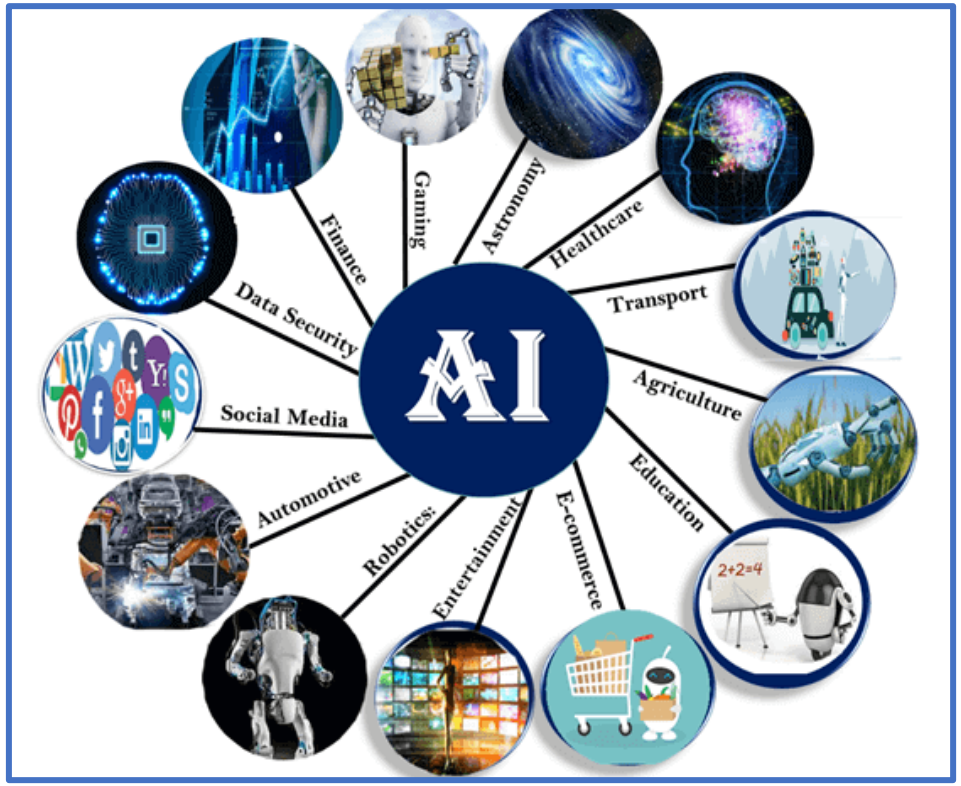
Artificial Intelligence is composed of two words Artificial and Intelligence, where Artificial defines "man-made," and intelligence defines "thinking power", hence AI means "a man-made thinking power."

