

Assignment 1.

Date _____
Page _____

Q1. Describe the four categories under which AI is classified with example?

Ans:- Basically AI categories in two main types.

1) Narrow AI-

- it is a type of AI which able to perform a dedicated task with intelligence. The most common and currently available AI is narrow AI in the world of Artificial intelligence.
Eg:- Apple siri is a good example of narrow AI.

2) General AI

- it is a type of intelligence which could perform any intellectual task with efficiency like human.
- The idea behind the general AI to make such a system which could be smarter and think like human by its own.

- AI is categories into 4 approaches:
 - 1) Think humanly
 - 2) Think rationally
 - 3) Acting humanly
 - 4) Acting rationally

1) thinking humanly

- This approach focuses on creating machines that replicate human thought processes. AI systems are designed to mimic how humans think and reason.

Eg:-

consider an AI system that diagnoses diseases by mimicking the way a doctor would think. The system uses medical knowledge, symptoms presented by the patient, and reasoning patterns similar to a human doctor to arrive at a diagnosis.

2) thinking rationally.

- This perspective emphasizes developing AI that performs logical reasoning, following formal rules of logic to make decisions and solve problems.

Eg:-

A chess-playing AI is a good example. It uses logical rules and a defined algorithm to evaluate all possible moves, considering the consequences of each, and chooses the optimal move.

3) Acting Humanly.

- This approach is about creating machines that behave like humans producing outputs indistinguishable from those of a human being in similar situations.

Eg:-

Chatbots like GPT-4 aim to simulate human conversation where you ask a question, the chatbot generates responses that are meant to mimic how a human might reply.

4) Acting Rationally.

- In this approach, AI is designed to act in a way that is the most effective or rational for achieving its goals, not necessarily in a human-like way.

Eg:-

Autonomous vehicles are designed to act rationally by making decisions based on the environment, such as avoiding obstacles, following traffic rules, and ensuring passenger safety.

Q2. Explain history of AI in details

Ans:- The history of AI dates back to ancient times, but the modern development of AI as a formal field of study began in the mid-20th century.

- Ancient and medieval times.
 - The concept of intelligent machine and automata can be traced back to ancient civilization, such as Greece and China, where inventors created mechanical devices that could mimic human actions. These early automata were often used for entertainment and religious purposes.
- Early concepts of computation.
 - In 17th century, mathematician like Blaise Pascal and Gottfried Wilhelm Leibniz developed early mechanical calculators, laying the groundwork for automated computation.

- Alan Turing and the Turing machine
 - In the 1930s and 1940s, British mathematician and computer scientist Alan Turing made significant contributions to the theory of computation.
- Dartmouth workshop (1956).
 - The term 'Artificial intelligence' was coined in 1956 at the Dartmouth workshop in New Hampshire, USA.
- Early AI research (1950s-1960s).
 - During this period, AI researchers developed rule-based systems, symbolic reasoning, and early machine learning techniques. The logic theorist (1955) and the general problem solver (1957) were among the pioneering AI programs.
- AI winter (1970-1980s)
 - Progress in AI faced significant challenges, and funding for AI research decreased. This period, often referred to as the "AI winter".

- Expert Systems (1980s)
 - Expert systems, which used symbolic reasoning and knowledge representation to solve specific problems, gained popularity.

Q3.

Ans:-

- Connectionism and Neural Networks (1980s - 1990s)
 - Research into neural networks and connectionist models, inspired by the brain's structure and function, saw a resurgence.
- AI resurgence (late 20th century)
 - The late 1990s and early 2000s saw renewed interest in AI, fueled by advances in machine learning, natural language processing and computer vision.
- Machine Learning and Big Data (21st century)
 - AI research and applications have flourished in the 21st century thanks to the availability of large datasets and advances in machine learning techniques, particularly deep learning.

Q3. Describe philosophy behind the development of AI.

Ans:- The philosophy behind the development of AI is deeply rooted in several key motivations and principles.

