Tutorial 1 :

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# Tutorial 1: 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 (AI) system is composed of an agent and its environment. The agent 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 fig. 1. 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 and infrared range finders for sensors and various motors and actuators for effectors.

Software agent: has encoded bit strings as its programs and actions
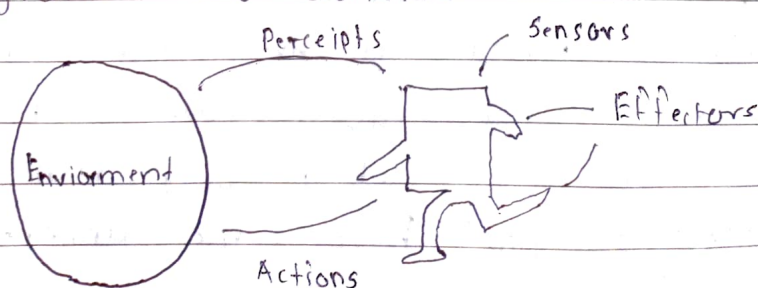
Agent structure can be viewed as a combination of Agent architecture and Agent program. Agent Architecture refers to machinery that an agent execute on wheras Agent program is an implementation of an agent function. fig. 2 shows four important types of agent architectures.

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 current precept. Agent environment for such agents is fully observable. Model Based Reflex Agents as shown in fig. 2b use a model of world to choose their actions. They maintain an internal states as a persistant information. Here the model means knowledge about how things happen in the world that is representation of unobserved aspect 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 knowelige supporting a decision is explicity modeled, thereby allowing for modifications. Goal is the description of desirable situation. finally, the Utility Based Agents shown in fig. 2d chous actions based on preference for each state. Goals are inadequate when there are conflicting goals out of which only few can be be achieved. goal have some uncertainty of being

achieved and you need to weigh likehood 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 reffered to as Rational Agent. A rational agent always performs right action, where the right action means the action that cause the agent to be most successful in given percept sequence. The problem the agent solves is characterized by performance Measure, Environment, Acutors and sensors (P.EAS). These are collectively referred to as PEAS description for agent task environment. PEAs description provide important insight into agent and 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 number of distinct clearly defined states of environment, the environment is discreate, otherwise it is continuous.

2. observable or Partially observable It is possible to determine the complete state of the environment at each time point from the percepts it is observable; otherwise it is only partially observable.

3. Static or Dynamic If the environment does not change while an agent is acting, then it is static; otherwise dynamic

4. Deterministic or Non-deterministic If the next state of the environment is completely determined by the current state and the actions of agent, then environment is deterministic, otherwise it is non-determaministic

5. Episodic or sequential In an episodic environment, each episode of events consist of agent perceiving and then acting. The quality of its action depends just on episode itself. subsequent episodes do not depend on actions in the previous episodes. Episodic environments are much simpler because the agent does not need to think ahead. e.g. part picking robots

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

7. Accessible or Inaccessible If the agent's sensory apparatus can have access to the complete state of environment, then the environment is accessible to that agent

Working: Search internet for AI based application is following scenarious and identify who is agent for that application. Further list out PEAS decriptors for agent environment in each of case. Finally try to clarify task environment properties like a list of attributes from above list of 7 task environment properties.

1. Autonumous Lunar Rover
2. Deep Blue chess playing computer program
3. Eliza the natural language processing computer program created from 1964 to 1966 at MIT Artificial Intelligence Laboratory by Joseph Weizenbaum.
4. Automatic portfolio management
5. Sophia is a social humanoid robot developed by Hong kong based company Hanson Robotics.
6. AlphaGo is a computer program that plays the board game Go. It was developed by Alphabet Inc DeepMind lab in London.
7. Apples virtual assistance Siri
8. Endgurance: A companion for Dementia Patients
9. Casper: Helping Insomniacs Get Through the Night
10. Marvel: Guarding the Galaxy with comic-book crossover
11. Automated cross word solver

→ 1. Deep Blue chess playing computer program

performance measure : Din/auso/chart , sorry of chess
· piece safty of ring piece.
no. of moves, time for each move

Environment :- chess board , chess pieces
Actuators :- Desktop, som ccrv
Sensors :- chess board
Task environment :- Discrete, fully observable,
Stoke, Deterministic, sequential single agent accesible

2. ELIZA the NLP computer program created from 1964 to
1966 at the MIT Artificial Intelligence Conanatary by
Joseph Weizenbaum

Performance measure : understanding user, maintaining
conversion Environment :- User, program keyboard.
user Next Input, Eize, Next output window.
Actuators :- Texts
Sensors :- user text, input
Task environment properties :- continious, fully measurable
static, Deterministic, sequential, single agent, accesible

3. Sophia is a social humanoid robot developed by
Hong kong based company Hamlon robotic

performance measure : understanding maintaing conversation
social apperents, respon time

Environments :- Human, objects...
Actuators :- Arms, mouth, legs, speaker
Sensors :- Eyes, ears, mis, and iv sensors

Task environment properties:- continuous. Fully
Observable pynamic, Deterministic, sequential.
Single Agent, accessible