

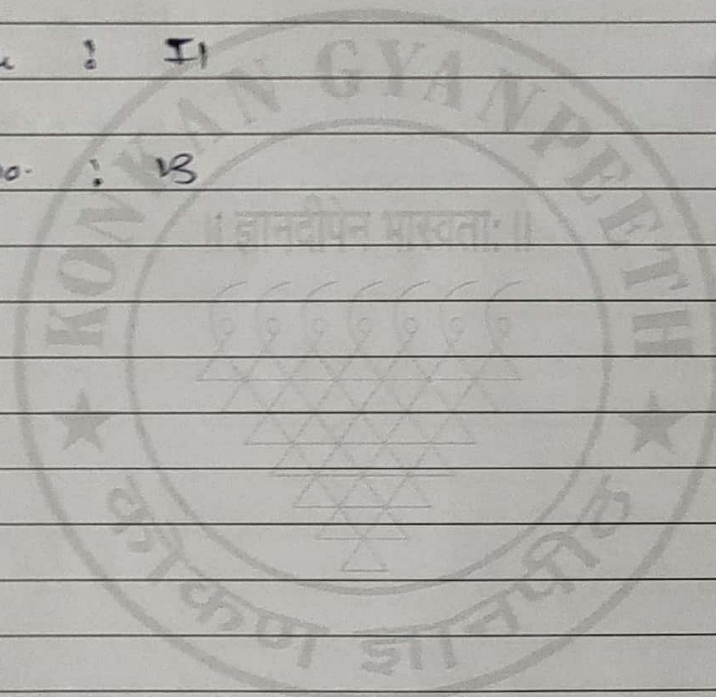
Tutorial - 1

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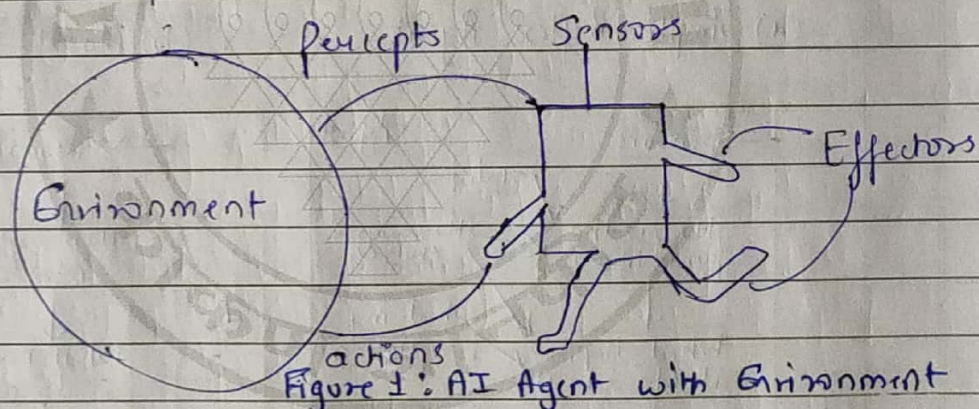
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Tutorial 1 : Design of Intelligent Agent

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

Theory : An Artificial Intelligent (AI) 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 & acts upon that environment through effectors. This can be clearly seen in Figure. 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 hands, legs, mouth, for effectors.

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

Software agent has encoded bit strings as its programs and actions.

Agent structure can be viewed as combinatⁿ of Agent architecture & Agent Program. Agent architecture refers to the machinery that an agent executes on whereas Agent Program is an implementatⁿ of an agent function. Figure 2 show four important types of agent architectures.