- Understanding intelligence.
 - one of the primary philosophical drivers behind AI is the quest to understand the nature of intelligence itself.
- Enhancement of human capability.
 - AI is often viewed as a tool to augment human abilities. The philosophy here is that AI can take over mundane, repetitive, or highly complex tasks that are difficult or time-consuming for humans, thereby freeing people to focus on more creative and strategic activities.
- Ethics and responsibility.
 - The development of AI is also shaped by ethical considerations. Philosophers and technologists debate the implications of AI on privacy

security, autonomy, and employment.

Q4

- mimicking human behavior.
 - Another philosophical aspect is the global trend to create machines that can mimic human behavior including the ability to reason, learn and even exhibit emotion.
- solving complex problems.
 - The development of AI is also driven by the philosophy of problem solving. AI is seen as a powerful tool to tackle some of the most complex challenges in various fields, from medicine to environmental science to logistics.
- The singularity and beyond.
 - Some philosophical perspectives on AI consider the possibility of achieving a 'singularity' a point where AI surpasses human intelligence.

ANS

Q4. what are the intelligent agent & describe good behavior of agent.

Ans:- Intelligent Agent.

An intelligent agent is an entity that perceives its environment through sensors, processes this information, and takes actions using actuators to achieve specific goals. These agents can be simple, such as a thermostat that adjusts the temperature based on a set value, or highly complex, like autonomous vehicles that navigate traffic or AI systems that play chess.

~~Intelligent agents are characterized by the following.~~

- 1) Autonomy
- 2) reactive behavior.
- 3) Goal-oriented behavior.
- 4) learning ability.
- 5) Adaptivity.

Good Behavior of an Agent.

The "Good Behavior" of an intelligent agent is determined by how effectively and efficiently it achieves its goals. Here are the key aspects that define the good behavior of the agent.

- Rationality:
 - A good agent should behave rationally, meaning that it should always select actions that maximize its expected performance given what it knows about environment.
- Autonomy
 - While autonomy is a characteristic of intelligent agents, good behavior requires a balance of autonomy.
- Flexibility and Adaptability.
 - A well-behaved agent should be flexible in adapting to new situations, learning from past experiences, and modifying its strategy to better achieve its goals in a dynamic environment.

Q5. What is AI? Explain Foundation of AI.

Ans:- What is AI.

Artificial Intelligence (AI) refers to the branch of computer science that aims to create machines and software capable of performing tasks that typically require human intelligence. These tasks include reasoning, learning, problem-solving, understanding natural language perception, and even exhibiting creativity. AI systems are designed to mimic human cognitive functions and can range from simple rule-based systems to complex neural networks that learn from vast amounts of data.

• AI categorized into two types.

1) Narrow AI: This type of AI is designed to perform a specific task, such as voice recognition, image classification, or recommendation systems.

2) General AI: It refers to AI that can perform any intellectual task that a human can do.

foundation of AI

The foundation of AI is built upon several key principles & disciplines.

1) Mathematics.

- AI relies heavily on mathematical concepts, particularly in areas like probability, statistics, linear algebra, calculus, and optimization.

2) Philosophy.

- AI raises important philosophical questions about the nature of intelligence, consciousness, and ethics.

3) Logic and reasoning.

- AI systems often use logic to simulate human reasoning.

4) Data & Machine learning.

- A significant foundation of modern AI is machine learning, a subset of AI that focuses on developing algorithms that allow machines to learn from and make predictions based on data.

Q6) Give the difference between simple reflex agent, utility based agent with diagram.

Ans:- • simple reflex agent

defn :- An agent that acts directly based on the current percept without considering the past or future states.

operation :- it uses a set of condition action rules to determine its action.

• utility - Based agent.

defn :- An agent that chooses action based on maximizing its expected utility.

operation :- it uses a utility function to evaluate the desirability of different states and actions.

eg :- A self-driving car that chooses the best route based on traffic conditions, fuel efficiency, and other factors.

