Notes, Chapter 2

Agents and Environments

- An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators
- Agents include humans, robots, vehicles, etc
- The agent function maps from percept histories to actions $f : P^* \rightarrow A$
- The agent program runs on the physical architecture to produce f
  $agent = architecture + program$

The goal of AI then is to link the percepts of the environment to actions that it can take.

Rationality

- A **rational agent** does the right thing, but what does it mean to do the right thing?
- A **performance measure** to evaluate the behavior of the agent in an environment
  - One point per square cleaned up in time T?
  - One point per clear square per time step, minus one per move?
- A rational agent chooses whichever action maximizes the expected value of the performane measure given the percept sequence to date.
- What is rational at any given time depends on four things:
  1. The performance measure that defines the criterion of success
  2. The agent's prior knowledge of the environment
  3. The actions that the agent can perform
  4. The agent's percept sequence to date

Definition of a Rational Agent

For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure given the evidence provided by the percept sequence, and whatever built-in knowledge the agent has.

The Nature of Environments / Task Environments (PEAS)

To design a rational agent, we must specify the task environment:

- Performance measure
- Environment
- Actuators
- Sensors

PEAS - Example - Automated Taxi

- Performance Measure: Profit, Safety, Destination (minimal path), Comfort
- Environment: US streets/freeways, traffic, weather
- Actuators: Steering, Accelerator, Brake, Horn, Speakers/Display, etc
- Sensors: Cameras, Accelerometers, Engine Sensors, GPS, etc

Properties of Task Environments

- Fully Observable vs Partially Observable
- Single-agent vs Multi-agent
  - Competitive vs Cooperative environment
- Deterministic vs Nondeterministic
  - In deterministic environments, the next state of the environment is completely determined by the current state and the action executed by the agent
- Episodic vs Sequential
  - In an episodic environment, the agen'ts experience is divided into atomic episodes. In each episode, the agent receives a percept and then performs a single action. The next episode does not depend on the action taken in the previous ones.
  - In a sequential environment, the current decisions could affect the future decisions.
- Static vs Dynamic: a dynamic environment can be changed for the agent
- Discrete vs Continuous: Able to process a snapshot vs ongoing inputs

Task Environment	Observable	Agents	Deterministic	Episodic/Sequential	Static/Dynamic
Self-Driving Taxi	Partially	Multiagent	Nondeterministic	Sequential	Dynamic
Crossword	Fully	Single	Deterministic	Sequential	Static