

Tutorial - I

Tutorial I : design of Intelligent Agent

Aim: To understand the concept of Agent Abstraction by studying definition of Rational Agent , Agent environment , Task Environment Descriptors , environment types .

Theory : An artificial intelligent system is composed of an agent and its environment . The agents act in their environment . An agent is anything that can perceive its environment through sensors and acts upon that environment through effectors . This can be clearly seen in figure 1.

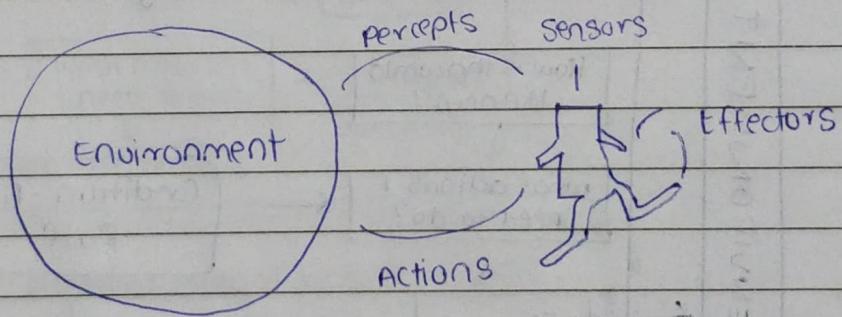


Fig.1 AI Agent
with environment

An agent in particular can be :

Human Agent has sensory organs such as eyes , ears , nose , tongue and skin parallel to the sensors , and other organs such as glands , legs , mouth , for effectors .

Robotic agent replaces cameras and infrared range finders for the sensors, and various motors and actuators for effectors

Software agent has encoded bit strings as its programs and actions

Agent structure can be viewed as a combination of Agent architecture and Agent Program. Agent Architecture refers to the machinery that an agent executes on whereas Agent Program is an implementation of an agent function. Figure 2 shows four important types of agent architecture.

