Introduction to Machine Learning

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What is an Agent?

Agent

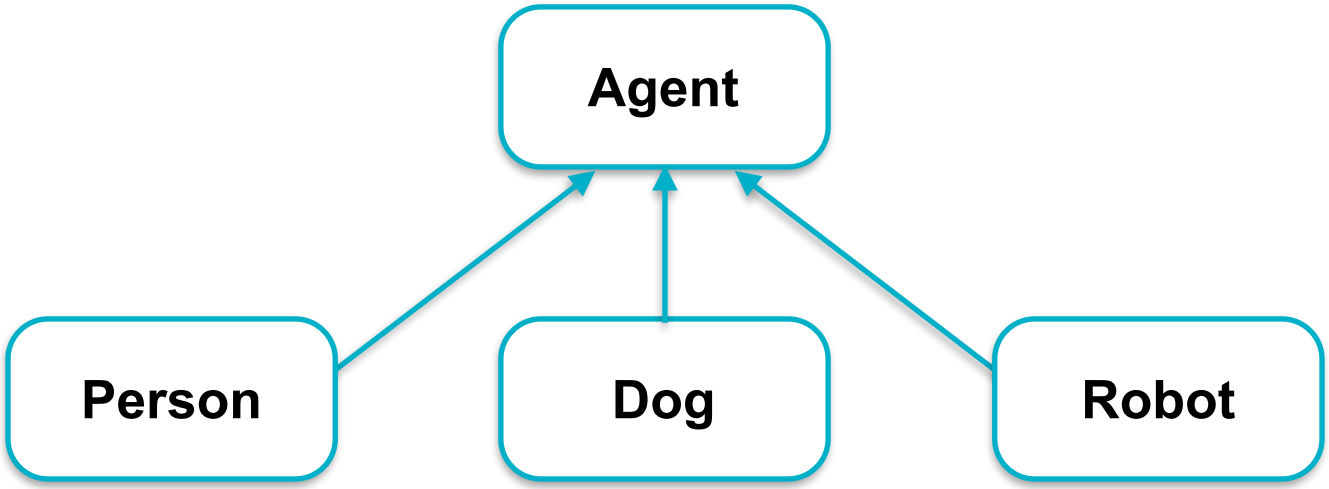
- Self-contained and independent
- Has its own “brains”
- Can interact with the world to make changes or to sense what is happening
- Has self-awareness

Therefore:

