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TE Comps A-4

ARTIFICIAL INTELLIGENCE

EXPERIMENT 1

AIM: Select a problem statement relevant to AI .

- i)Identify the problem
- ii)PEAS Description
- iii)Problem formulation

DESCRIPTION:

Artificial intelligence is defined as the study of rational agents. A rational agent could be anything that makes decisions, as a person, firm, machine, or software. It carries out an action with the best outcome after considering past and current percepts(agent's perceptual inputs at a given instance). An AI system is composed of an agent and its environment. The agents act in their environment. The environment may contain other agents.

An agent is anything that can be viewed as :

- perceiving its environment through sensors and
- acting upon that environment through actuators

TYPES OF AGENTS:

Agents can be grouped into four classes based on their degree of perceived intelligence and capability :

- Simple Reflex Agents
- Model-Based Reflex Agents
- Goal-Based Agents
- Utility-Based Agents
- Learning Agent

TYPES OF ENVIRONMENTS:

An environment in artificial intelligence is the surrounding of the agent. The agent takes input from the environment through sensors and delivers the output to the environment through actuators. There are several types of environments:

- Fully Observable vs Partially Observable
- Deterministic vs Stochastic
- Competitive vs Collaborative
- Single-agent vs Multi-agent
- Static vs Dynamic
- Discrete vs Continuous

PART A)

Write the problem faced in each one of them

- 1) **AGENT:** Chess playing with a clock
 - a. **Performance Measure:**
 - i. Win:Lose ratio
 - ii. Speed
 - iii. Total game time
 - b. **Environment:**
 - i. Chessboard
 - ii. Clock
 - c. **Environment Type:**
 - i. Fully observable as the entire chessboard can be seen.
 - ii. Discrete as at any stage, there are a finite number of possible moves.
 - iii. Dynamic as with every move, the chessboard changes.
 - iv. Competitive as it is competing against another human/agent.
 - d. **Actuator:**
 - i. Pausing of the clock
 - ii. Movement of chess pieces
 - e. **Sensors:**
 - i. Movement arm
 - ii. Servo Motors
 - iii. Location of chess pieces using reed switches.
 - f. **Problem:**

- i. Playing a timed game human vs AI. Every piece has a fixed movement pattern and there are a fixed number of possible movements.

2) **AGENT:** Driving a car

a. Performance Measure:

- i. Speed
- ii. Time Taken
- iii. Comfort
- iv. Fuel Economy

b. Environment:

- i. Car
- ii. Road
- iii. Traffic
- iv. Signposts
- v. Potholes

c. Environment Type:

- i. Partially Observable as the agent cannot see everything at the same time and has a few blind spots
- ii. Stochastic as the environment is random
- iii. Dynamic as the environment keeps on changing.
- iv. Collaborative as all the cars have to follow proper rules so as to avoid accidents.

d. Actuator:

- i. Steering Wheel
- ii. Brake
- iii. Accelerator
- iv. Mirror
- v. Gearstick

e. Sensors:

- i. GPS
- ii. Odometer
- iii. Speedometer
- iv. Fuel tank capacity meter

f. Problem:

- i. Driving a car from point A to B. There may or may not be passengers and traffic. Road conditions can change.

3) **AGENT:** Interactive English tutor

a. Performance Measure:

- i. Language Improvement

- ii. Increase in test score
 - iii. Number of errors made per paragraph
- b. Environment:**
 - i. Classroom
 - ii. Table
 - iii. Chair
 - iv. Students
 - v. Whiteboard
 - vi. Books
- c. Environment Type:**
 - i. Deterministic as the current state determines the next action.
 - ii. Collaborative as the student and teacher have to work in accordance.
 - iii. Multi-agent as there is a student as well as a teacher agent
- d. Actuator:**
 - i. Writing on whiteboard
 - ii. Opening and reading the books
 - iii. Checking of test papers
- e. Sensors:**
 - i. Eyes
 - ii. Ears
 - iii. Books
 - iv. Test Papers
- f. Problem:**
 - i. Learning the English language from a tutor in a classroom setting with all the necessary stationary.

- 4) **AGENT:** Part picking robot
- a. Performance Measure:**
 - i. % Efficiency of the robot
 - b. Environment:**
 - i. Parts
 - ii. Conveyer belt
 - c. Environment Type:**
 - i. Collaborative as multiple agents are working together
 - ii. Dynamic as the environment keeps on changing
 - iii. Discrete as at any stage, there are only finite number of possible motions.
 - d. Actuator:**
 - i. Picking up the parts
 - ii. Sorting the parts
 - e. Sensors:**
 - i. Camera
 - ii. Robot Arm

- iii. Distance Sensor

- iv. Servo motors

f. Problem:

- i. Pick up pieces from a conveyor belt, analyse it and sort it accordingly into bins.

5) **AGENT:** Satellite Image Analysis System

a. Performance Measure:

- i. % Correct Analysis
- ii. Time taken

b. Environment:

- i. Camera

c. Environment Type:

- i. Dynamic as the environment keeps changing continuously
- ii. Discrete as the system will have a finite number of processing steps it will perform.
- iii. Multi-agent as multiple systems can collaborate to get one picture of higher quality and data analysis.
- iv. Collaborative as there is no competition and requires multiple systems to collaborate.

d. Actuator:

- i. Capturing of Images
- ii. Movement of the satellite

e. Sensors:

- i. Camera
- ii. Color Sensor

f. Problem:

- i. Take pictures from a satellite, analyse the images to get useful data from them.