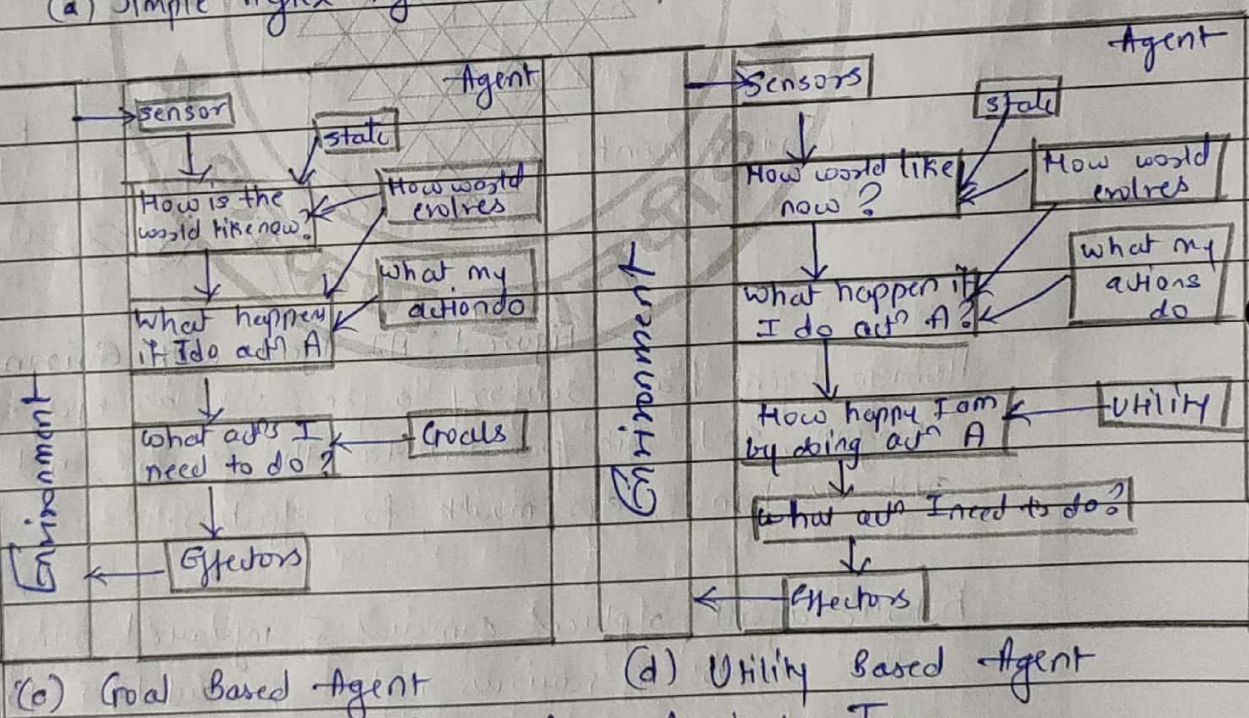
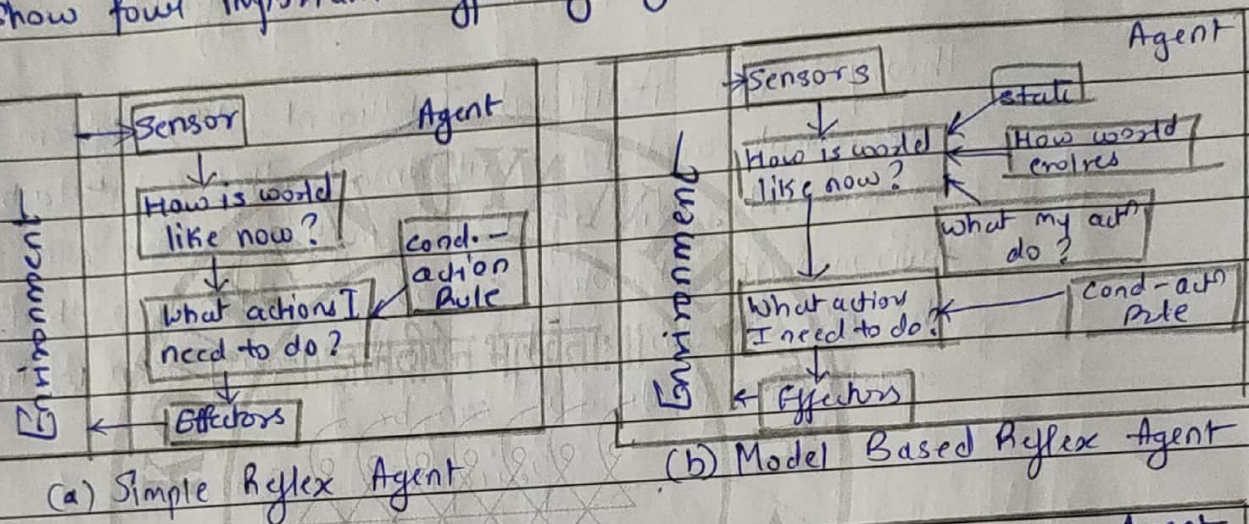


Fig. 2 : Agent Architecture Types

As seen in Fig 2(a) Simple Reflex agents choose actions only based on current percept. They are rational only if a correct decision is made only on the basis of current percept.

