

Tutorial 1: Design of Intelligent Agent

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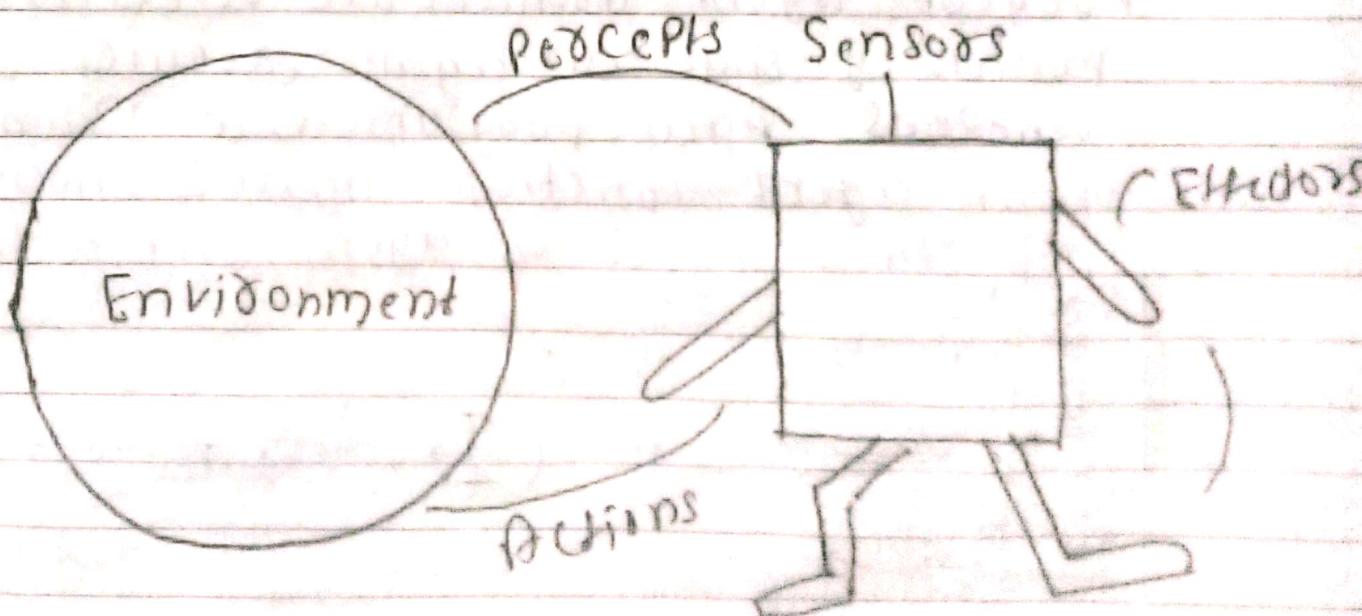
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II Tutorial 1: Design of Intelligent Agents

Aim To understand the concept of Agent Abstraction by studying definition of Rational Agent, Agent environment.

Task Environment Descriptive 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 and acts upon that environment through effectors. This can be clearly seen in figure 1 an