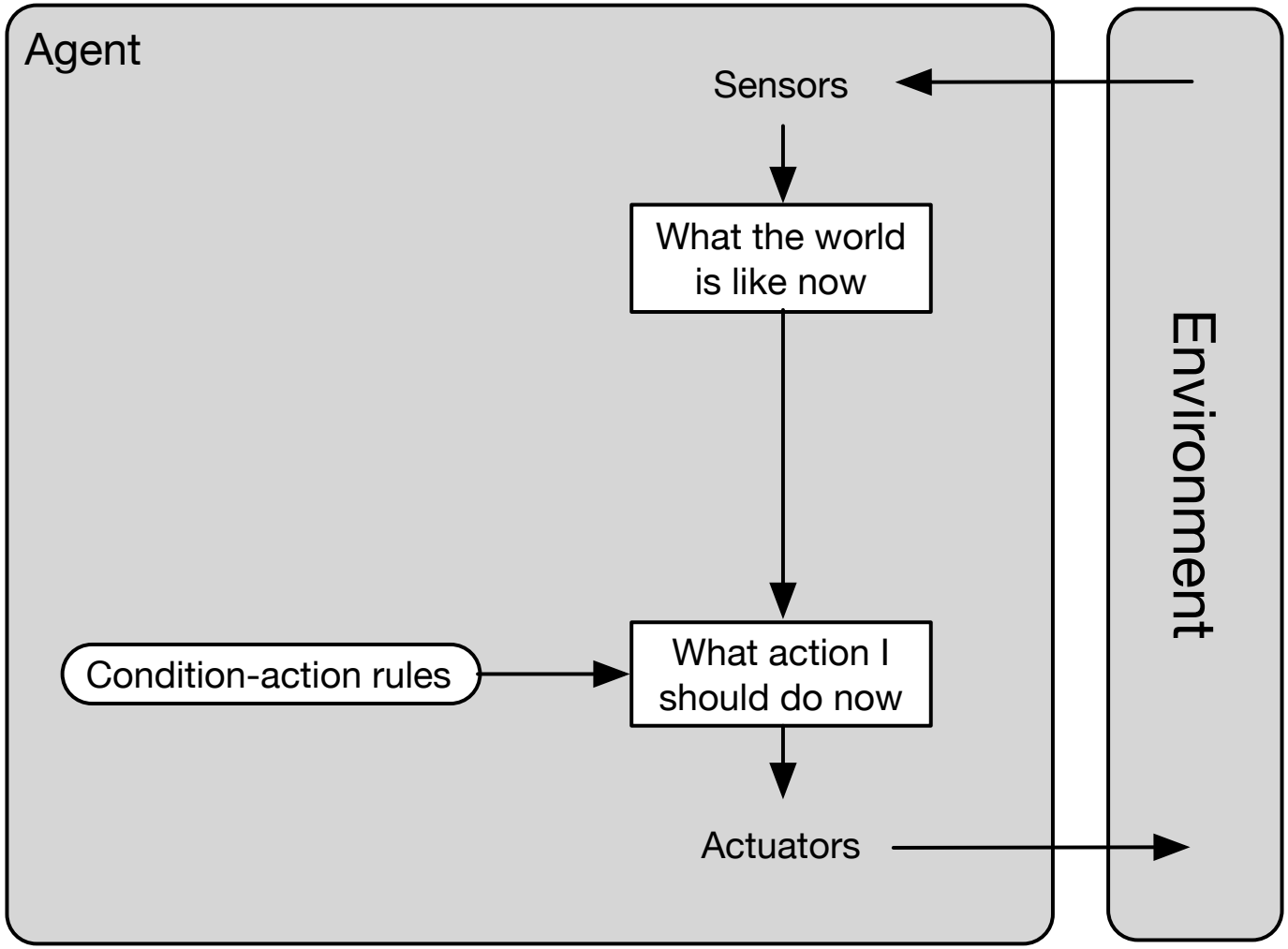
- A person is an agent
- A dog, a cat, or a frog is an agent

Agency Concept

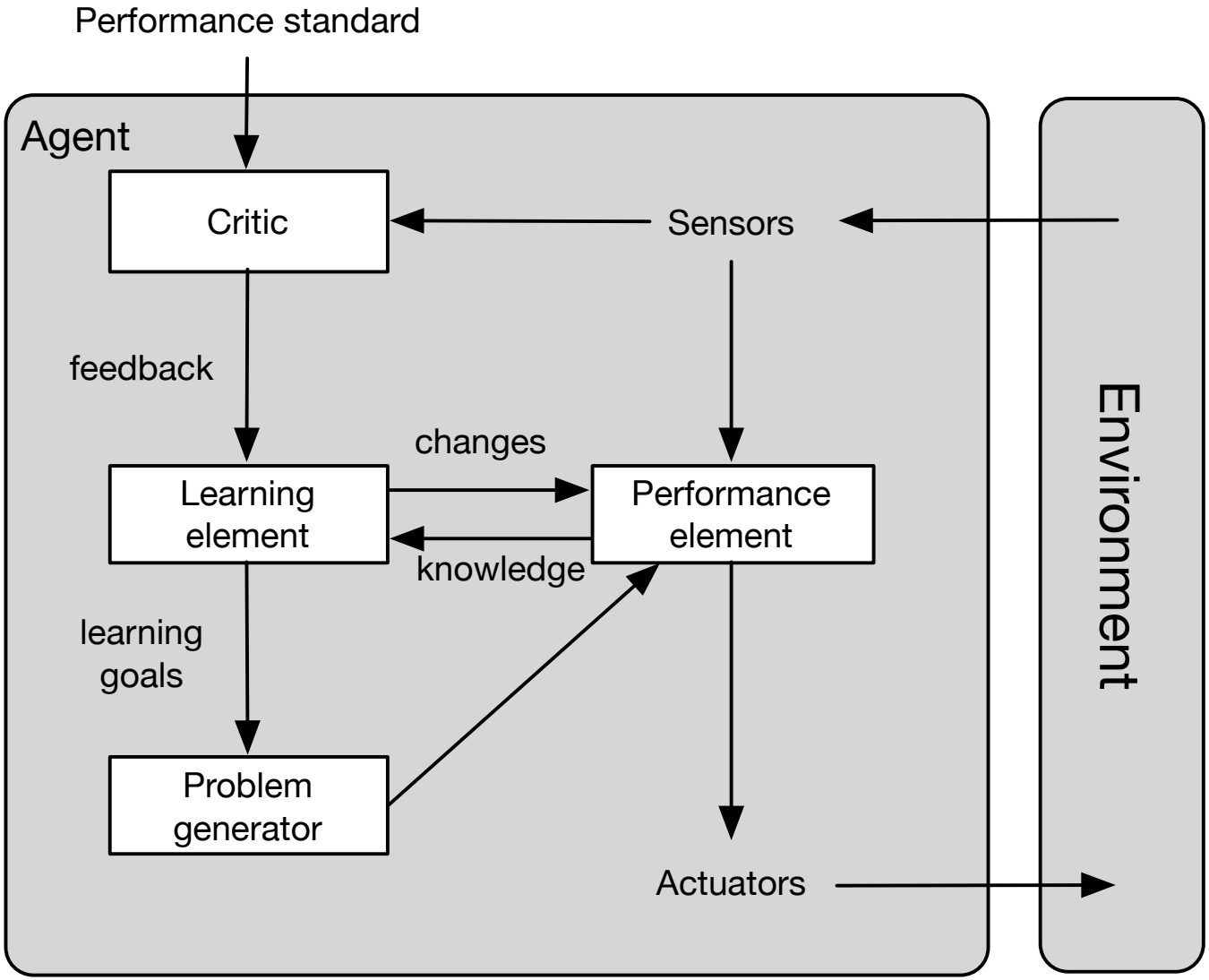
Agency is a **concept** in Artificial Intelligence that allow researchers *to discuss the properties of intelligence* without *discussing the details* of how the intelligence got in the particular agent



