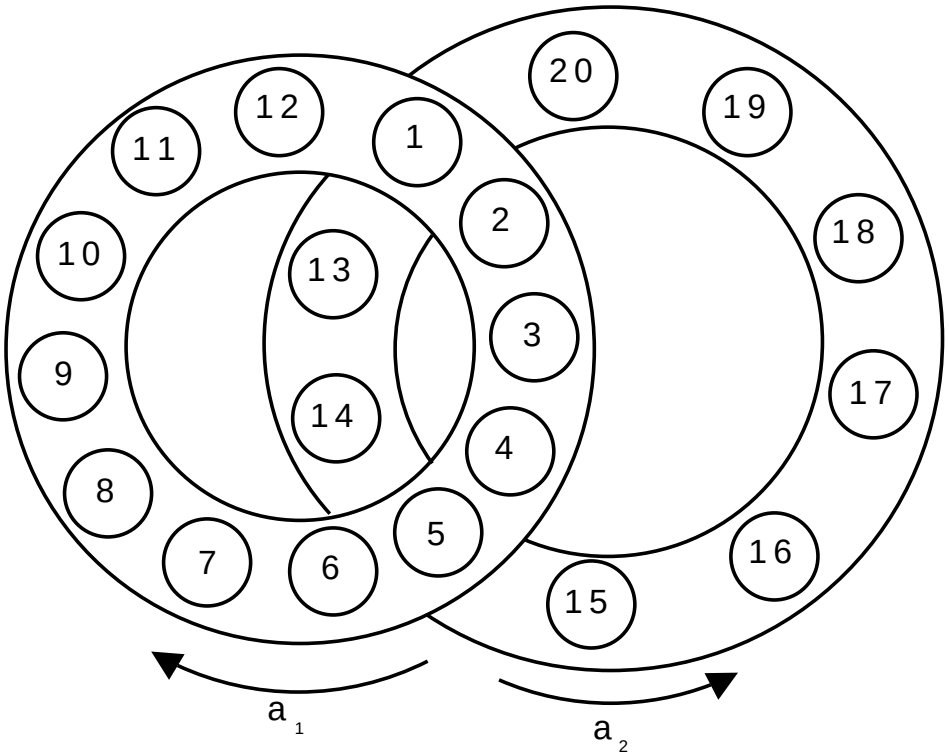

An open problem

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In general, learning a representation is hard

Sometimes we can do it

We can gain a lot by having the right representation

And now...

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Discussion!