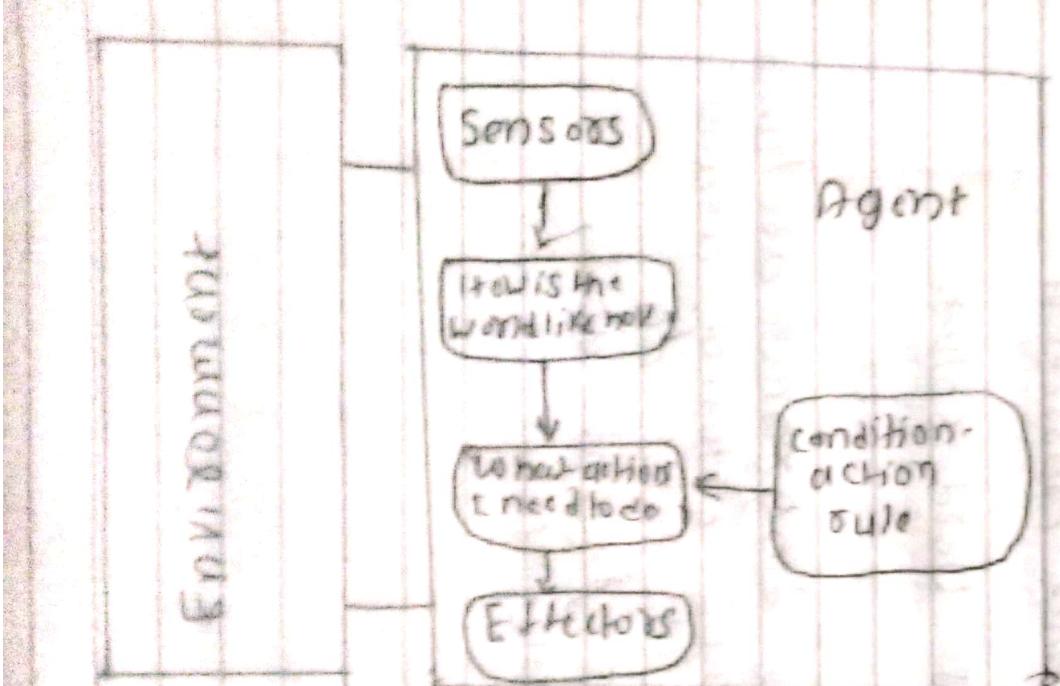
agent in particular in the

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

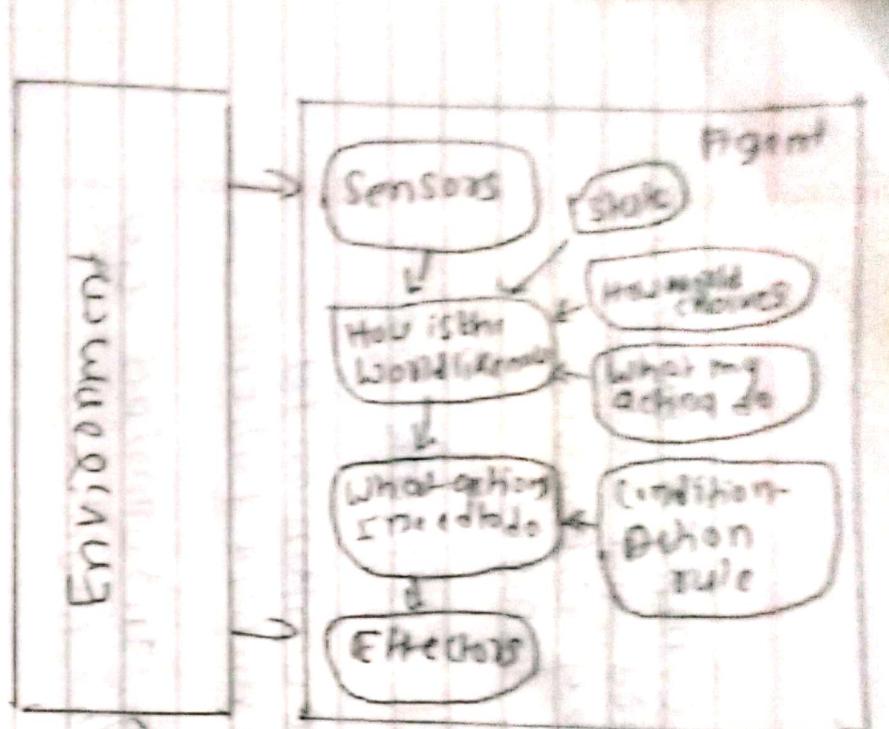
Robotic agent replaces sensors and introduces range finders for the sensors and various motors and actuators for effectors