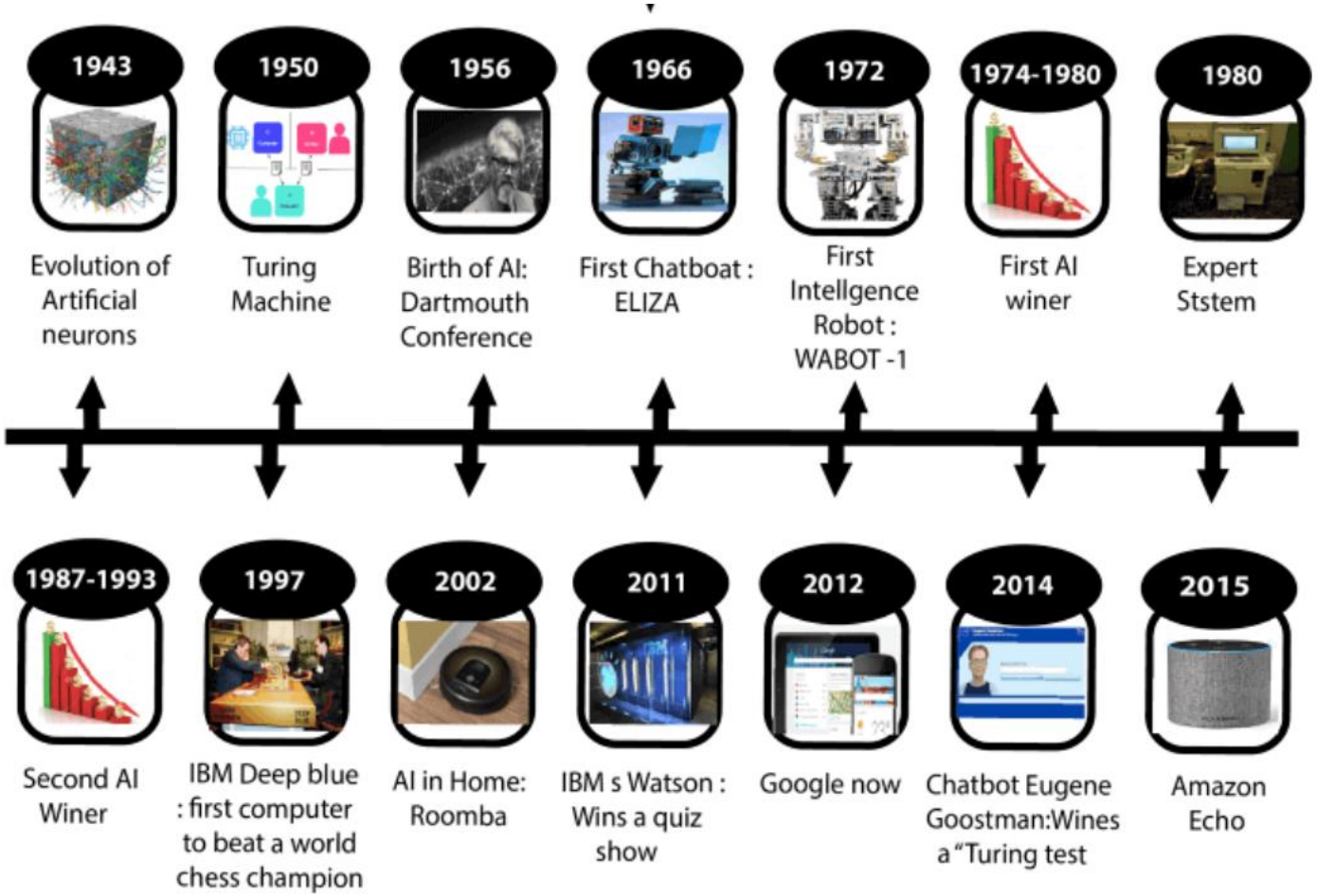


Application of AI

Year 1956

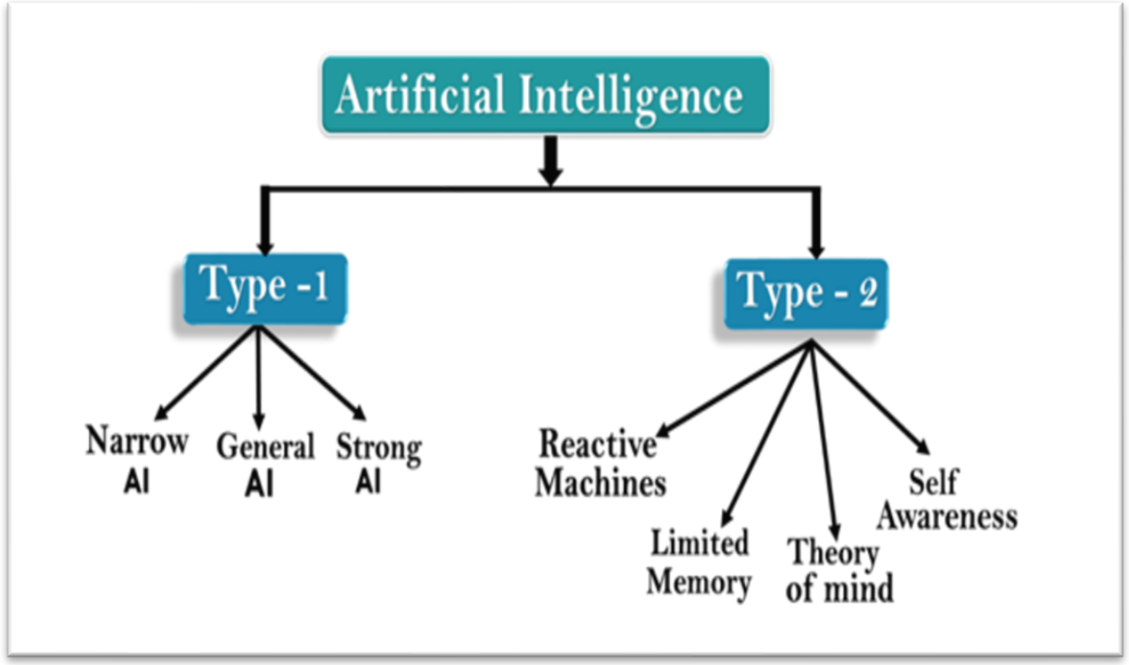
first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field.

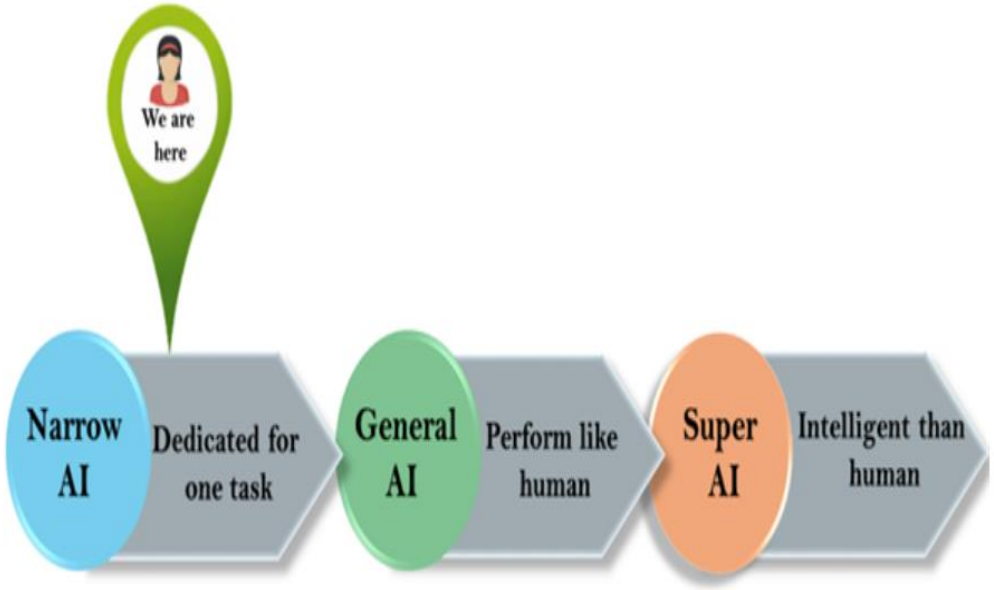
History of Artificial Intelligence



Types of Artificial Intelligence

Artificial Intelligence can be divided in various types, there are mainly two types of main categorization which are based on capabilities and based on functionally of AI. Following is flow diagram which explain the types of AI.