6) **AGENT:** Medical Diagnosis System

a. Performance Measure:

- i. % of correct diagnosis
- ii. Time taken
- iii. Systems correctly found
- iv. Number of lawsuits
- v. Cost

b. Environment:

- i. Patient
- ii. Hospital

c. Environment Type:

- i. Deterministic as the current state defines the next actions.
- ii. Partially Observable as not everything can be observed simultaneously.

d. Actuator:

- i. Asking questions
- ii. Recommending further tests
- iii. Printing reports
- iv. Dispensing medicines

e. Sensors:

- i. Camera
- ii. Microphone
- iii. Speaker
- iv. Printer

f. Problem:

- i. Create an AI machine that can diagnose patients by asking questions, can recommend tests, print out reports and dispense medicines.

7) **AGENT:** Refinery Controller**a. Performance Measure:**

- i. % Efficiency
- ii. Speed

b. Environment:

- i. Refinery workers
- ii. Machines

c. Environment Type:

- i. Collaborative as multiple agents have to work in synchronization.
- ii. Multi-Agents as different agents have to work together.

d. Actuator:

- i. Turn on/off systems
- ii. Adjust temperatures
- iii. Adjust pressures

e. Sensors:

- i. Temperature sensor
- ii. Pressure sensor
- iii. Proximity sensor

f. Problem:

- i. Control and regulate sections of the refinery through an AI machine. The controller machine should work in tandem with the human workers.

8) **AGENT:** Poker playing**a. Performance Measure:**

- i. Rounds won
- ii. Number of correct moves

b. Environment:

- i. Cards
- ii. Humans
- c. Environment Type:**
 - i. Discrete as there exist only a finite number of moves at any time.
 - ii. Competitive as multiple agents compete to win.
- d. Actuator:**
 - i. Dealing the cards
 - ii. Playing the cards
- e. Sensors:**
 - i. Camera
 - ii. Color sensor
 - iii. Servo motor
 - iv. Movement Arm
- f. Problem:**
 - i. Have an AI controlled movement arm that deals the cards. One player is AI and the others are humans. The AI must play the game properly and try to win the game.

9) **AGENT:** Chatbot

- a. Performance Measure:**
 - i. Time taken
 - ii. Grammatical accuracy
- b. Environment:**
 - i. Chatbot
 - ii. Human
- c. Environment Type:**
 - i. Continuous as the actions cannot be numbered.
 - ii. Collaborative as it works in parallel with one or more agents.
- d. Actuator:**
 - i. Displaying the questions
 - ii. Taking responses
- e. Sensors:**
 - i. Keyboard
 - ii. Screen
- f. Problem:**
 - i. An AI robot that can interact with humans and reply to questions with human-like answers or ask human-like questions. The input and output can be in the form of text or audio.

10) **AGENT:** Soccer playing robot

- a. Performance Measure:**
 - i. Number of goals scored
 - ii. Number of goals saved

- iii. Number of penalties
- iv. Number of games won
- b. Environment:**
 - i. Soccer field
 - ii. Goal posts
 - iii. Goat net
 - iv. Humans (Other players)
- c. Environment Type:**
 - i. Continuous as the actions at a time cannot be numbered.
 - ii. Collaborative as the robot has to play alongside other agents.
- d. Actuator:**
 - i. Movement of the ball
- e. Sensors:**
 - i. Servo motors
 - ii. Proximity sensors
- f. Problem:**
 - i. The robot will play soccer alongside humans. It has to predict the moves of the players and apply the counter moves. It has to try to win by shooting goals and saving goals (if its in the position of a goalkeeper).

11) **AGENT:** Recommender system

- a. Performance Measure:**
 - i. % Efficiency
 - b. Environment:**
 - i. Dataset
 - ii. Input variables
 - c. Environment Type:**
 - i. Continuous as the results cannot be numbered.
 - ii. Competitive as it tries to increase its efficiency continuously.
 - d. Actuator:**
 - i. Creating the algorithm
 - ii. Using the algorithm
 - e. Sensors:**
 - i. Keyboard
 - ii. Screen
 - f. Problem:**
 - i. An AI bot that can make recommendations based on patterns found in past datasets.
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PART B)

Identify a suitable problem faced during the pandemic

Describe its PEAS properties

Formulate the AI problem

During the pandemic, sanitization was one of the main ways of preventing the spread of the virus. It was an important thing that needed to be done at frequent intervals. So I have written the PEAS for a robot that automates the process and itself requires no human contact. Multiple robots can work together if the room area is high and we want to reduce the time.

AGENT: Sanitization robot (Modified roomba)

- **Performance Measure:**
 - Speed
 - Battery Capacity
- **Environment:**
 - Sanitizer
 - Room
- **Environment Type:**
 - **Continuous** as the movements cannot be numbered.
 - **Partially Observable** as the robot can see/sense only specific areas at a time.
 - **Collaborative** as all agents have to work together in achieving the goal of sanitizing the room.
 - **Multi-agent** as multiple robots can work together for achieving the same task.
- **Actuator:**
 - Navigation of the robot
 - Spraying of sanitizer
- **Sensors:**
 - GPS
 - Servo motors
 - Spray pump
 - Proximity sensors
- **Problem:**

- A problem faced during the pandemic was contactless sanitization of areas.
 - A study revealed that coming in contact with the sanitization machines itself was a covid risk
 - Create a robot that will sanitize everything, will avoid crashing into humans and would require no human contact.
 - Multiple robots should be able to work together.
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