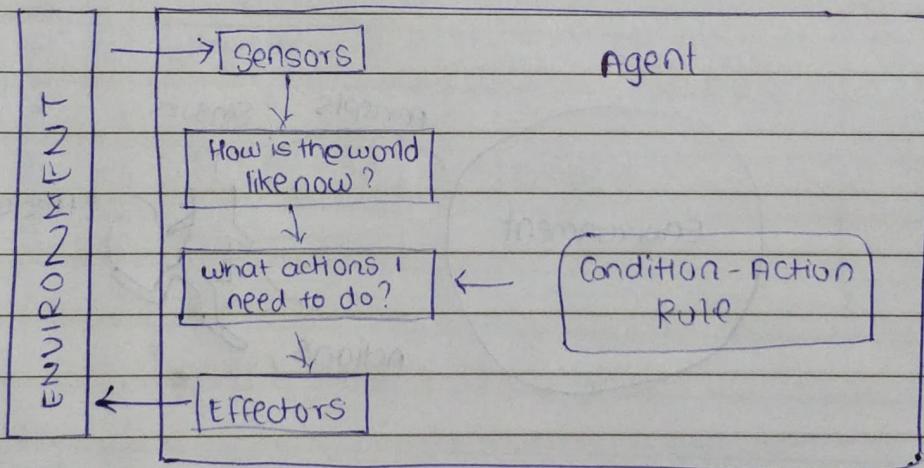


fig.2(a) simple reflex agent

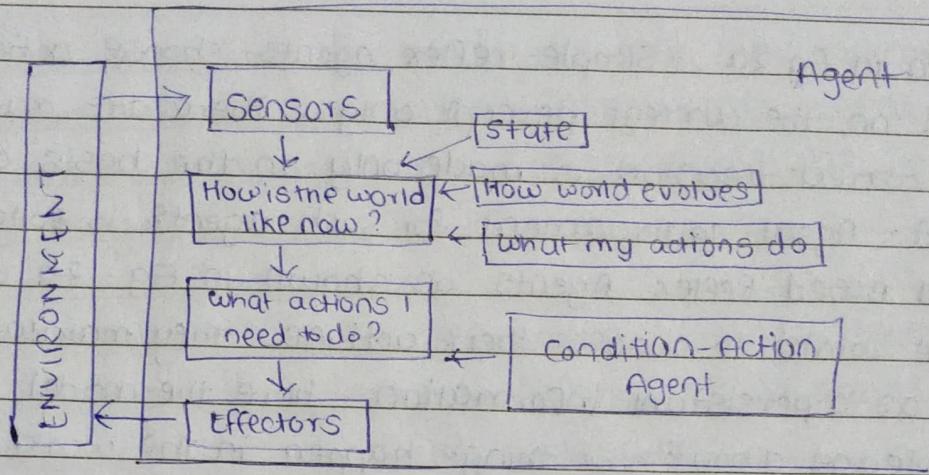


fig2(b) Model based Reflex agent

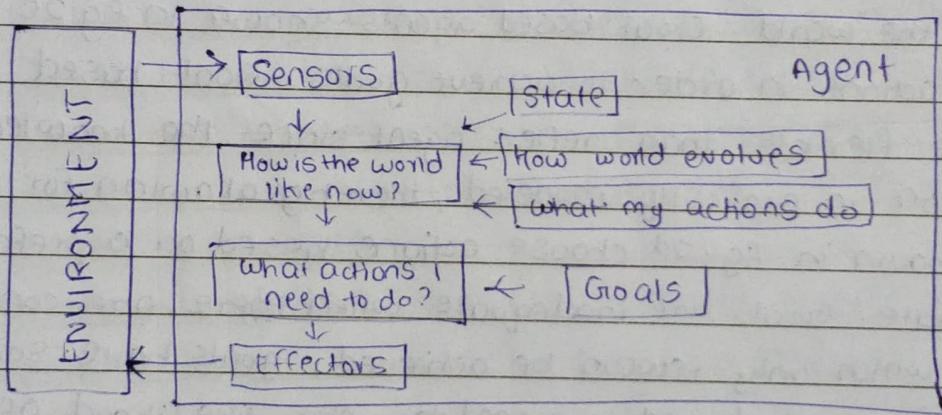


fig2(c) · Goal based agent

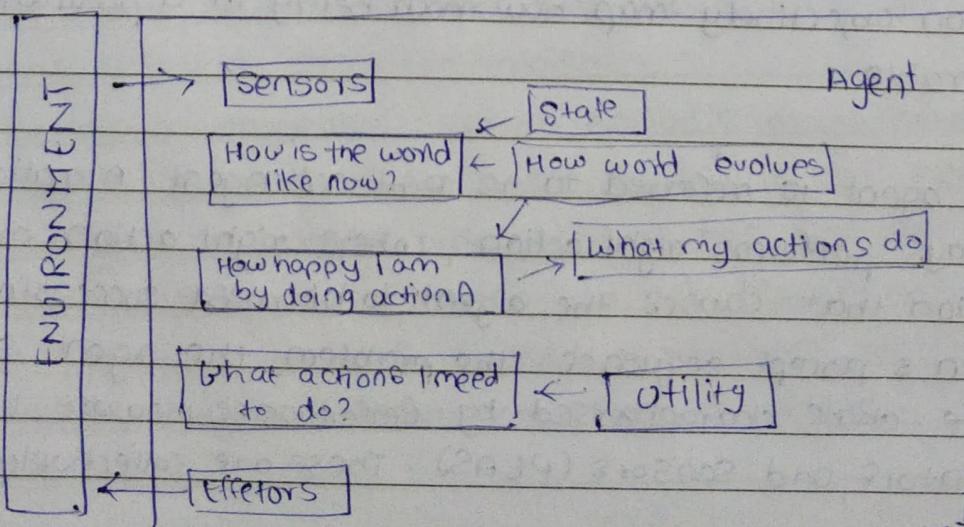


fig.(d) Utility Based Agent

As seen in fig 2a, simple reflex agents choose actions only based on the current percept only. They are rational only if a correct decision is made only on the basis of their current percept. Agent environment for such agents is fully observable.