Narrow or Weak AI

Narrow AI cannot perform beyond its field or limitations, as it is only trained for one specific task. Hence it is also termed as weak AI. Narrow AI can fail in unpredictable ways if it goes beyond its limits.

Some Examples of Narrow AI are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition.

General AI

- General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.

- Currently, there is no such system exist which could come under general AI and can perform any task as perfect as a human.

Super AI

Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties. It is an outcome of general AI.

Some key characteristics of strong AI include capability include the ability to think, to reason,solve the puzzle, make judgments, plan, learn, and communicate by its own.

Advantages of Artificial Intelligence

Following are some main advantages of Artificial Intelligence:

High Accuracy with less errors: AI machines or systems are prone to less errors and high accuracy as it takes decisions as per pre-experience or information.

High-Speed: AI systems can be of very high-speed and fast-decision making, because of that AI systems can beat a chess champion in the Chess game.

High reliability: AI machines are highly reliable and can perform the same action multiple times with high accuracy.

Useful for risky areas: AI machines can be helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.

Digital Assistant: AI can be very useful to provide digital assistant to the users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirement.

Useful as a public utility: AI can be very useful for public utilities such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.

Disadvantages of Artificial Intelligence

Every technology has some disadvantages, and the same goes for Artificial intelligence. Being so advantageous technology still, it has some disadvantages which we need to keep in our mind while creating an AI system. Following are the disadvantages of AI:

High Cost: The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.

Can't think out of the box: Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.

No feelings and emotions: AI machines can be an outstanding performer, but still it does not have the feeling so it cannot make any kind of emotional attachment with human, and may sometime be harmful for users if the proper care is not taken.

•**Increase dependency on machines:** With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.

•**No Original Creativity:** As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

Goals of Artificial Intelligence

Following are the main goals of Artificial Intelligence:

Replicate human intelligence
Solve Knowledge-intensive tasks
An intelligent connection of perception and action
Building a machine which can perform tasks that requires human intelligence such as:

- **Proving a theorem**
- **Playing chess**
- **Plan some surgical operation**
- **Driving a car in traffic**

What is an Agent?

An agent can be anything that perceiveits environment through sensors and act upon that environment through actuators. An Agent runs in the cycle of perceiving, thinking, and acting. An agent can be:

Human-Agent: A human agent has eyes, ears, and other organs which work for sensors and hand, legs, vocal tract work for actuators.

Robotic Agent: A robotic agent can have cameras, infrared range finder, NLP for sensors and various motors for actuators.

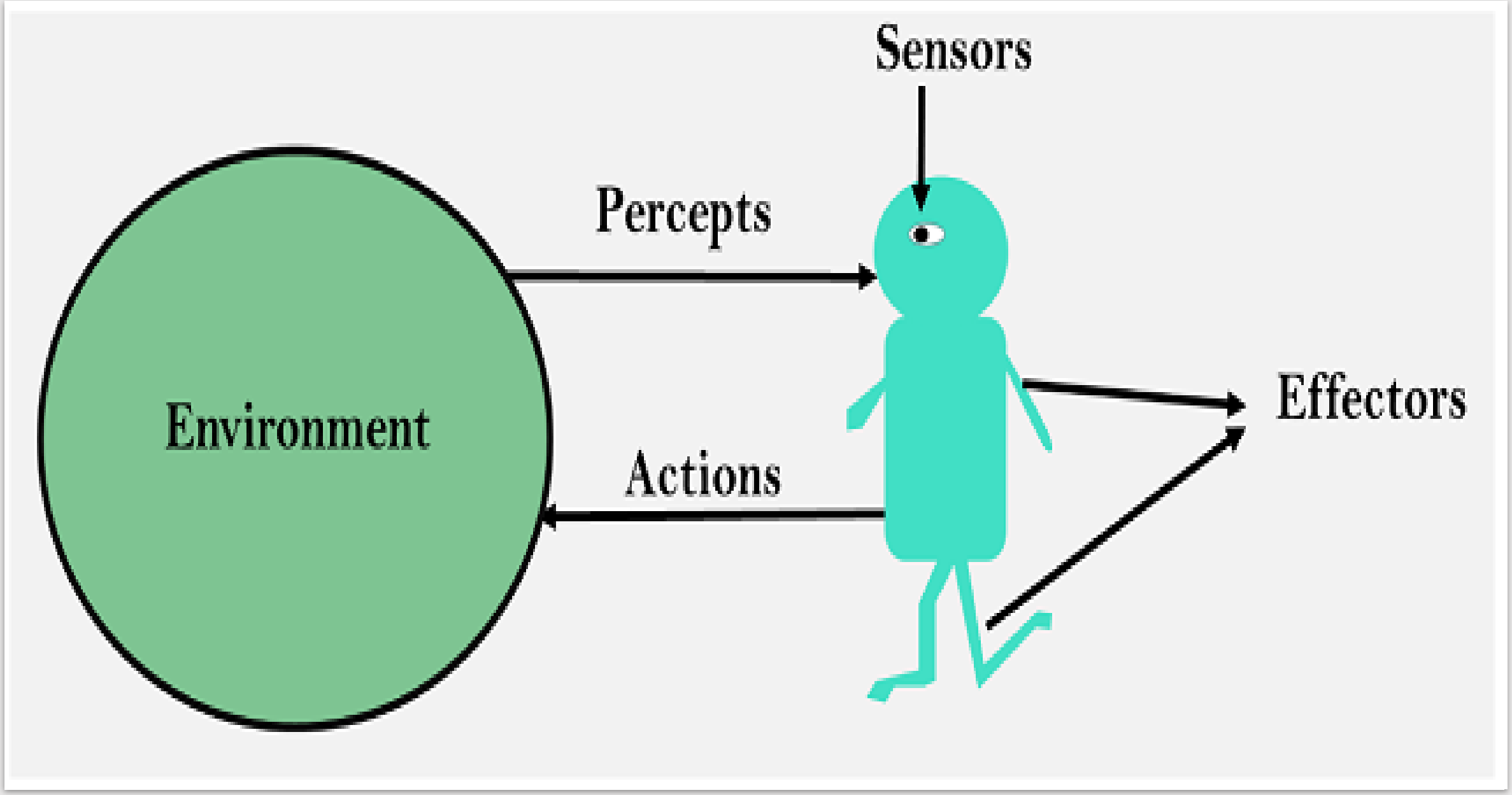
Software Agent: Software agent can have keystrokes, file contents as sensory input and act on those inputs and display output on the scree

