24/08/2025

UNIT - 1

ADVANCE ARTIFICIAL INTELLIGENCE

Q. Describe AI with its applications.

Ans. Artificial Intelligence is an branch of computer science that focuse on creating systems capable of performing tasks that normally require human intelligence. These tasks include learning, reasoning problem-solving, perception, language understanding & Decision making. AI uses algorithm, data, and computational models to simulate human cognitive abilities and improve their performance over time through experience and learning.

KEY FEATURES OF AI:

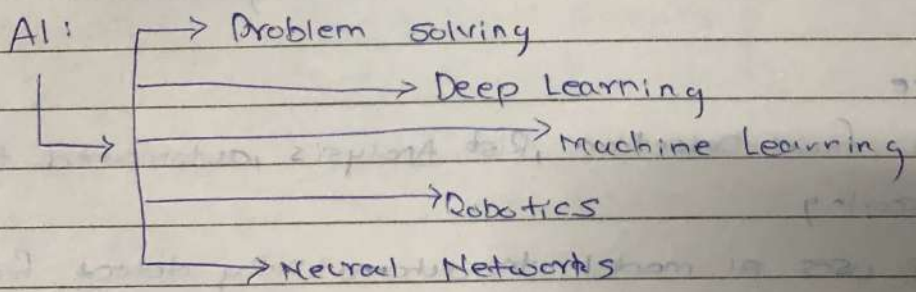
(i) Automation: Reduces human effort by automating tasks

(ii) Adaptability: Learns and improves from data

(iii) Problem Solving: Provides solutions where solutions where human decision making may be complex

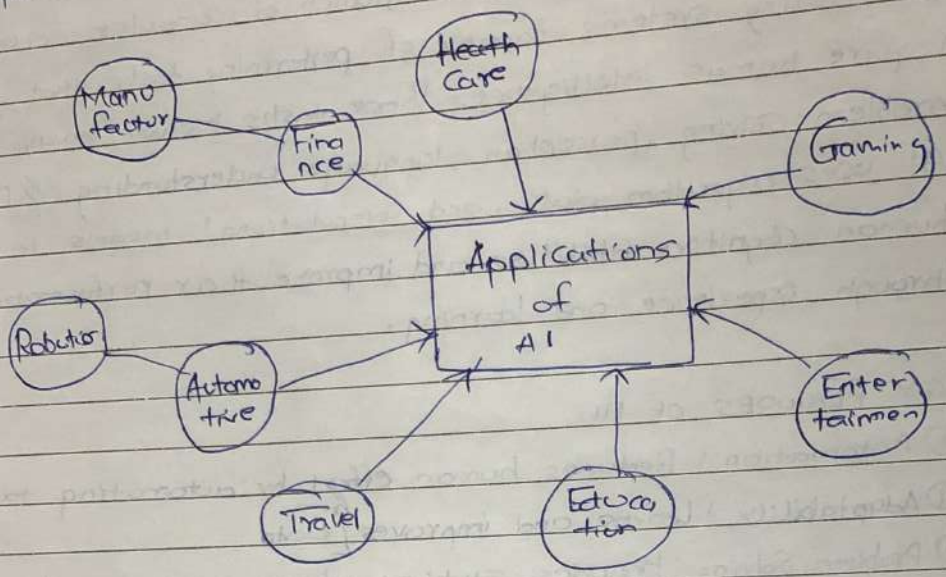
(iv) Scalability: Works with large volume of data efficiently.

FUNDAMENTALS OF AI.



Fundamentals of AI cover core such as problem-solving, techniques, ML, DL, NL & Robotics. These elements enable machines to analyze data and interact with physical world. Together, they form the foundation for building smart system that mimic human intelligence.

Applications of AI



① Healthcare.

AI Assits in disease diagnosis, drug discovery, medical imaging and personalized treatement.

Ex: Detecting cancer from X-RAYs using AI Models

② Finance

Used for fraud Detection, Risk Analysis, automated trading and credit scoring

Ex: Banks uses AI model to automatically detect fraud transac

③ Transportation

Powers self-driving cars, smart traffic system and rate optimiza

Ex: Tesla Autopilot, Google waymo.