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

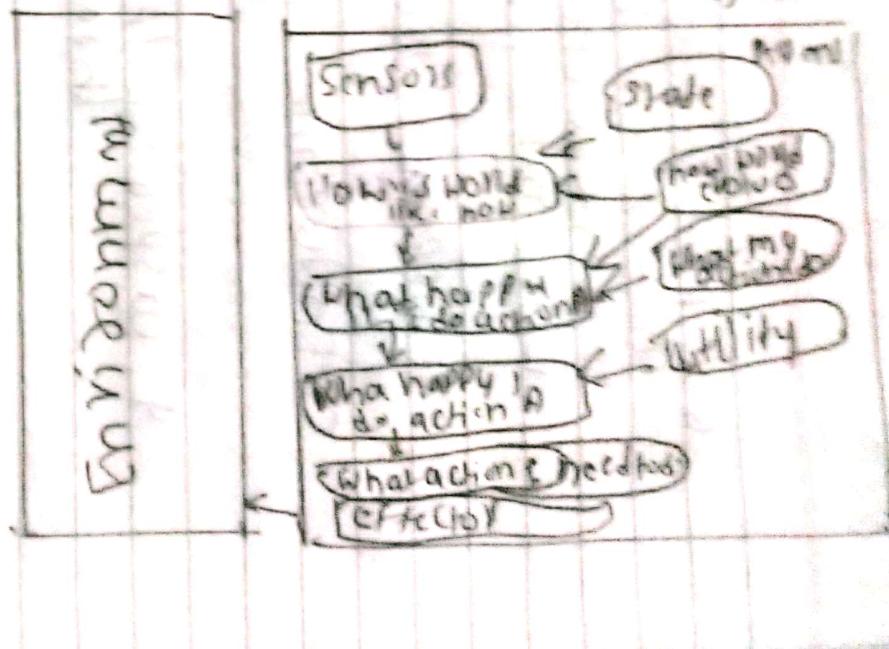
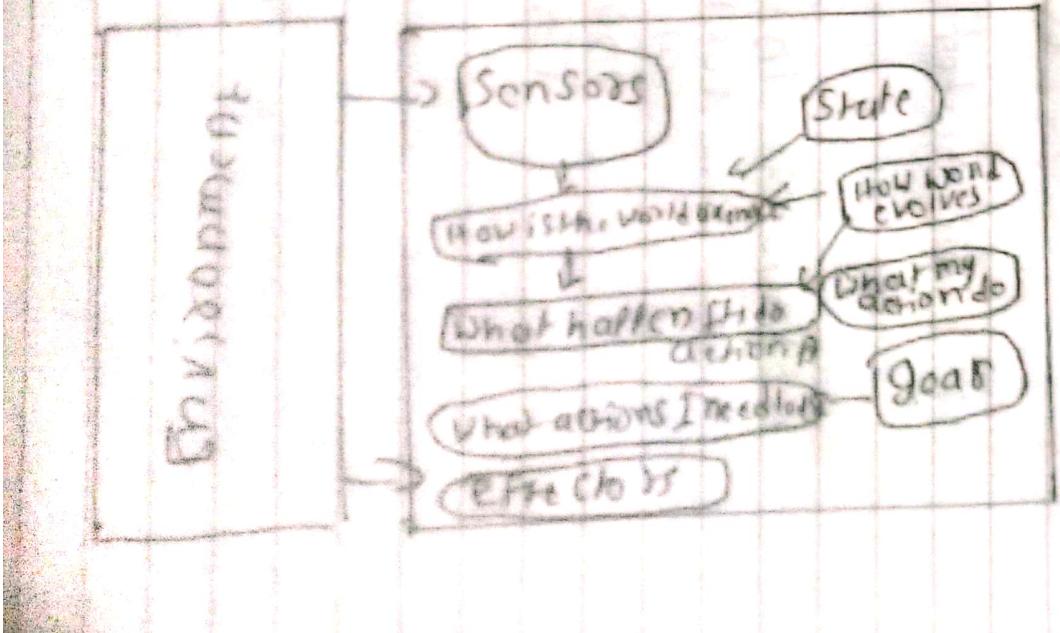
Agent structure can be viewed as a combination of Agent architecture and Agent program. Agent architecture refers to the machinery that an agent executes on whereas Agent program is an implementation of an agent function. Figure 2 shows four important types of agent architecture.