Hence the world around us is full of agents such as thermostat, cellphone, camera, and even we are also agents.
Before moving forward, we should first know about sensors, effectors, and actuators.

Sensor: Sensor is a device which detects the change in the environment and sends the information to other electronic devices. An agent observes its environment through sensors.

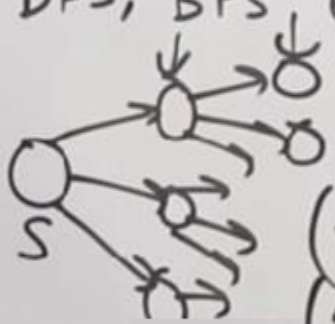
Actuators: Actuators are the component of machines that converts energy into motion. The actuators are only responsible for moving and controlling a system. An actuator can be an electric motor, gears, rails, etc.

Effectors: Effectors are the devices which affect the environment. Effectors can be legs, wheels, arms, fingers, wings, fins, and display screen.


Sensors
Percepts
Environment
Actions
Effectors

Uninformed Searching

1) Search without Information
2) No knowledge
3) Time Consuming
4) More Complexity (Time, Space)
5) DFS, BFS, etc.

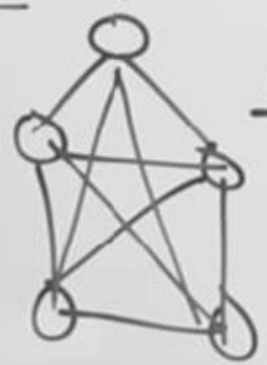


TSP

$(n-1)!$

$(5-1)!$

$4! = 24$



NP

b^d

24

(b^d)