(iv) Education

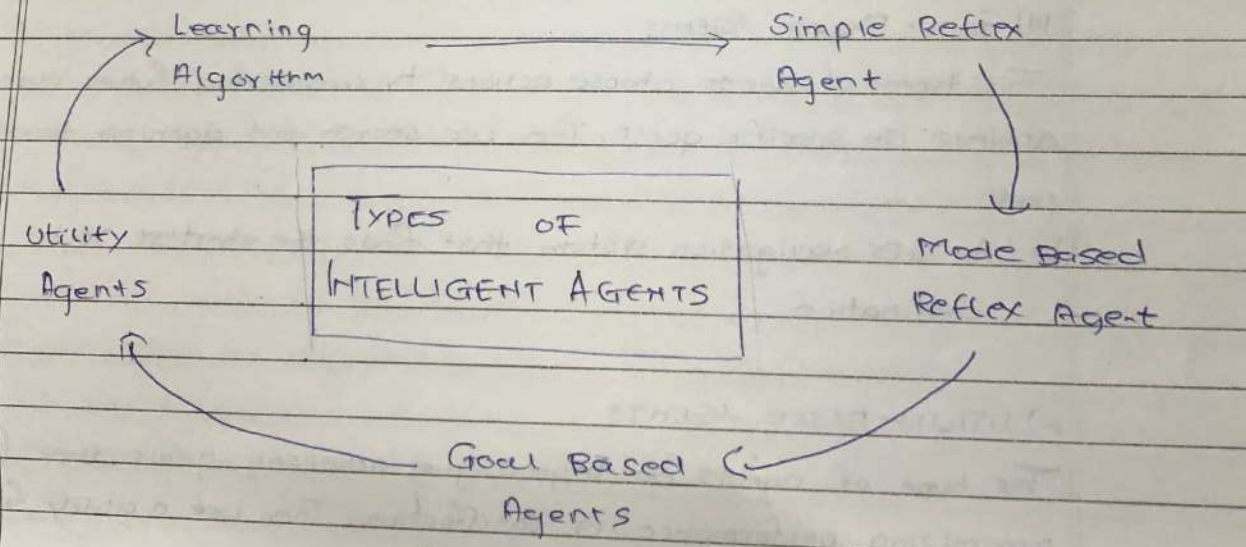
Personalized learning platforms, grading system & AI tutors.

(v) Business & Customer Service

AI chatbots and virtual Agent improve customer experiences

Q. Intelligent Agents & it's Types with Diagram.

Ans An Intelligent Agent (IA) is an autonomous entity in AI that percieves the environment through sensors and acts upon the environment using actuators to achieve specific goals.
It can make decisions, learn from experience and act rationally to maximize performance.



In Artifical Intelligence, intelligent agents are classified into five main types.

I) SIMPLE REFLEX AGENT:

This type of agents act only on the basis of the current situation without considering past data. They follow an condition-action rule, like if "condition, then action.

Ex: A thermostat that turns on the heater if the temperature

II) MODEL-BASED REFLEX AGENTS.

This type of agents maintain an internal state to keep track of past percepts and changes in the environment. This helps them work in partially observable environments.

For Ex: A self-driving car remembers the location of nearby vehicles even when they are temporarily out of sight

III) GOAL-BASED AGENTS

This types of agents choose actions by considering future outcomes to achieve an specific goals. They use search and planning to decide best path.

Ex: An GPS Navigation system that finds the shortest route to a destination

IV) UTILITY-BASED AGENTS.

This type of agents go beyond just acheiving goals, they focus on maximizing performance or satisfaction. They use a utility function to evaluate the best possible outcome

Ex: An online shopping recommendation system, suggests products not only relevant to search but almost also most useful for the customers.

v) LEARNING AGENTS:

This type of agents have ability to learn from experience and improve over time. They consist of learning element that updates knowledge and a performance elements that makes good decisions.

Ex: An Voice Assistant like Alexa or Siri, which improves its responses as more user interacts with it.

Each type of intelligent agent increases in complexity - from simple reflex agents that act on present inputs to learning agents that adapt and improve performance over time, making AI system more powerfull & intelligent.

Q. Explain Problem Solving Agents.

ANS: A problem-solving agent in AI is an type of intelligent agent that decides it's action by formulating and solving problems. Instead of reacting instantly, it uses search strategies to find sequences of actions that will lead to it from initial state to its goal state.

STEPS OF PROB-SOLVING AGENT:

① Formulate the Problem

The agent identifies following thing.

i) intial state (where it starts)

ii) the possible actions (what it can do)

iii) the goal state (What it wants to achieve)

iv) the path cost (measure of efficiency like time, distance or money)

② Search For Solutions - The agent explores different paths from the initial state to the goal state using search algo's like BFS, DFS & A*

(iii) Executing the Solution

Once the best sequence of action is found, the agent carries them out in the real world to achieve goal.

Ex:

① ROUTE PLANNING

Using Google Maps, Imagine you want to travel from Mumbai to Pune

- Initial State → You're in Mumbai
- Goal State → You ~~can take dif~~ want to Reach in Pune
- Action → You can take different roads or highways
- Path cost → Distance, time, toll charges or fuel usages.

The problem solving agent (Google MAPS) will check all the best possible routes (like Mumbai → Lonavla → Pune) or (Mumbai → Expressway → Pune). It then searches for the shortest or fastest route an suggests the best option

In Summary we can say that an Problem Solving Intelligent agent in AI that formulates problems, searches for solutions and executes action to reach an specific goals. Instead of just reacting to inputs, it plans ahead by considering future actions & outcomes.