Agent

feature

simple
reflex

utility

Q87.

1) decision-
makingBased on
current
perceptBased on
expected
utility.

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2) memory

no internal
stateMaintain
internal state.

3) learning

limited to
rule-based
learning.can learn from
experience and
adapt.

4) complexity

suitable for
simple
environmentcan handle
complex
environment.

5) flexibility

less flexible

more flexible

Q7. Draw and explain structure of agent with example.

ANS:- Structure of AI agent.

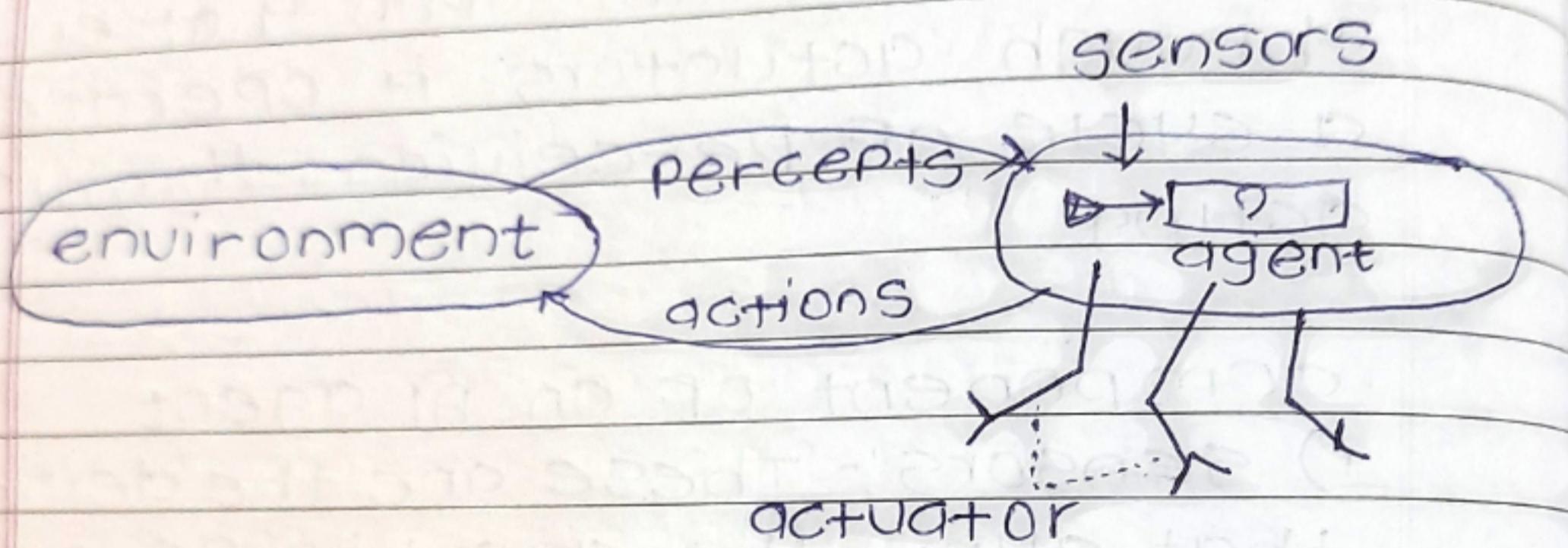
An AI agent is a system that can perceive its environment through sensors and act upon that environment through actuators. It operates on a cycle of perceiving, thinking & acting.

Component of an AI agent.

- 1) Sensors:- These are the devices that allow the agent to perceive its environment. eg- camera, microphone.
- 2) Actuators:- These are the devices that allow the agent to interact with its environment. eg- motors, speaker.
- 3) Percept:- This is the information that the agent receives from its sensors.
- 4) Agent function:- This is the mapping from percepts to actions.
- 5) Agent program:- This is the implementation of the agent function.

6) Architecture:- This is the machine on which the agent program executes.