Simple Reflex Agent



A General Learning Agent

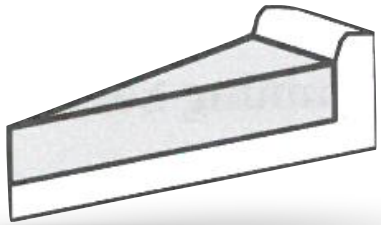


Simple Machine-Learning Task

- Given:
  - set of examples
- Goals:
  - knowledge about the examples
- How:
  - machine-learning algorithms
  - machine-learning techniques
- Challenge:
  - performance, attributes selection, …

A Simple Task

Determine "**a pie that Johnny likes**"



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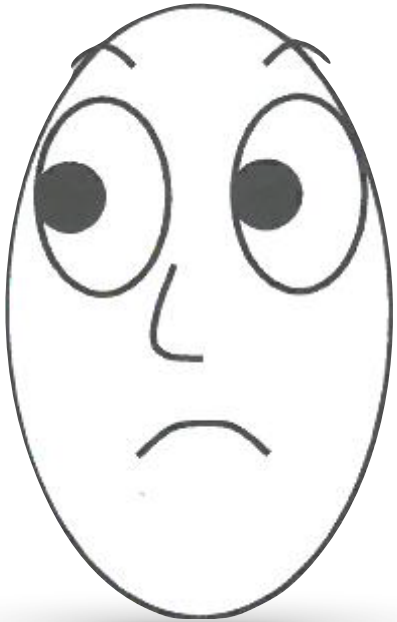

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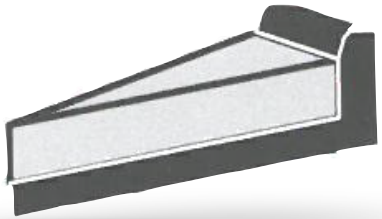

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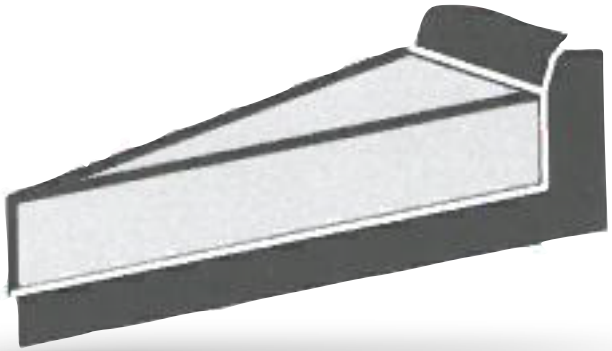
Johnny likes:

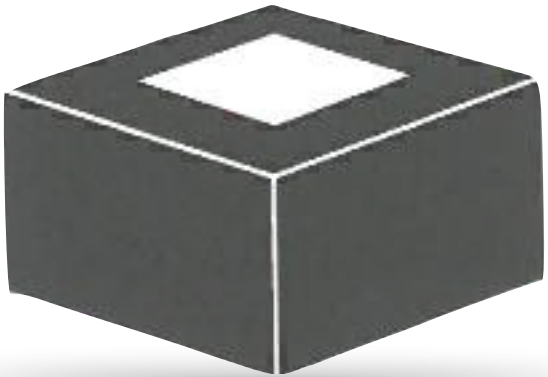
ex1

ex2

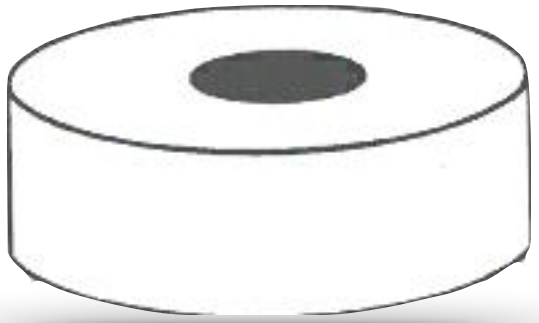


ex3

ex4



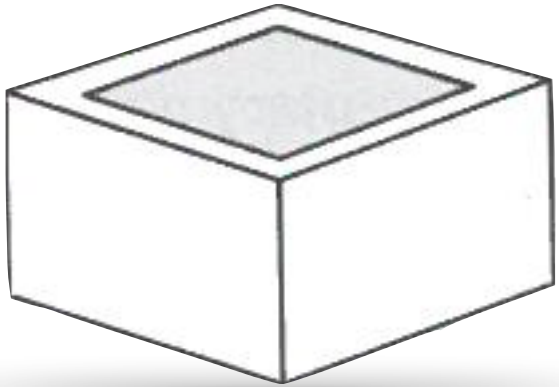
ex5



ex6

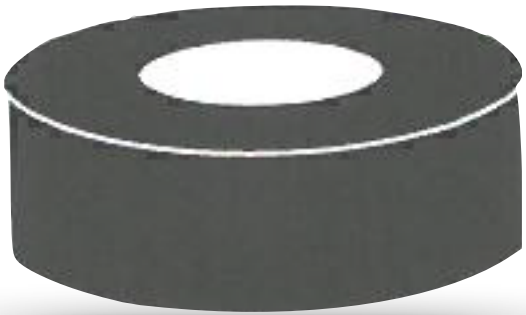
Johnny does NOT like:

ex7

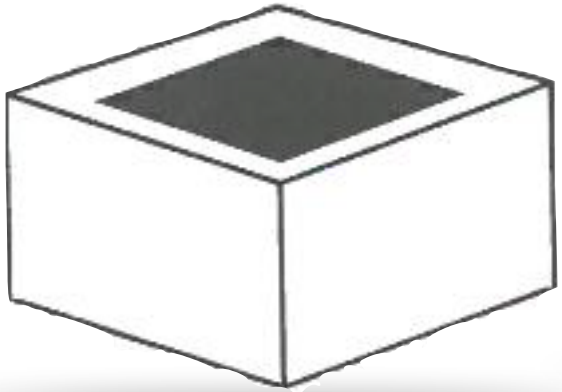


ex8

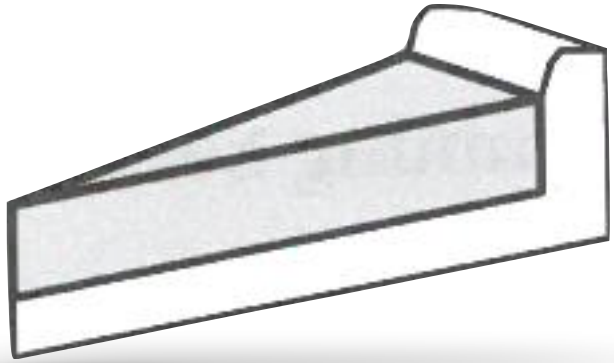
ex9



ex10



ex11

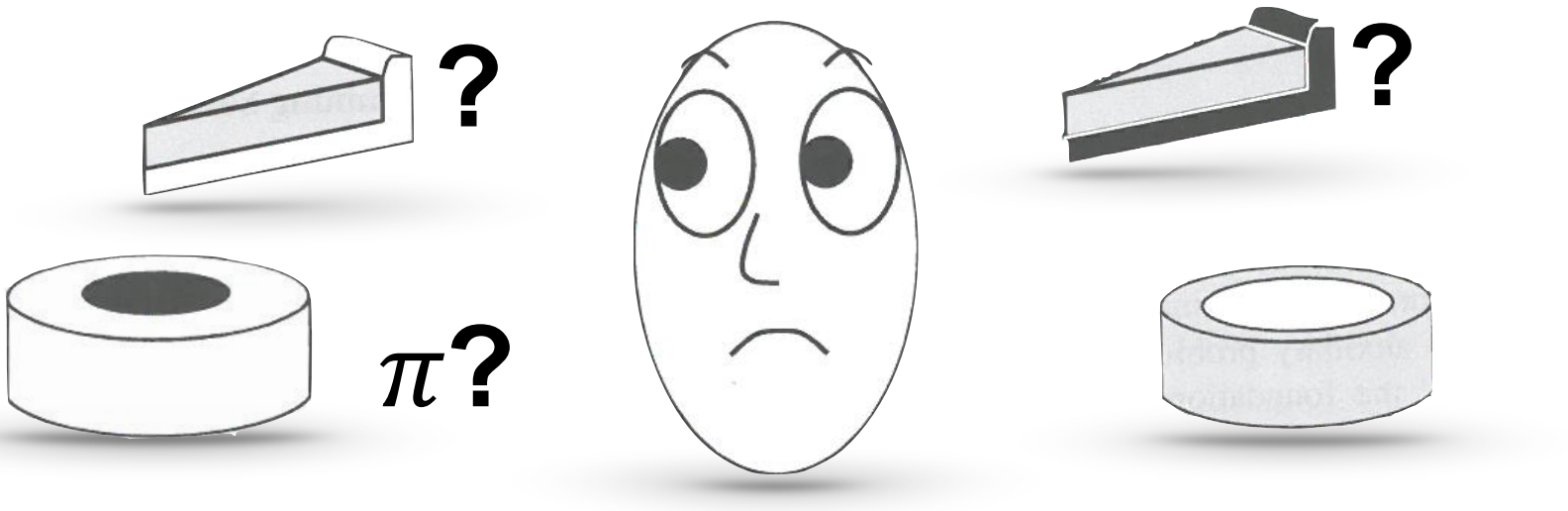


ex12

Exercise:

Please discuss and answer the following questions:

- What is the input and output of the “Johnny’s pie” task?
- What are the attributes for the given learning problem?
- How does the learned knowledge look like?



Training Examples "Johnny's Pie"

example	shape	crust		filling		class
		size	shade	size	shade	
ex1	circle	thick	gray	thick	dark	pos
ex2	circle	thick	white	thick	dark	pos
ex3	triangle	thick	dark	thick	gray	pos
ex4	circle	thin	white	thin	dark	pos
ex5	square	thick	dark	thin	white	pos
ex6	circle	thick	white	thin	dark	pos
ex7	circle	thick	gray	thick	white	neg
ex8	square	thick	white	thick	gray	neg
ex9	triangle	thin	gray	thin	dark	neg
ex10	circle	thick	dark	thick	white	neg
ex11	square	thick	white	thick	dark	neg
ex12	triangle	thick	white	thick	gray	neg