Model Based Reflex Agents as shown in fig. 2b use a model of the world to choose their actions. They maintain an internal state as a persistent information. Here the model means knowledge about how things happen in the world that is representation of unobserved aspects of current state depending on percept history. Agent take into account how its actions affect the world.

Goal based agents shown in fig 2c, choose their actions in order to achieve goals. Goal-based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, thereby allowing for modifications.

Goal shown in fig. 2d choose actions based on a preference for each state. Goals are inadequate when there are conflicting goals, out of which only few can be achieved, goals have some uncertainty of being achieved and you need to weigh likelihood of success against the importance of a goal. On the other hand utility function objectively map how much being in a particular state is desirable.

An AI agent is referred to as Rational Agent. A rational agent always performs right action, where right action means the action that causes the agent to be most successful in the given percept sequence. The problem the agent solves is state-space characterised by Performance measure, Environment, Actuators, and Sensors (PEAS). These are collectively referred to

as PEAS descriptors for the agent task environment. PEAS descriptors provide important insight into agent and the task environment it operates in. These insights are very useful in agent design.

Another important piece of information is task environment properties. While analyzing task environment the agent architect needs to consider following properties:

- 1) Discrete or Continuous : If there are a limited numbers of distinct, clearly defined ; otherwise it is continuous.
- 2) Observable or Partially observable : If it is possible to determine the complete state of the environment at each time point from the percepts . It is observable ; otherwise it is partially observable.
- 3) Static or Dynamic : If the environment doesn't change while an agent is acting , then it is static ; otherwise it is dynamic.
- 4) Deterministic or non-deterministic : If the next state of the environment is completely determined by the current state and the actions of the agents , then the environment is deterministic, otherwise it is non-deterministic.
- 5) Episode or sequential : In an episodic environment each episode of events consists of the agent perceiving and then acting. The quality of its actions depends on first just on the episode itself . Subsequent episodes do not depends on the actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead .

6. Single agent or multiple agents : The environment may contain a single agent or other agents of which may be of the same or different kind as that of the agent. These agents may be co-operating or competing with each other.

7. Accessible or Inaccessible : If the agent sensory apparatus can have access to the complete status of the environment then the environment is accessible to that agent.

Working :

Search internet for AI based applications in following scenarios and identify who is good for that agent environment in each case. Finally try to classify task environment properties like a list of attributes from above list of task environment properties.

1. Deep Blue chess playing computer program :

Performance measure (P) :- win/loss/draw

Environment (E) : Chess board, chess pieces

Actuators (A) : Chess Desktop screen, CPU

Sensors (S) : Chess board

Task environment properties :- Discrete, Fully observable, Accessible

2. ELIZA, the NLP computer program created from 1964 to 1966 at the MIT AI lab by Joseph Weizenbaum :

P : Understanding user, maintaining conversation.

E : User, program, keyboard, mouse

A: Texts

S: user text inputs.

Task Environment: continuous, Fully observable, static

③ Sophia is a social humanoid robot developed by Hong Kong based company Hanson Robotics.

P: understanding user, maintaining conversations

E: Humans, objects

A: Arms, legs, mouth

S: eyes (cameras), mic., speaker

Task Environment: continuous, fully observable, dynamic

4) Apple's virtual assistant Siri

P: understanding user, text and speech, summoning

E: user, speech, text

A: Mobile screen, ~~the~~ Speaker

S: Speaker , mic , button

Task Environment: Fully observable, static, Deterministic

5) Automated & co. crossword Solver

P: Understanding hints, hidden and visible letters

E: crossword board, paper

A: screen and program

S: crossword board

Task Environment: Fully observable, static, episodic,
simple agent, accessible.