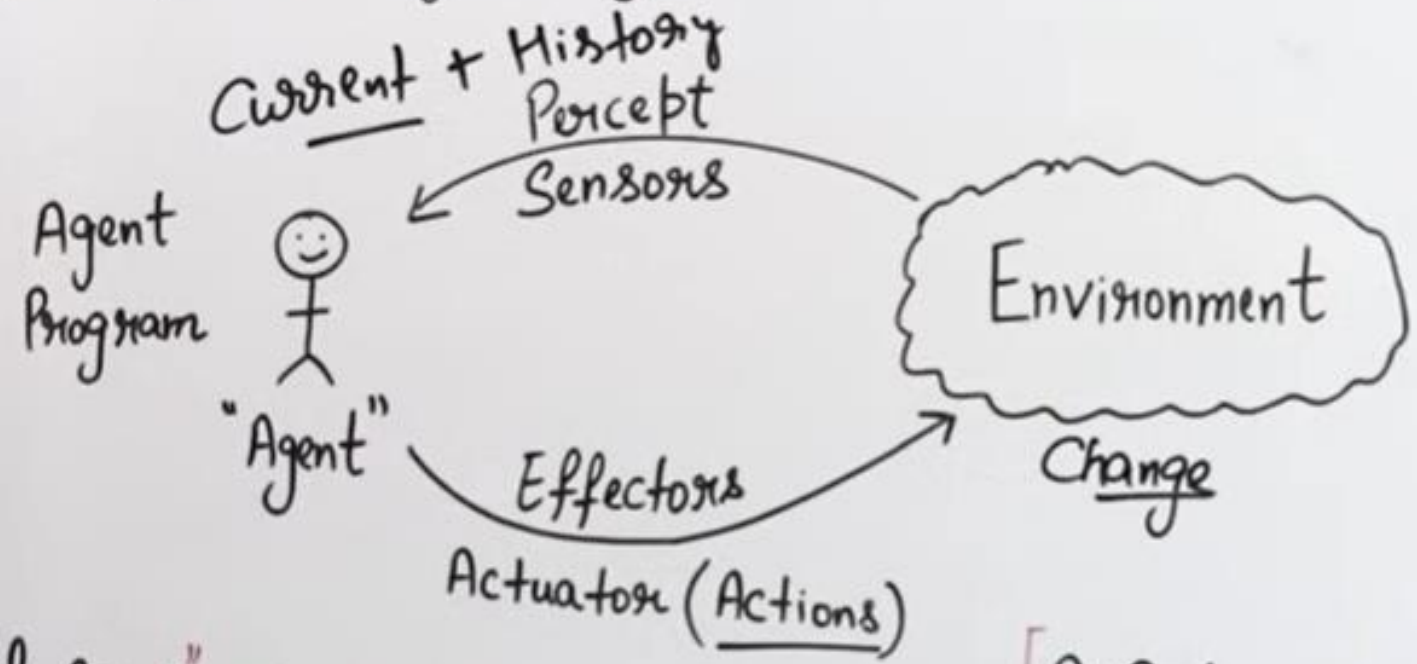
Informed Searching

1) Search with information
2) Use knowledge to find steps to solution
3) Quick solution
4) Less Complexity (Time, Space)
5) (A*) Heuristic DFS, Best first Search

Heuristic $h(n)$

Optimality

Agents / Intelligent Agents



"Types"

1) Simple Reflex Agents
2) Model Based Reflex
3) Goal Based Agents
4) Utility-Based Agents
5) Learning Agents

"Goals of Agent" → High Performance
Optimized Result
Rational Action
Right

P: Performance
E: Environment
A: Actions
S: Sensors

Agent → Percept → Decision → Actions

"Simple Reflex Agents"

→ ✓ Act only on the basis of current perception

→ ✓ Ignore the rest of percept history

→ Based on If - Then Rules

→ Environment should be fully observable.
Partially "

if temp > 45°
then Switch on AC
if Room is not empty

1. Simple Reflex agent:

The Simple reflex agents are the simplest agents. These agents take decisions on the basis of the current percepts and ignore the rest of the percept history.

These agents only succeed in the fully observable environment.

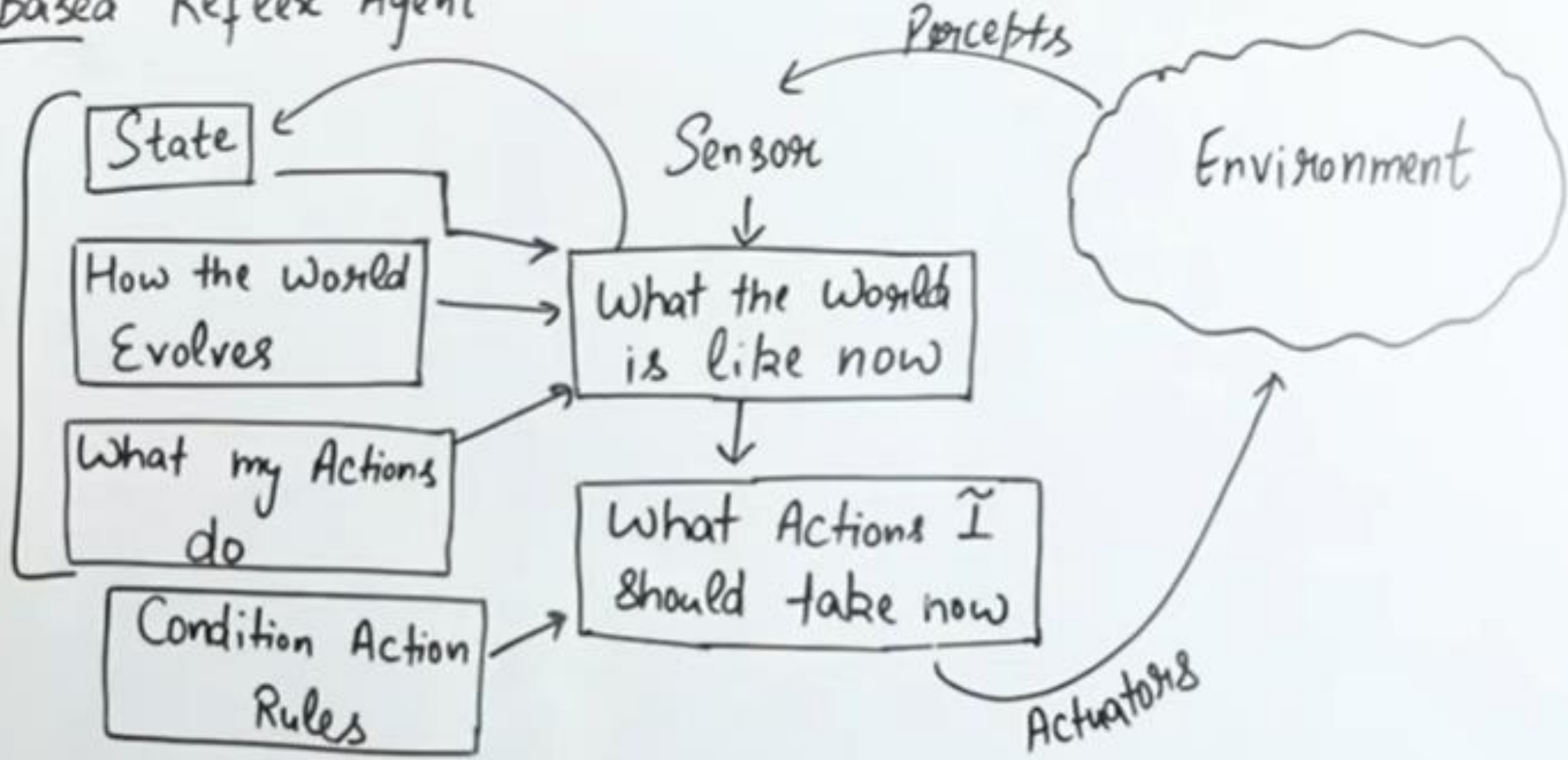
The Simple reflex agent does not consider any part of percepts history during their decision and action process.
The Simple reflex agent works on Condition-action rule, which means it maps the current state to action.