Search Problem

Search Operators

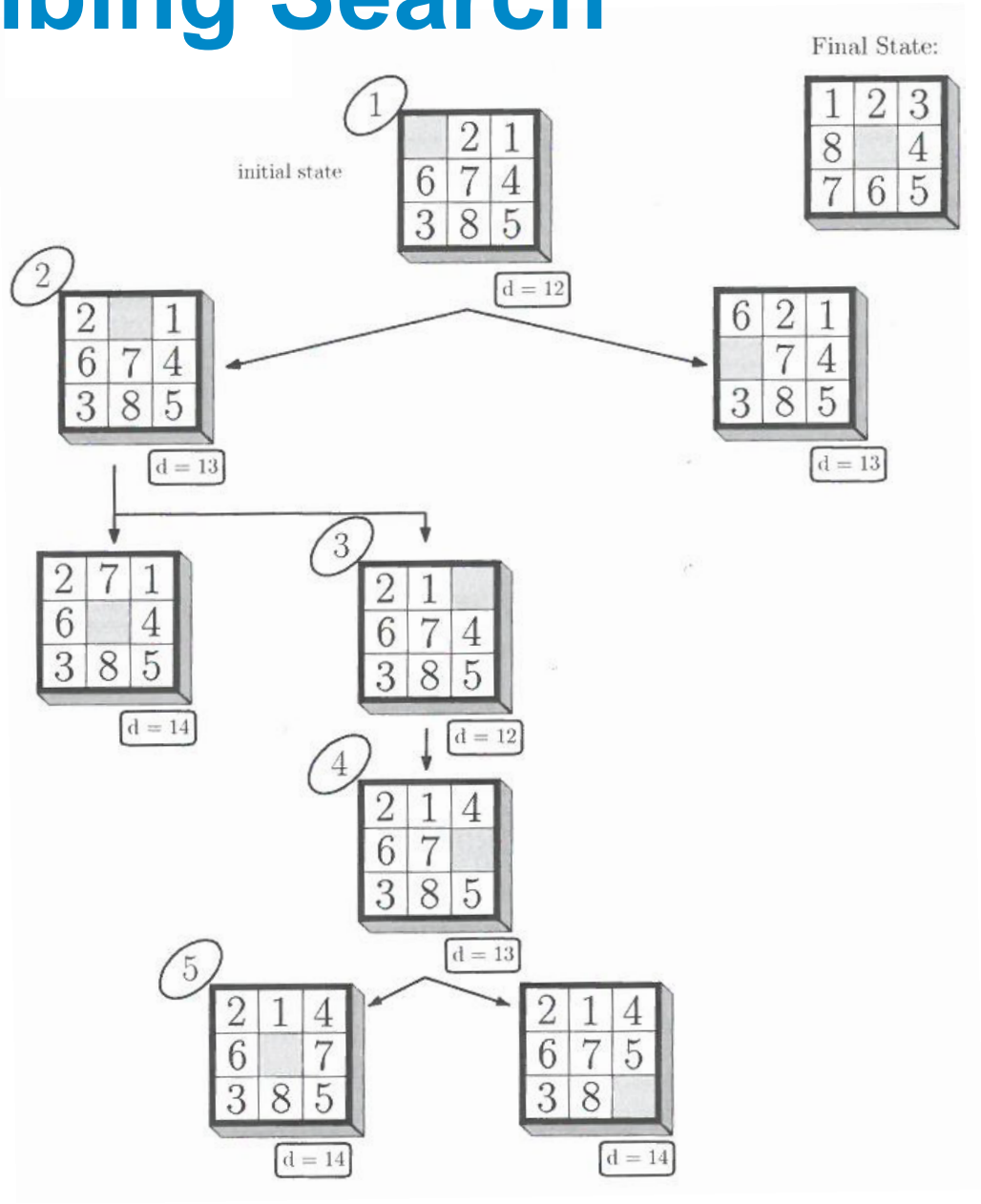
Search Strategy

Initial State

Final State

Search Agent

Hill-Climbing Search



Hill-Climbing Search Algorithm

1. Create two lists, ***L*** and L_{seen}. At the beginning, ***L*** contains only the initial states and L_{seen} is empty.
2. Let n be the first element of ***L***. Compare this state with the final state. If they are identical, stop with success.
3. Apply to ***n*** all available search operators, thus obtaining a set of new states. Discard those states that already exist in L_{seen}. As for the rest, sort them by the evaluation function and place them at the front of ***L***.
4. Transfer ***n*** from ***L*** into the list, L_{seen}, of the states that have been investigated.
5. If ***L*** = ∅, stop and report failure. Otherwise, go to step 2.

Exercise

Discuss in group, how do you apply hill-climbing algorithm in the “Johnny’s pies domain”