• structural diagram.



e.g:- A self-driving car.

A self driving car is an example of an AI agent. its components include.

1) Sensors:- cameras, LiDAR, radar etc

2) Actuators:- steering wheel, accelerator, brake, } turn signals.

3) Percepts:- images from cameras, distance measurement from LiDAR and radar.

4) Agent that base and -

5) Agent implementation

6) Agent system and

4) Agent Function:- A complete algorithm that determine the car's actions based on the percepts, traffic rule, and the car's goals.

5) Agent Program :- The software that implements the agent functions.

6) Architecture:- The car's computer system, including it's hardware and software.

Q8) Explain 4 basic techniques of AI.

Ans:- 1) Machine learning.

Defn:- A subset of AI that involves training algorithms to learn from data and improve their performance over time without being explicitly programmed.

- TYPES:-
 - supervised learning
 - unsupervised learning
 - reinforcement learning.
- APPLICATION:- Image recognition, natural language processing.

2) Neural Network.

Defn:- A computational model inspired by the human brain, consisting of interconnected nodes that process information.

- TYPES:-
 - Artificial Neural Networks.
 - convolutional Neural Network
 - Recurrent Neural Network.
- APPLICATION:- Image recognition, natural language processing,

3) Expert Systems.

Defn:- AI systems that mimic the decision making abilities of human experts in a specific domain.

- components:
 - 1) Knowledge base :- contain facts & rules.
 - 2) Inference engine:- applies rules to deduce conclusion.
- Application:- medical diagnosis, financial analysis.

4) Genetic Algorithm.

Defn:- Optimization algorithms inspired by the process of natural selection.

- process:-
 - 1) Initialization.
 - 2) Evaluation.
 - 3) Selection.
 - 4) crossover.
 - 5) Mutation.
- Application:- optimization problems, design, engineering.

Q9) write a short note on concept of rationality in AI.

Ans:- Rationality of AI

Rationality in AI refers to the ability of an AI agent to make decisions that are consistent with its goals and beliefs. A rational agent is one that chooses actions that maximize its expected utility, given its knowledge of the world.

Key aspects of rationality in AI.

- Goal-directedness :- Agents should have clearly defined goals that they strive to achieve.
- Belief formation :- Agents should form beliefs about the world based on their observation and prior knowledge.
- Decision-making :- Agents should choose actions that are expected to lead to the achievement of their goals, given their beliefs.

- learning :- Agents should be able to learn from their experience and update their beliefs accordingly.
- challenges in achieving rationality:
 - 1) uncertainty :- The real world is often uncertain, and AI agents may not have complete or accurate information.
 - 2) complexity :- The decision making process can be complex, especially in large-scale environments.
 - 3) computational limitation : AI agents may have limited computer resources, which can constrain their ability to reason and act rationally.

- Q10) Difference between
1) Artificial intelligence
2) Machine learning
3) Deep learning.

Ans:- 1) Artificial Intelligence (AI) is the broader concept of creating intelligent agent that can reason, learn, and solve problems. In essence, AI aims to simulate human intelligence in machines.

2) Machine learning (ML) is a subset of AI that focuses on algorithms that allow computers to learn from data and improve their performance over time. ML models can identify patterns, make predictions, and automate tasks without being explicitly programmed.

3) Deep learning (DL) is a subset of ML that uses artificial neural networks with multiple layers to learn complex patterns from data. DL models are particularly effective at tasks involving large amounts of data, such as image recognition, natural language processing, and speech recognition.

Feature	AI	ML	DL
SCOPE	Broad concept of intelligent agent	Algorithm for learning from data.	specific type of ML using neural network.
FOCUS	Simulating human intelligence	learning from Data.	learning complete patterns.
Technique	Diverse (e.g.- rule based systems.)	various algorithms (e.g-regression)	Deep neural network.
APPLICATION	wide ranging (robotics)	various (recommendation systems)	primarily focused on tasks involving large amount of data.