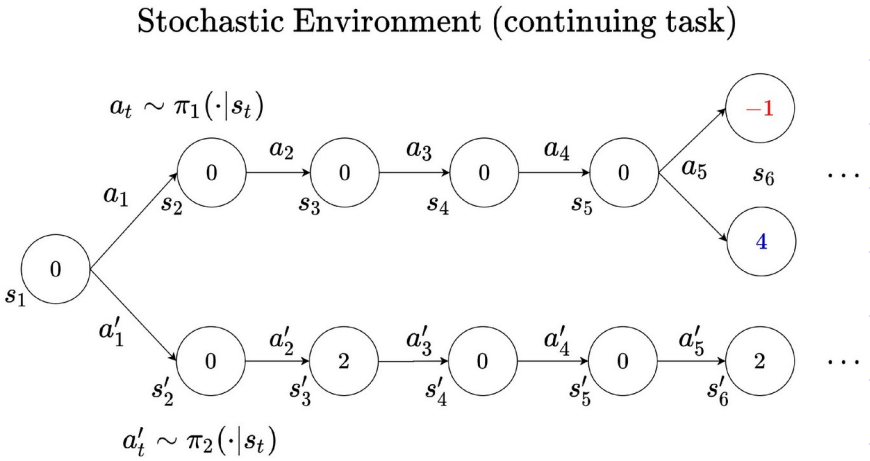
Continuing Tasks

Objectives

- Understand the differentiate between episodic and continuing task
- Using discounting for continuing tasks

Continuing tasks

- Continuing tasks, also known as ongoing tasks or recurring tasks, are activities that require regular attention and maintenance over an indefinite period. These tasks do not have a defined endpoint and typically repeat at regular intervals or as neede



Continuing tasks

- Characteristics of Continuing Tasks:
  - **Ongoing Nature**: Continuing tasks persist over time and require continuous attention and effort.
  - **Regular Intervals**: They may occur at regular intervals, such as daily, weekly, monthly, or annually, depending on the nature of the task.
  - **No Defined Endpoint**: Unlike episodic tasks, continuing tasks do not have a clear endpoint or completion date. They continue indefinitely or until they are no longer necessary.

Continuing tasks

- Characteristics of Continuing Tasks:
  - **Maintenance and Monitoring**: These tasks often involve regular maintenance, monitoring, and adjustment to ensure they are performed effectively and efficiently.
  - **Evolution Over Time**: Continuing tasks may evolve over time to adapt to changing circumstances, requirements, or priorities.

Continuing tasks

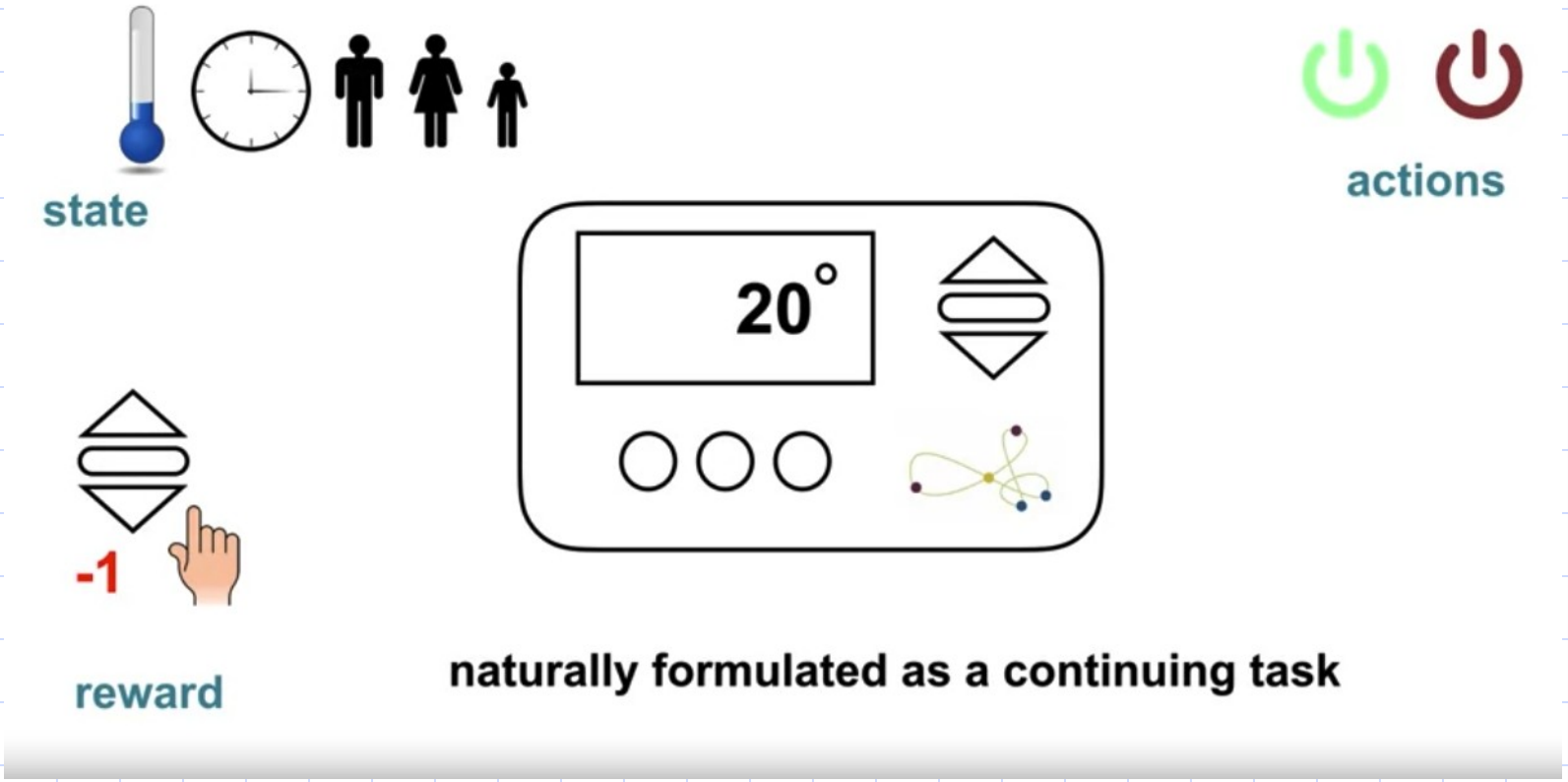
	Episodic Tasks	Continuing Tasks
Definition	Episodic tasks are those that have a distinct beginning and end. They are typically discrete activities or projects with a defined goal or outcome	Continuing tasks, also known as ongoing tasks or recurring tasks, are those that persist over time without a defined endpoint. They are activities that require regular attention and maintenance.
Duration	These tasks are time-limited and are usually completed within a relatively short timeframe.	These tasks are indefinite and repeat at regular intervals or as needed.
Examples	Writing a report, completing a specific project, organizing an event, or studying for an exam are examples of episodic tasks.	Routine administrative tasks, managing a website, providing customer support, and maintaining equipment are examples of continuing tasks.