Such as a Room Cleaner agent, it works only if there is dirt in the room.

Problems for the simple reflex agent design approach:

They have very limited intelligence
They do not have knowledge of non-perceptual parts of the current state
Not adaptive to changes in the environment.

"Model Based Reflex Agent"



Partially observable Environment

Store Percept History (Internal Model)

2. Model-based reflex agent

The Model-based agent can work in a partially observable environment and track the situation.

A model-based agent has two important factors:

Model: It is knowledge about "how things happen in the world," so it is called a Model-based agent.

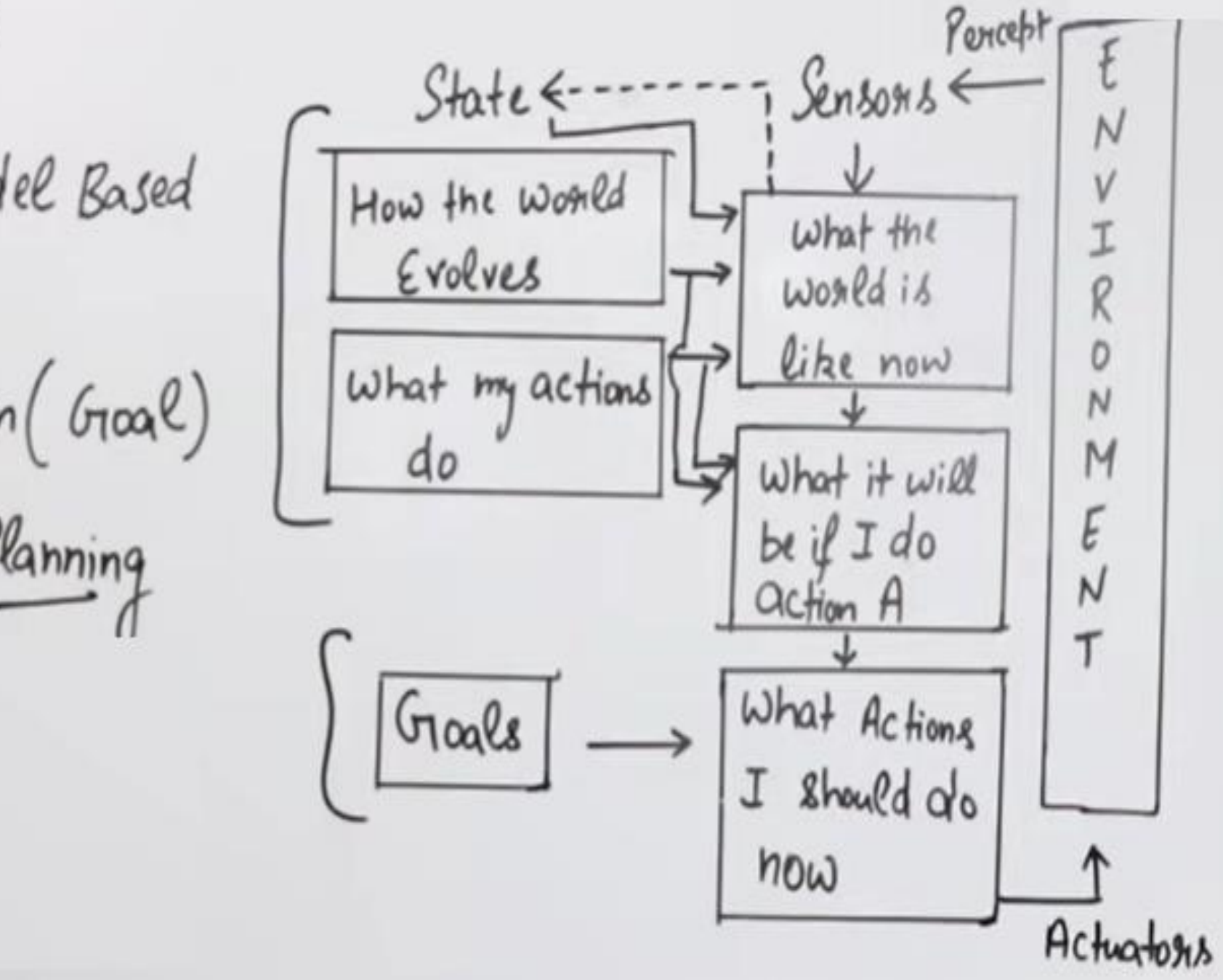
Internal State: It is a representation of the current state based on percept history.