Agent environment for such agents is fully observable. Model Based Reflex Agents as shown in Fig 2(b) use a model of world to choose their action. They maintain an internal state as persistent info. Here model means knowledge about how the things happen in the world i.e. representation of unobserved aspects of current state depending on percept history. Agent take into acc. how its actions affect the world. Goal based approach is more flexible than reflex agent since the knowledge supporting a decision is explicitly modeled, by foll. modifications. Finally Utility Based Agents 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 & you need to weigh likelihood of success against imp. 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 agent to be most successful in the given percept sequence. The problem solved by agent is characterized by Performance Measure, Environment, Actuator & Sensors (PEAS). PEAS descriptors provide imp. insight into agent & task environment it operates in. These insights are very useful in agent design. Another imp. piece of info. is task environment prop. While analyzing task environment the agent architect needs to consider foll. properties :

- 1] Discrete / Continuous ? If there are limited no. of distinct, clearly defined, states of environment, the environment is discrete (Eg: chess); otherwise it is continuous (Eg: automated driving).
- 2] Observable / Partially Observable ? If it is possible to determine complete state of environment at each time point from the percepts it is observable; otherwise it is only partially observable.
- 3] Static / Dynamic ? If the environment does not change while an agent is acting, then it is static, otherwise it is dynamic.
- 4] Deterministic / Non-deterministic ? If the next state of environment is completely determined by current state & actions of agent, then the environment is deterministic; otherwise it is not deterministic.
- 5] Episodic / Sequential ? In an episodic environment, each episode of events consists of agent perceiving & then acting. The quality of its action depends just on episode itself. Episodic environments are much simpler because agent does not need to think ahead. eg. Paint Picking robots. Complementary to this is sequential environment where current action dictates the future action.
- 6] Single agent / Multiple agent ? The environment may contain single agent or other agents which may be of the same / diff. kind as that of the agent.
- 7] Accessible / Inaccessible ? If the agent's sensory apparatus can have access to complete state of environment, then environment is accessible to that agent.

Working : Search internet for AI based applicatⁿ in foll. scenarios & identify who is agent for that application. further list of PEAS descriptors for agent environment in each of the case. List of attributes from above list of task environment properties.

1. Autonomous Lunar Rover
2. Deep Blue Chess playing computer program
3. Eliza natural language processing computer program created from 1964-1966 at MIT Artificial Intelligence Laboratory by Joseph Weizenbaum.
4. Automatic Portfolio management
5. Sophia is social humanoid robot developed by Hong Kong based company Hanson Robotics.
6. Apples virtual assistance Siri
7. Endurance : A companion for Dementia Patients
8. Cusper : Helping Insomniacs Get Through Night
9. Maud : Guarding the Galaxy with Comic-Book Characters
10. Automated : Cross word Solver

Resources : The above diagrams are taken from online tutorial available at Tutorials points on topic AI - Agents and Environments.

1) Deep Blue chess playing computer program

~~Performance~~ measure : win/loss/draw, safety of chess pieces, safety of king piece, no. of moves, time for each move.

Environment : Chess board, Chess pieces.

Actuators : Desktop server, CPU

Sensors : Chess board

Task environment properties : Discrete, fully observable, static, deterministic, sequential, single agent, accessible.

- 2) ELIZA, the NLP computer program created from 1964-1966 at the MIT artificial intelligence laboratory by Joseph Weizenbaum.

~~Performance~~ Measure : Understanding user, maintaining conversation

Environment : User, program, keyboard, user text inputs, Eliza feeds, output window

Actuators : texts

Sensors : User text inputs

Task environment properties : Continuous, fully observable, static, deterministic, sequential, single agent, accessible

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

Performance measure : Understanding user, maintaining conversation, facial expressions, response time

Environment : Humans, objects

Actuators : Arms, mouth, legs, speaker

Sensors : Eyes (cameras), ears, mic, audio sensors

Task Environment Properties : Continuous, fully observable, dynamic, deterministic, sequential, single agent, accessible

- 4) Apple's virtual assistant Siri

Performance measures : Understanding user text & speech, producing best results, summoning (trigger), response speed

Environment : User, speech, text

Actuators : Mobile screen, speaker

Sensors : Mobile screen, mic, button

Task environment properties : Continuous, fully observable, static, deterministic, episodic, single agent, accessible.

5) Automated Crossword solver

Performance measure : Understanding hints, analyzing solver hidden & visible letters, time to solve.

Environment : Hints, visible letters, crossword board

Actuators : Desktop, screen, program

Sensors : Crossword board

Task Environment Properties : Discrete, fully observable, static, deterministic, episodic, single agent, accessible