Searching: Intro

CPSC 322 – Search 1

Textbook §3.0 – 3.3

Lecture Overview

Agents and Representations

- Recall that an agent is something that acts in an environment
- The agent also receives observations about the environment
  - this could be observations from sensors such as cameras, laser rangefinders, etc.
  - can also include "observations" of the agent's own past actions
- In a deterministic environment, the agent can perfectly predict the outcome of an action
  - doesn't need sensors: just needs to remember its own past actions

The Table-Lookup Agent

- An agent can be thought of as a mapping from observations to the new action that the agent will take
- How should agents be constructed? One choice:
  - agent takes in the sequence of observations
  - agent looks up the correct action for this sequence of observations based on an internal representation (e.g., a table)
- Such an agent could indeed behave rationally. What's the problem?

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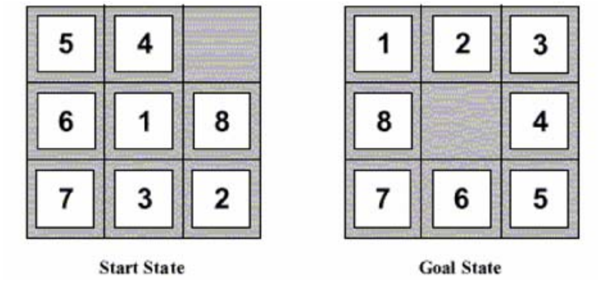
- Such an agent could indeed behave rationally. What's the problem?
  - too many sequences of observations are possible!
  - e.g., 10 possible observations, 10 timesteps $\rightarrow 10^{10}$ different entries in the table
  - compare this to e.g., the number of different move sequences that are possible in chess

Lecture Overview

Example Problems

- To make things more concrete, let's think about some example problems:
  - solving a Sudoku
  - solving an 8-puzzle
  - the delivery robot planning the route it will take

What's an 8-Puzzle?



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- Are these single or sequential decision problems?
  - as discussed before, the distinction isn't really useful here; problems can be seen both ways
  - CSPs: settings where there's nothing meaningfully sequential about the decision
  - Planning: decisions are always sequential
  - Now: we're going to define the underlying tools that allow us to solve both

Lecture Overview

State Spaces

- Idea: sometimes it doesn't matter what sequence of observations brought the world to a particular configuration; it just matters how the world is arranged now.
  - called the Markov assumption
- Represent the different configurations in which the world can be arranged as different states
  - which numbers are written in cells of the Sudoku and which are blank?
  - which numbers appear in which slots of the 8-puzzle?
  - where is the delivery robot?
- States are assignments of values to one or more variables
  - a single variable called "state"
  - x and y coordinates; etc...
- From each state, one or more actions may be available, which would move the world into a new state
  - write a new number in a blank cell of the Sudoku
  - slide a tile in the 8-puzzle
  - move the delivery robot to an adjacent location

Agent Design

- An agent can be thought of as a mapping from the given state to the new action that the agent will take
- However, there's a problem... often, we don't understand the domain well enough to build the mapping
  - we'd need to be able to tell the agent how it should behave in every state
  - that's why we want intelligent agents: they should decide how to act for themselves
  - in order for them to do so, we need to give them goals

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- Some states are goal states
  - A Sudoku state in which all numbers are different in each box, row and column
  - The single 8-puzzle state pictured earlier
  - The state in which the delivery robot is located in room 123