Goal Based Agents

→ Expansion of Model Based Reflex Agents

→ Desirable Situation (Goal)

→ Searching and Planning



3. Goal-based agents

The knowledge of the current state environment is not always sufficient to decide for an agent to what to do.

The agent needs to know its goal which describes desirable situations.

Goal-based agents expand the capabilities of the model-based agent by having the "goal" information.

They choose an action, so that they can achieve the goal.

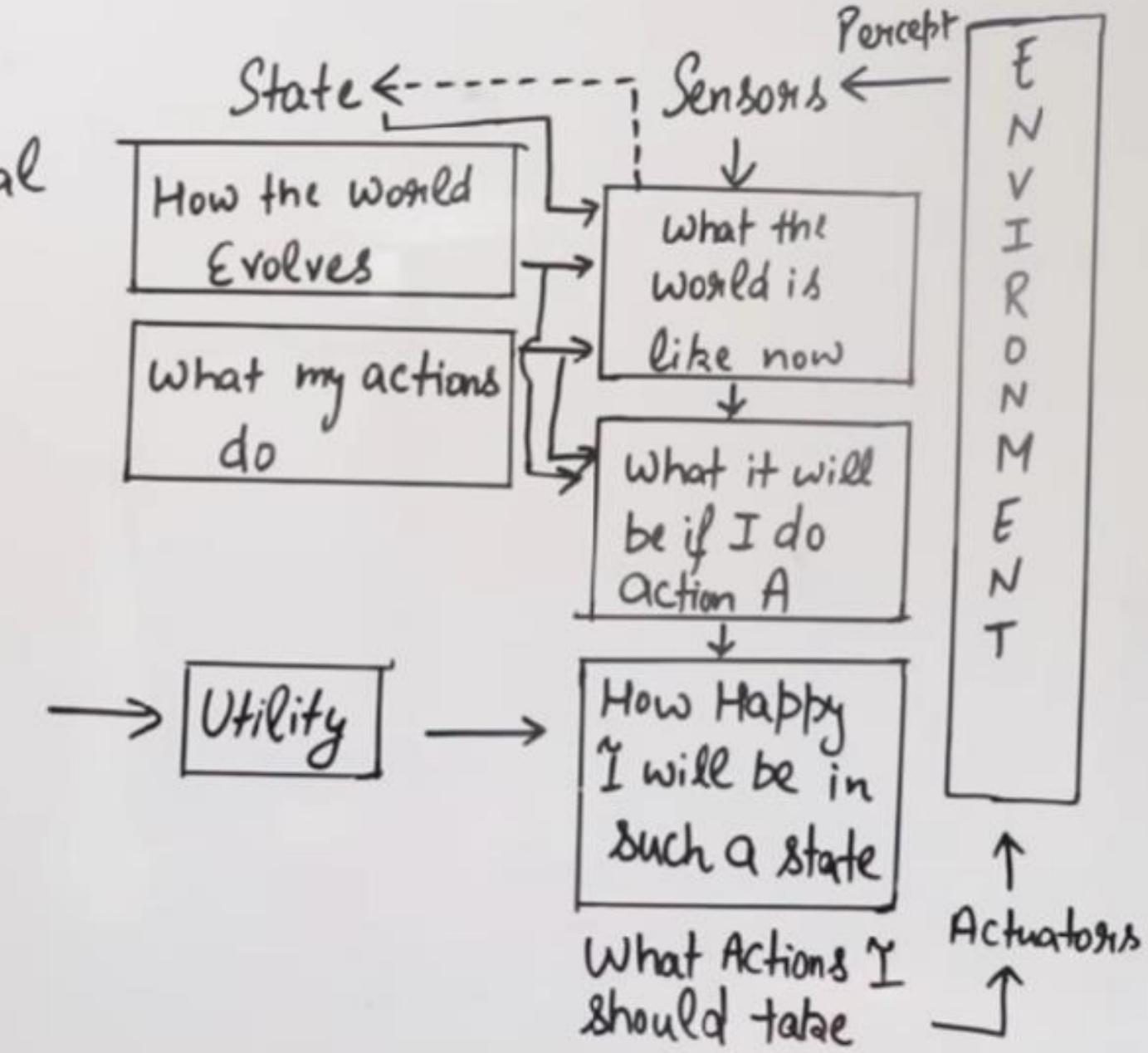
These agents may have to consider a long sequence of possible actions before deciding whether the goal is achieved or not. Such considerations of different scenario are called searching and planning, which makes an agent proactive.

Utility Based Agents

→ Focus on Utility not goal

→ Utility function

→ Deals with Happy and unhappy



Utility-based agents

•These agents are similar to the goal-based agent but provide an extra component of utility measurement which makes them different by providing a measure of success at a given state.

•Utility-based agent act based not only goals but also the best way to achieve the goal.

•The Utility-based agent is useful when there are multiple possible alternatives, and an agent has to choose in order to perform the best action.

•The utility function maps each state to a real number to check how efficiently each action achieves the goals.

Artificial Intelligence:- AI is the study of How to make computer do things which people do better. [machine + human Intelligence]

↳ AI Can Cause a machine to work as human.

