

2. Agent Modelling

Course: Introduction to AI

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1 Human Thoughts

2 Human Actions

3 Rational Thoughts

4 **Rational Actions**

- Operate autonomously, sense the environment, create, adapt and pursue goals in a way so as the maximise gains.
- **John McCarthy wanted to name the area of enquiry**
Computational Rationality instead of Artificial Intelligence



- The aim of AI is to create agents that can conduct autonomously in specified task environments.
- A task environment is characterised in terms of the following components:
 - **P**erformance measure
 - **E**nvironment description
 - **A**ctuators
 - **S**ensors



Performance measure

What is the measure of how well the agent is doing?

- Has the agent reached the goal state?
- Has the agents received the most rewards along the way?
- Has the agent arrived at goal without injury to self or others?



Figure: Task Environment



Environment description

What is the environment type? Let's look at the different dimensions of variability.

- Deterministic ————— Stochastic
- Discrete ————— Continuous
- Episodic ————— Sequential
- Single agent ————— Multi agent
- Static ————— Dynamic
- Partially Observed ————— Fully Observed
- Known ————— Unknown

Task environment - Environment description

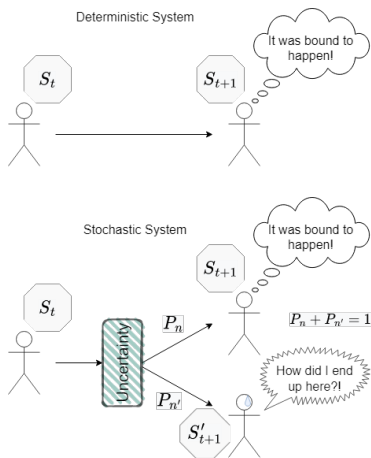


Figure: Deterministic vs. Stochastic

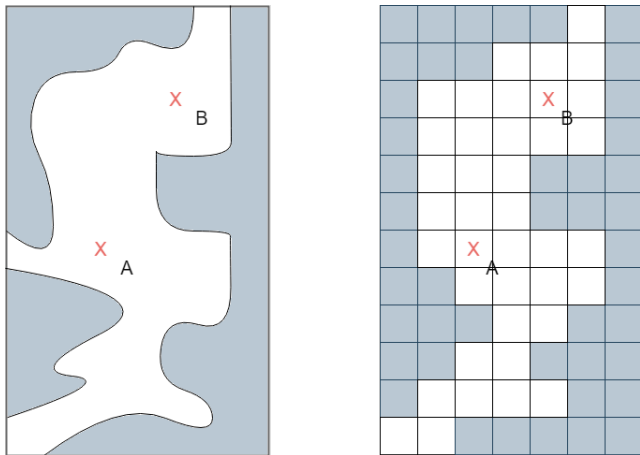


Figure: Continuous vs. Discrete

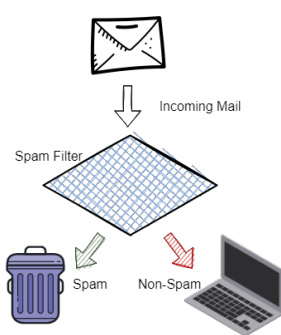


Figure: Episodic vs. Sequential

Task environment - Environment description



5	3			7				
6			1	9	5			
	9	8					6	
8				6				3
4			8		3			1
7				2				6
	6					2	8	
			4	1	9			5
				8			7	9

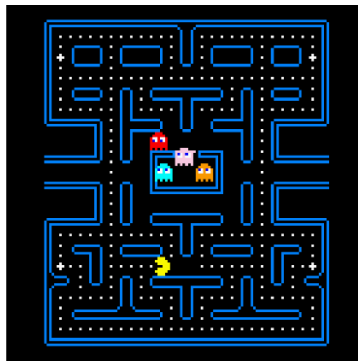


Figure: Single vs. Multi agent

Task environment - Environment description



Figure: Static vs. Dynamic

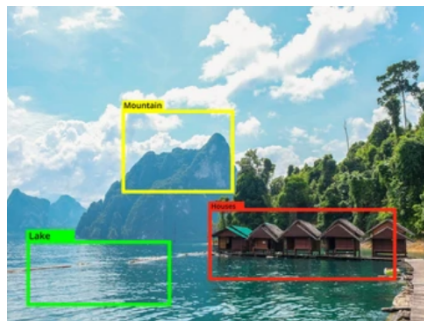


Figure: Fully vs. Partially observed

Task environment - Environment description

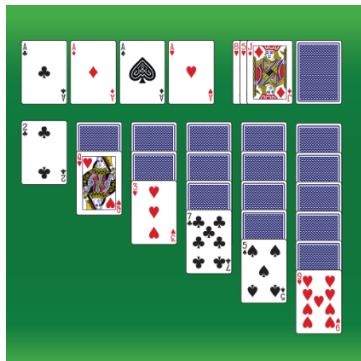


Figure: Known vs. Unknown



Actuators

The actions that the agent can perform in the space

- Can the agent move an arm?
- Can the agent walk?



Sensors

How much and what of the environment can the agent observe/sense?

- Can the agent see behind walls?
- Can the agent perceive the intention of fellow driver on the road?

Task environment: Interaction of Components

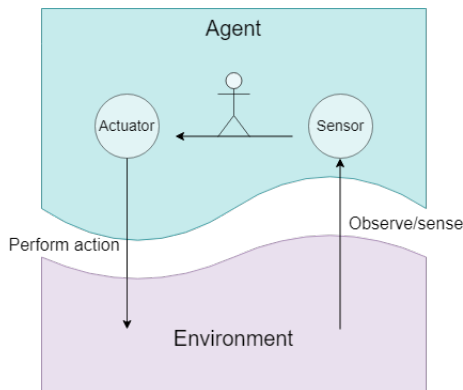
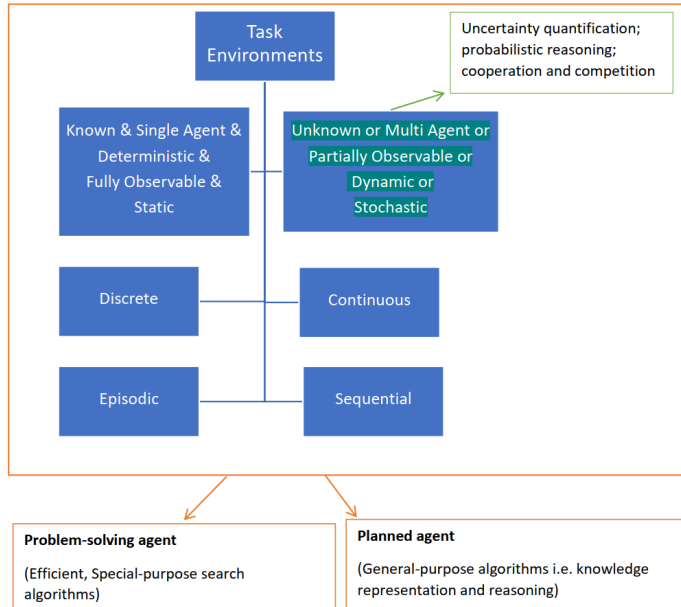


Figure: Constraints on observations and actions affect the description/nature of the environment.



Types of Environments: A Taxonomy





1 Reminder

- Computational Rationality

2 Autonomous agents

3 Task environments

- Performance measure
- Environment description
- Actuators
- Sensors

4 Types of Environments: A Taxonomy