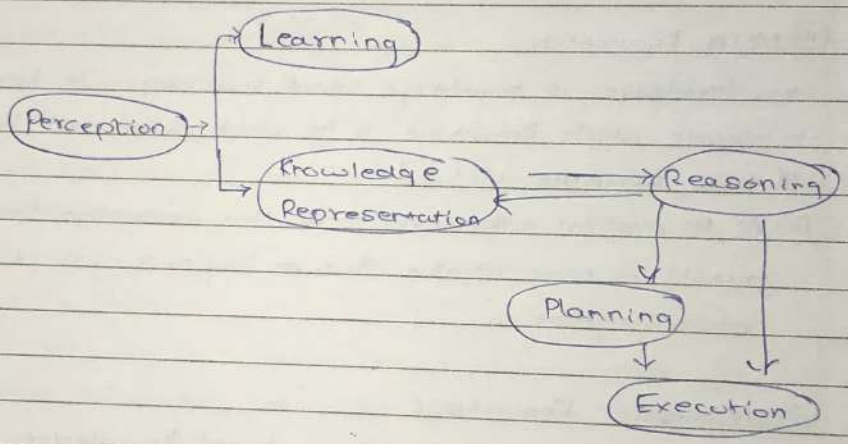
WHY IS IT USED

① Enable Goal-oriented Decision making
② Can Handle complex and dynamic environments
③ Provide systematic search for best solutions
④ Useful in Real-world examples
⑤ make AI systems more flexible & intelligent

Q. Concept of Knowledge Representation in AI.

ANS: Knowledge Representation (KR) in AI, is an method of storing, organizing and structuring information so that a computer system can understand, reason and use it to solve problems intelligently. In simple words, it is about how knowledge is represented inside a machine so that the AI system can think like humans.

Ex: Just like humans use language, diagrams and symbols to represent knowledge, AI uses logic, rules, semantic networks, and frames.



* TYPES OF KNOWLEDGE IN AI.

① DECLARATIVE KNOWLEDGE:

Delarative knowledge refers to the knowledge of facts and information about the world. It answers "what is true" rather than "how to do something". It is stored as simple statements, facts and information in AI system. This knowledge does not involves steps or processes it only tells what the system what exists or what is correct.

Ex: "Paris is the capital of France" or "Water boils at 100°C". In AI, if you ask what is capital of France? the system retrieves this fact and answers correctly.

(ii) PROCEDURAL KNOWLEDGE

It is the knowledge of how to perform tasks or processes. It answers "how to do something". This ~~type~~ of knowledge is stored as rules methods, or sequences of actions. AI uses it to perform specific tasks step by step.

Ex: knowing the steps to solve an quadratic equation or instructions a robot follows to pick up and place an object. In AI algorith for sorting a list or pathfinding a maze are procedural knowledge

(iii) META KNOWLEDGE

Meta-knowledge is knowledge about knowledge. It helps AI system to decide which knowledge to be used, when and how to use, & HOW RELIABLE IT IS?:

Ex: An AI medical system may know that information from peer-reviewed journals is more reliable than an blog post, so it prefers that while diagnosing.

(iv) HEURISTIC KNOWLEDGE:

Heuristic knowledge is experience based knowledge or rules of thumb that helps AI to solve problems faster ~~than~~ when exact methods are not practical. Heuristic provides "shortcuts" or "educated guess". They don't garauntee the perfect answer, but they give efficient and near correct solution.

Declarative → what is true, Procedural → How to do (steps)
META → knowledge about knowledge, Heuristice → Rule & Experi.

There are some knowledge based Representation that are used to achieve the goal.

Q. Explain with example, How Reasoning works in knowledge Representation

Ans. In Artificial Intelligence, knowledge is stored as in forms like logic, rules, frames or semantic networks. However just storing the knowledge is not enough, the system must also reason it to answer questions and make decisions. This is done by the inference engine which applies logical steps to connect facts and rules. Without Reasoning, an AI would just be an storage system and not a decision making system. The working of reasoning begins with the knowledge base, which contains facts (specific information) and rule (general information/knowledge or condition).

Reasoning can be of different types.

(i) DEDUCTIVE REAS:

DR moves from general rules to specific conclusions such as "All humans are mortal" + "Socrate is an human" → "Socrates is mortal"

(ii) INDUCTIVE REAS:

IR moves from specific observations to general rules, Ex: "if the sun has risen every day so far, the system infers that "The sun rises every day"

(iii) ABDUCTIVE REAS:

AR tries to find the best possible explanation for an observation

Ex: "The grass is wet" → "probab it would rained last night"

Another way reasoning works through is production Rules (IF-THEN) Statements. Ex: If an patient has Fever and cough, THEN the system concludes the patient may have flu.

Finally, the new knowledge generated through reasoning is used for decision-making and actions. In expert systems, reasoning helps in medical diagnosis. In conclusion reasoning in knowledge Representation is the key step that connects the stored knowledge with intelligent agent action. By combining facts & Rules, applying inference and generated new knowledge, reasoning enables AI systems to act intelligently, make decision and solve problem just like or better than humans.

The Flow can be Represented As :