PROGRAM: BACHELOR OF SCIENCE IN COMPUTER SCIENCE

FACULTY OF COMPUTING AND INFORMATION SCIENCES

DEPARTMENT OF COMPUTER SCIENCE

COURSE UNIT: ARTIFICIAL INTELLIGENCE (LCS 2206)

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TASK:

Discuss model-based reflex agents.

MODEL-BASED REFLEX AGENTS

A **model-based reflex agent** is an agent that uses its percept history and internal memory to make decisions about an internal model of the world/environment. The internal memory allows the agent to store information about the environment.

The agent then uses the semi-subjective history to understand the environment better.

Model-based reflex agents are made to deal with partial accessibility; they do this by not only keeping track of the part of the world it can see now but also keeping an internal state that depends on what it has seen before so it holds information on the unobserved aspects of the current state.

The Model-based agent can work in a **partially observable environment**, and track the situation.

A model-based agent has two important factors:

- **Model:** It is knowledge about "how things happen in the world," so it is called a Model-based agent.
- **Internal State:** It is a representation of the current state based on percept history.

Updating the internal memory/state

In order to update this internal state, two things are needed;

a) How the world evolves independently from the agent

b) How the agent's action affects the world.

This knowledge helps the agent predict how the world may react.

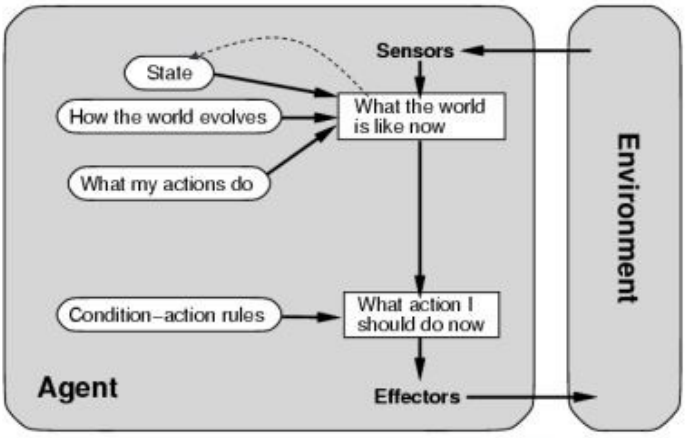
This knowledge about “how the world works” is termed as **model of the world** and can be in form of propositional logic, data structures, attributes & their values

Example

We can predict how the world will react with **facts** like if you remove a supporting rock under a ledge the ledge will fall, such facts are called models, hence the name model-based agent.

Steps a model-based reflex agent follows

- Updating internal state requires two kinds of encoded knowledge
  - knowledge about how the world changes (independent of the agents' actions)
  - knowledge about how the agents' actions affect the world
- But, knowledge of the internal state is not always enough
  - how to choose among alternative decision paths (e.g., where should the car go at an intersection)?
  - Requires knowledge of the **goal** to be achieved



function Reflex-Agent-With-State(*percept*) **returns** action
static: *rules*, a set of condition-action rules
state, a description of the current world

state ← Update-State(*state*, *percept*)
rule ← Rule-Match(*state*, *rules*)
action ← Rule-Action[*rule*]
state ← Update-State(*state*, *action*)
return *action*

In the update state section the parts of the world that the agent cannot see it put through the natural evolution algorithm, the parts that the agent can see are changed to the expected state of the world after the agents actions.
The **main advantage** of a model-based reflex agent is that it considers history enabling it to work in a partially observed environment.

Differences between simple-reflex and model-based reflex agent

SIMPLE-REFLEX AGENT	MODEL-BASED REFLEX AGENT
A simple-reflex agent selects actions based on the current states.	A model-based reflex agent selects actions based on past events
Works in fully observable environment	Can work in partially observable environment
Doesn't compute complex computational problems but rather only map the current state to an action	It involves carrying out computations to decide an action

- **Problems associated with model-based reflex agents**

  - It is difficult for the agent to determine the exact current state of a partially observable environment
  - Decision has to be made by the agent even though there is uncertainty about the current state
  - They don’t operate towards a specific outcome

- **Applications of Model-based Reflex agents**

  - Used in some self-driving cars such as Waymo
  - Used in self-operating vacuum cleaners
  - Factory robots
  - Mail delivery robots

References

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