(a) Simple Reflex Agent



(b) Model based Reflex agent



As seen, simple reflex agents choose actions only based on the current percept only they are rational only if a current decision is made only on a basis of current percept. Agent environment for such agents is fully observable. Model Based Reflex Agents as shown, to use a model of the world to choose their actions. They maintain an internal state as a persistence information. Using the model means knowledge about how things happen in world that is description of unobserved aspects of audience state depending on previous history. Agents take into account how its actions affect world. Goal based agents goals approach is more flexible than reflex agent since knowledge supporting a decision is explicitly modeled thereby allowing for modification. goal is description of desirable situation.

Fig 2.0 choose actions based on a preference for each state. Goals are inadequate when there are conflicting goals, out of which only one can be achieved, goals have some uncertainty of being achieved and you need to weight likelihood against the importance of a goal. On other hand utility function objectivity map how much being in a particular state is different.

An AI agent is called a Rational Agent. A rational agent always performs right action i.e., the right action means the action that causes the agent to be most successful in his given POMDP S-LU. In POMDP the agent solves it characterized by Performance Measure, Environment, Situation, and Sensors (PEAS). These are collectively referred to as PEAS descriptors for 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 analysing 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 the environment environment is discrete; otherwise it is continuous.
- 2 Observable or Partially observable: if it is possible to determine complete state of environment at each time point from its percept.

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 it is dynamic
- 4) Deterministic or non-deterministic: if the next state of the environment is deterministic; otherwise it is non-deterministic
- 5) Episodic or sequential: In an episodic environment, each episode of events consists of the agent perceiving and then acting. Quality of its action depends just on episode itself. Subsequent episodes do not depend on action in previous episode. Episodic environments are much simpler because agent does not need to think about e.g. part picking robots. Comparatively to this is sequential memory where current action affects future action
- 6) Single agent or multiple agents: in environment may contain single agent or other agents which may be same or different kind of that of agent. These agents may be co-operating or competing with each other.

7. Accessible or inaccessible if the agent sensor apparatus can have access to complete state of environment

Working : Search intention for AI based applications in following sensors and identify who is agent for that application further list out PEs descriptions for agent environment in each of case finally try to classify task environment properties like a list of attributes from above list of task environment properties.

1. Autonomous 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 board game Go.
It was developed by DeepMind Inc.
DeepMind Lab, London

7 Applied visual assistance set

8 Endudunc : A companion for
Dementia patient

9 cosper: helping insomniacs get
through night.

10 Marvel: guarding galaxy with
comic book crossword

11 Automated cross word solver

Resources: The above diagrams are taken
from online tutorial available
at tutorials point on
topic P1 - Agent and
Environment

→ Working:

Search internet for AI based application is following scenarios and identify who is agent for that application. Further list out PEST descriptors for agent environment in each of the case. Finally try to classify for tools environment properties like a list of attributes from above list or task environment properties.

1 Deep Blue chess playing computer program.

Performance measure: Win/lose/draw, Safety of chess pieces Safety of king piece, no of moves, time for each move

Environment: chess board, chess pieces

Actuators: Desktop screen, 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 to 1966 at the man Artificial intelligence laboratory by Joseph Weizenbaum.



Performance measure: understanding user, maintaining conversations environment user, program, keyboard, user text inputs, Eliza, texts, output window

Actuators: Texts

Sensors: user texts 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 expression, response time

Environment: humans, objects

Actuators: Arm, mouth, tear, speak

Sensors: Eye (camera) ears, microphone, audio sensor

4) Apple's virtual assistant Siri

Performance measure: understanding user and speech producing by results, summarizing, response size

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 hidden and visible letters, time to solve.

Environment: hints, visible letters, crossword board.

Actuators: Desktop screens, programs

Sensor: crossword board

Task Environment Properties:

Discrete, fully observable, static,

Deterministic, Episodic, Single agent

Accessible