BRAC UNIVERSITY

Inspiring Excellence

CSE422 : ARTIFICIAL INTELLIGENCE

PROPERTIES OF ENVIRONMENT

BY

BENJIR ISLAM ALVEE

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)**

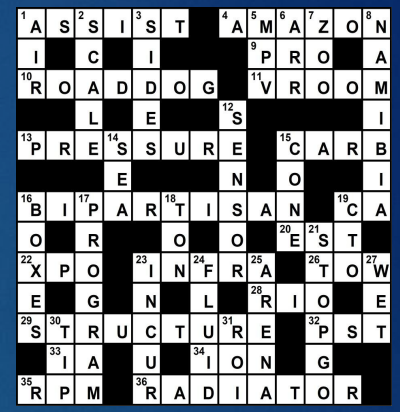
- A **fully observable** environment is easy as there is no need to maintain the internal state to keep track history of the world.
- An agent with no sensors in all environments then such an environment is called as **unobservable**.

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

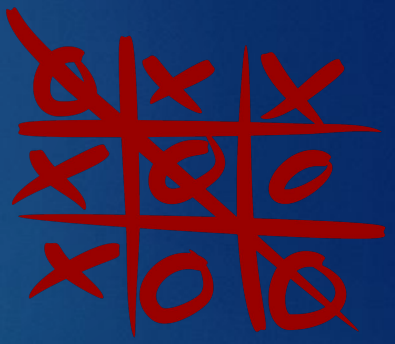
Example: **Single agent(Crossword Puzzle), Multi-agent(Chess)**



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						

Characteristics of environments

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Poker						
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Poker	NO	NO	NO	YES	YES	NO
Taxi driving	NO	NO	NO	NO	NO	NO
Image analysis						
Medical diagnosis						

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Taxi driving	NO	NO	NO	NO	NO	NO
Image analysis	YES	YES	YES	SEMI	NO	YES
Medical diagnosis						

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Poker	NO	NO	NO	YES	YES	NO
Taxi driving	NO	NO	NO	NO	NO	NO
Image analysis	YES	YES	YES	SEMI	NO	YES
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 !