Continuing tasks

	Episodic Tasks	Continuing Tasks
Characteristics	✓ They often require a focused effort until completion. ✓ They have clear objectives and deliverables. ✓ Once finished, they do not require ongoing attention or maintenance.	✓ They require ongoing effort and attention. ✓ They may not have clear endpoints and may evolve over time. ✓ They often involve regular monitoring and adjustment to meet changing requirements or conditions.

Continuing tasks

- Example: Smart thermostat which regulates the



Continuing tasks

- Example: Smart thermostat which regulates the temperature of a building
  - The thermostat never stops interacting with the environment.
  - The state could be the current temperature along with details of the situation like the time of day and the number of people in the building.
  - There are just two actions, turn on the heater or turn it off.
  - The reward to be minus one every time someone has to manually adjust the temperature and zero otherwise.
  - To avoid negative reward, the thermostat would learn to anticipate the user's preferences

Continuing tasks

- Interaction goes on continually
- No terminal state

$$G_t \doteq R_{t+1} + R_{t+2} + R_{t+3} + \dots$$

- We're summing over an infinite sequence. This return might not be finite. What is solution ?

Discounting

- Discount future rewards by a factor Gamma called the discount rate.
- Gamma is at least zero, but less than one.
- The return formulation can then be modified to include discounting.
- The effect of discounting on the return is simple, immediate rewards contribute more to the some.
- Rewards far into the future contribute less because they are multiplied by Gamma raised to successively larger powers of k

Discounting

- Discount the rewards in the future by gama, where 0<gama<1

$$G_t \doteq R_{t+1} + R_{t+2} + R_{t+3} + \ldots + R_{t+k} + \ldots$$

Discounting

- We can concisely write this sum as this expression, which is guaranteed to be finite.

$$G_t \doteq R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \ldots + \gamma^{k-1} R_{t+k} + \ldots$$

$$= \sum_{k=0}^{\infty} \gamma^k R_{t+k+1}$$

Finite as long as $0 \leq \gamma < 1$

Discounting

- The effect of gama on agent behavior

$$G_t \doteq R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \ldots + \gamma^{k-1} R_{t+k} + \ldots$$

- When Gamma = 0 the return is just the reward at the next time step. So the agent is shortsighted and only cares about immediate expected reward.

$$G_t \doteq R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \ldots + \gamma^{k-1} R_{t+k} + \ldots$$

$$\gamma = 0$$

$$= R_{t+1} + 0 R_{t+2} + 0^2 R_{t+3} + \ldots + 0^{k-1} R_{t+k} + \ldots$$

$$= R_{t+1}$$

Discounting

- The effect of gama on agent behavior

$$G_t \doteq R_{t+1} + \gamma R_{t+2} + \gamma^2 R_{t+3} + \ldots + \gamma^{k-1} R_{t+k} + \ldots$$

  - when Gamma approaches one, the immediate and future rewards are weighted nearly equally in the return. The agent in this case is more farsighted.

Student task

- Give an example of a continuing task, and analyze its components: agent, environment, state,...

Summary

- Understand the differentiate between episodic and continuing tasks
- Using discounting for continuing tasks

Q & A