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CSE422 : ARTIFICIAL INTELLIGENCE

PROPERTIES OF ENVIRONMENT

BY

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What is Environment?

- ▶ An environment is everything in the world which surrounds the agent, but it is not a part of an agent itself.
- ▶ An environment can be described as a situation in which an agent is present.

Fully observable/Partially observable

- If an agent sensor can sense or access the complete state of an environment at each point of time then it is a **fully observable** environment, else it is **partially observable**.

Example: **Tic-Tac-Toe, Chess(A player gets to see the whole board)**

- A **fully observable** environment is easy as there is no need to maintain the internal state to keep track history of the world.
- An agent with no sensors in all environments then such an environment is called as **unobservable**.

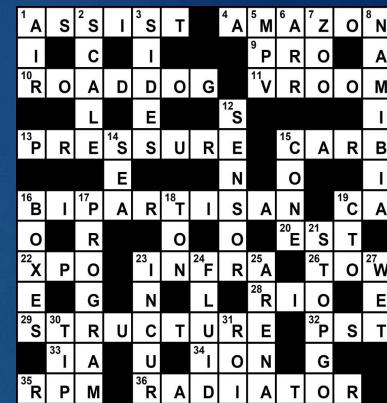
Example: **Automated taxi driving, Poker(A player gets to see only his own cards, not the cards of everyone in the game)**



Single agent/Multi-agent

- If only one agent is involved in an environment, and operating by itself then such an environment is called **single agent** environment.
- However, if multiple agents are operating in an environment, then such an environment is called a **multi-agent** environment.
- The agent design problems in the **multi-agent** environment are different from **single agent** environment

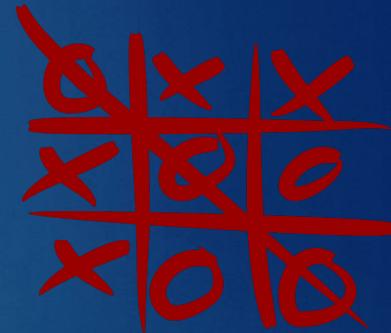
Example: **Single agent(Crossword Puzzle), Multi-agent(Chess)**



Deterministic/Stochastic

- If an agent's current state and selected action can completely determine the next state of the environment, then such environment is called a **deterministic environment**.
- A **stochastic environment** is random in nature and cannot be determined completely by an agent.
- In a **deterministic, fully observable** environment, agent does not need to worry about uncertainty.

Example: **Deterministic(Tic Tac Toe, Chess), Stochastic(Poker)**



Episodic/Sequential

- ▶ In an **episodic** environment, there is a series of one-shot actions, and only the current percept is required for the action.
- ▶ However, in **sequential** environment, an agent requires memory of past actions to determine the next best actions.
- ▶ Such environments do not require the agent to plan ahead.

Example: **Episodic(Part Picking Robot, Vacuum cleaner), Sequential(Chess, Taxi Driving)**



Static/Dynamic

- ▶ If the environment can change itself while an agent is deliberating then such environment is called a **dynamic** environment else it is called a **static** environment.
- ▶ **Static** environments are easy to deal because an agent does not need to continue looking at the world while deciding for an action.
- ▶ However for **dynamic** environment, agents need to keep looking at the world at each action.

Example: **Static(Crossword Puzzle), Dynamic(Taxi Driving)**

Discrete/Continuous

- If in an environment there are a finite number of percepts and actions that can be performed within it, then such an environment is called a **discrete** environment else it is called **continuous** environment.

Example: **Discrete(Crossword Puzzle, Poker), Continuous(Taxi Driving)**

Known/Unknown

- ▶ **Known** and **unknown** are not actually a feature of an environment, but it is an agent's state of knowledge to perform an action.
- ▶ In a **known** environment, the results for all actions are known to the agent. While in **unknown** environment, agent needs to learn how it works in order to perform an action.
- ▶ It is quite possible that a **known** environment to be **partially observable** and an **unknown** environment to be **fully observable**.

Characteristics of environments

| Task Environment | Fully observable? | Deterministic? | Episodic? | Static? | Discrete? | Single agent? |
|-------------------|-------------------|----------------|-----------|---------|-----------|---------------|
| Crossword | | | | | | |
| Poker | | | | | | |
| Taxi driving | | | | | | |
| Image analysis | | | | | | |
| Medical diagnosis | | | | | | |

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| Medical diagnosis | NO | NO | NO | NO | NO | YES |

- The most challenging environments are partially observable, stochastic, sequential, dynamic, and continuous, and contain multiple intelligent agents

Thank You!

GOOD LUCK !