↳ AI → Artificial [Man-Made]
→ Intelligence [Power of thinking]

GOALS OF AI: i) Replication of Human Intelligence.
ii) Solving problems - that require Knowledge.
iii) Building a machine that Can do human Intelligence task. [CHESS, Proving theorem, automated car driving ...]

Reasons of Boost in AI:

↳ i) S/w or device Can be made to solve Real-time Problems.
ii) Creation of Virtual assistant [SIRI, CORTANA]
iii) Robots development. [Helps in dangerous env. cond^n]
iv) New JOB opportunities.

Applications of AI:-

(1) AI in Gaming: Chess, Poker, tic-toe.
↳ machine can think large no. of moves.

(2) AI in NLP: Natural lang. Processing
↳ Machine can understand human lang.

(3) AI in HealthCare: Fast diagonsis
↳ Robotic Surgery.

(4) AI in Finance: Adaptive Intelligence.
↳ automatic chatbots, algorithm trading.

(5) AI in Data Security: Helps in making data/appln more secure.
↳ AEG bot, AI2

(6) Expert System: Integration of s/w machine and special infon to provide reasoning & advise.

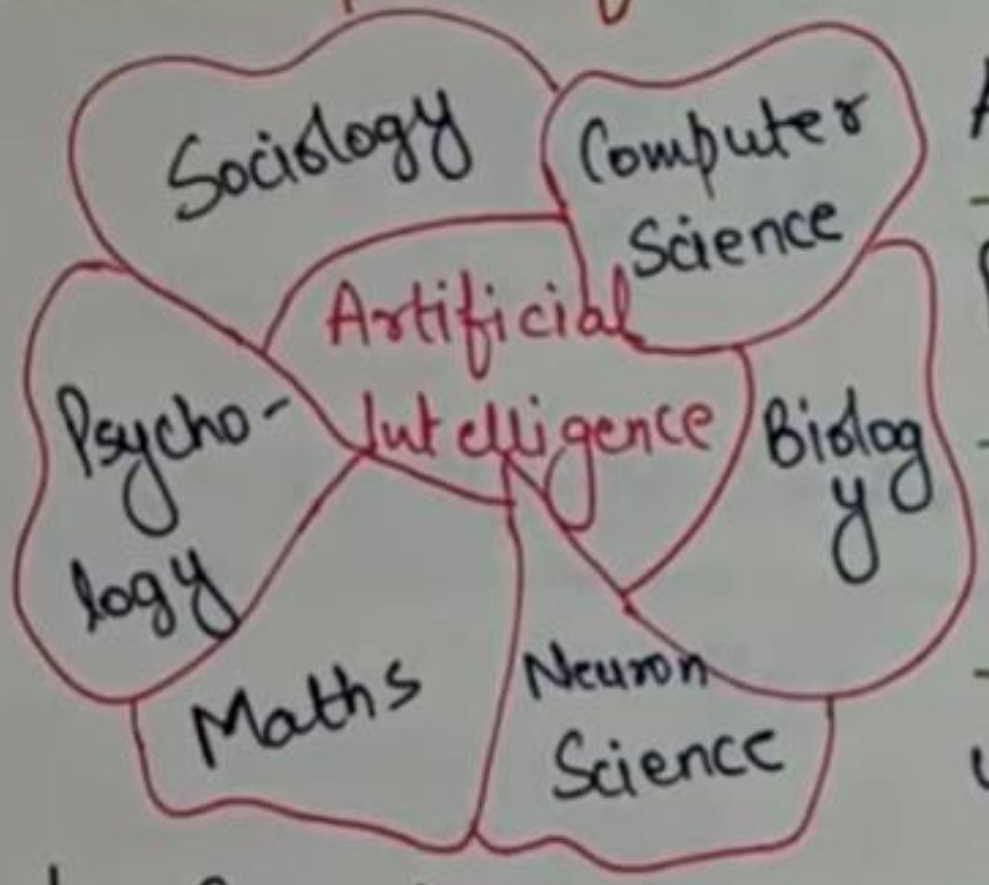
(7) Computer Vision: Understand the visual automatically by machine.

(8) Speech Recognition: Extract the meaning of sentence by human talk. [slang removal, noise rem.]

(9) Robotics:
Talk and behave like humans.
↳ Erica and Sophia.

(10) AI in e-Commerce: Automatic recomendation of

AI is Comprised of :-



- ↳ Reasoning
- ↳ Learning
- ↳ Problem solving
- ↳ Language Understanding.

Advantages of AI	Disadvantages of AI
Accuracy ↑ & Error ↓	COST ↑
Fast Decision Making.	Can't thing beyond th limits.
Reliability is more	No feeling & emtions
usefulness in Risky Area.	more dependency on machines ↑.
Digital Assistant	No original thinking

Classification of AI:-

Narrow AI

WEAK AI: Able to perform dedicated task with Intelligence. [Not concerned with How]

↳ Can't perform beyond its field or limitations.

↳ Example:-
- Flying machine using logics
- Apple SIRI
- Playing chess

Evolutionary AI: It is the study and design of machines that simulate simple creatures and attempt to evolve.

↳ Example: Ants, Bees etc.

Strong AI: It is the study and design of machines that simulate human mind to perform intelligent tasks.

↳ i) Borrowing ideas from psychology and neuroscience

↳ ii) Forgetting things, Genetics, Language.

Super AI:- Hypothetical Concept.

machine > Human.

[machine ⟷ machine]