Introduction to Artificial Intelligence

Chap 2 – Intelligent Agents

Q1: For each of the following agents, develop a PEAS description of the task environment:
(a) Autonomous Mars rover
(b) GO game player
Ans:

(a) Autonomous Mars rover →

P (Performance Measure): Explore information on Mars, collecting samples to analyze, check if it's an appropriate place for human beings
E (Environment): Mars, rover launcher, landing point
A (Actuators): Wheels, robot arms, tool head, analysis device, nuclear battery, radio antenna
S (Sensors): Camera, laser sensor, orientation sensor, radio receiver, light sensor, image display

(b) GO game player →

P (Performance Measure): Defeat opponent, learn more from pervious matches, demonstrate an machine can become rational agent through deep learning, maximize a winning game
E (Environment): GO game player experts, checkerboard, Go chess pieces, timer
A (Actuators): Analysis device, big memory data, NPU (Network Processing Unit)
S (Sensors): Image display, camera, keyboard

Q2: For each of the above agent, characterize the environment according to the properties given in Section 2.3, and select a suitable agent design.
Ans:
Task environment:

Autonomous Mars rover →

Obserable: Partially
Agents: Single
Deterministic: Stochastic

Episodic: Sequential
Static: Dynamic
Discrete: Continuous
Agent Design: Model-based reflex agents

GO game player →

Obserable: Partially
Agents: Multi
Deterministic: Stochastic
Episodic: Sequential
Static: Static
Discrete: Discrete
Agent Design: Combine Goal-based agents and Learning agents

Q3: Consider the vacuum cleaner, for which the agent is penalized one point for each movement.
(a) Can a simple reflex agent be perfectly rational for this environment? Explain.
(b) What about a reflex agent with state? Design such an agent.
(c) How do your answers to (a) and (b) change if the agent's percepts give it the clean/dirty status of every square in the environment?
Ans:
(a)No, a simple reflex agent won't be perfectly rational because the environment isn't "Fully Observable". It may be obstacles or walls in the environment that the vacuum cleaner can't response when encountered. Also a vacuum cleaner that learns to foresee where and when additional dirt will appear will do better than one that doesn't.

(b)A reflex agent with state, which is so-called "Model-based reflex agent" will perform better than a simple reflex agent. It can tackle "Partially Observable" and keep tracking the part of the world that the agent can't see. So if the vacuum cleaner is a model-based reflex agent, it can handle the situation such as obstacles occurred and is capable to foresee what the environment is gonna be. However, if the environment is all cleaned, a model-based reflex agent will still keep finding dirty place and never stop.

A Model-based reflex agent Design:

function Model-Based-Reflex-Vacuum-Cleaner (percept) returns an action
persistent:
state, the vacuum cleaner's conception of the environment currently.
model, a description of how the next state depends on the current state and action. For example, {move one point to location A, suck}
rule, a set of condition-action rule. For instance,
if status = dirty, then return suck
else if (direction = right && can move right), then return one point to right
else if (direction = right && can move down), then direction = down, return one point to down
else if (direction = down && can move left), then direction = left, return one point to left ……
action, initially none, according to rule.

State update-state (state, action, percept, model)
Rule rule-match (state, rules)

Action rule → action

return action

(c) If the agents in (a), (b) percepts the clean/dirty status of every square. It will only clean the dirty square as the given status. Therefore, the agents is capable to take no action if the environment were all cleaned and also take the shortest route to vacuum all squares.