ARTIFICIAL INTELLIGENCE
UNIT-1ST

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Artificial Intelligence

AI= Artificial +Intelligence

Artificial means –non natural/simulated

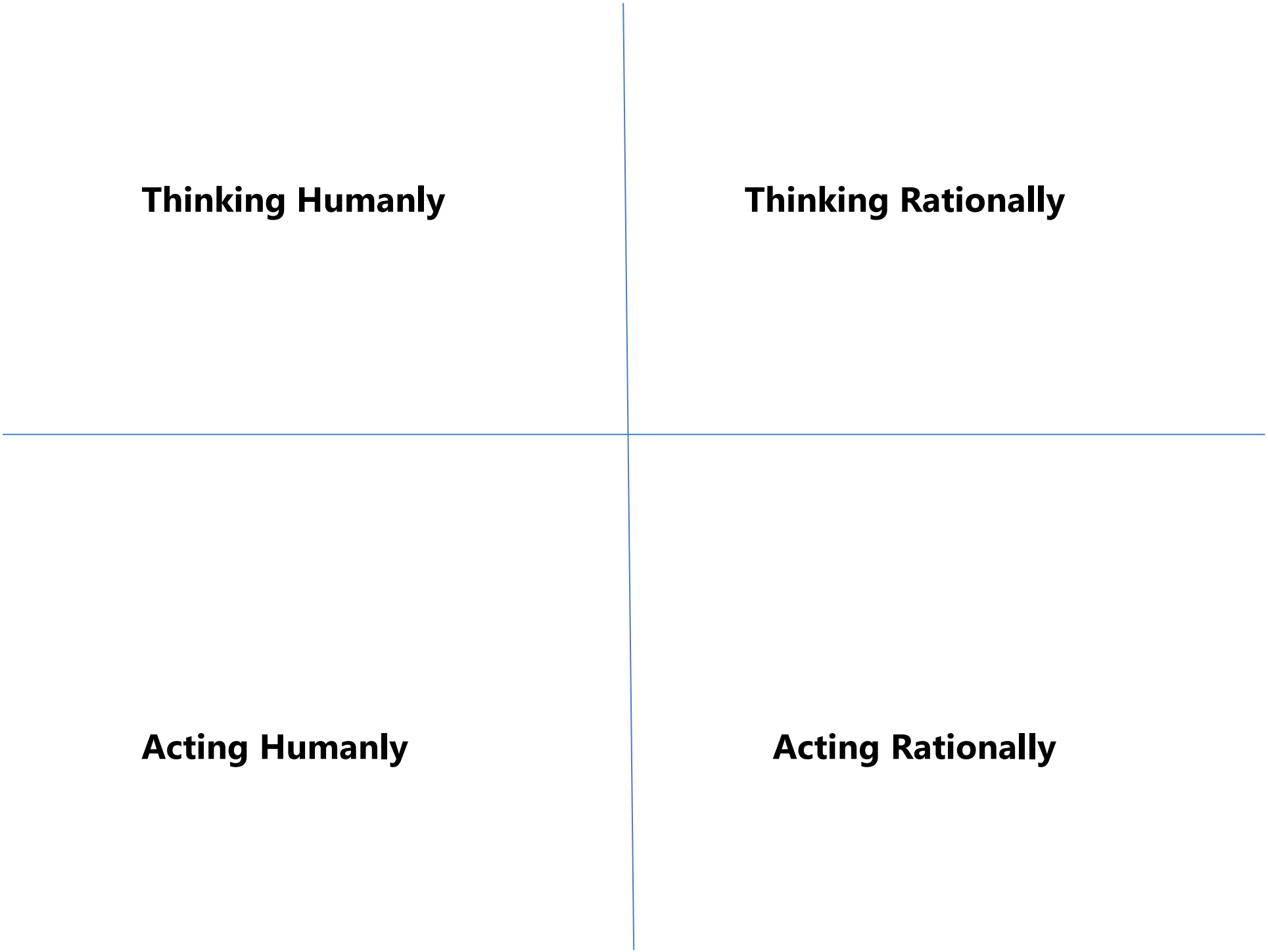
Intelligence means- ability to understand ,thinks & Learn

Artificial is a technique ,which is made a copy of something natural and Intelligence ,the ability to gain and apply knowledge and skills.

So Artificial Intelligence is basically is study how to make a system that think, behave and act exactly or better than what a human being can act or reacts

"AI is the branch of computer science in which we can study as how to make a computer that thinks like human"

View of AI- divide into four categories


Thinking Humanly
Thinking Rationally
Acting Humanly
Acting Rationally

- Thinking Humanly means you can make system which can think like human being .We are making efforts like system can crash information and process that information what a human being can do.
- Or we want to develop a system which can act on basis of the information process, which can act like a human being on availability of information. Which have been processed by the system.

- Thinking Rationally means we want to develop a system, which can think sensibly and wisely ,means which can think on the basis of available facts, on the basis of available logic.
- Acting rationally, we want to develop a system which can act on the basis of available facts and available believe.
- On the basis of all these views we can develop a good AI system.

Basis of AI :- There are 4 basic subject…….
1.Psycology
2.Philosophy
3.Mathematics
4.Linguistic
These all subjects making a big role to enhance the AI

Difference Intelligence and Artificial intelligence

Intelligence	**Artificial intelligence**
1.Intelligence is natural	**1.** Programmed by Human being
2.Increase with experience	**2**.sytem do learn from experience
3.Highly refined and no electricity from outside is required to generate output	**3.**we need electricity
4.No one is an expert. We can always Better solution from another human	**4.**expert system are made which have the capacity of many individual person exp. And ideas

Brief history of AI - The Birth of AI

1943 McCulloch & Pitts: Boolean circuit model of brain

1950 Alan Turing published his famous Articles "Computing machinery and intelligence" in which a computer could be programmed so as to habit intelligent behaviour and also examine its intelligence by test called Turing Test.

1956 The term 'Artificial Intelligence' was coined in a proposal for the conference at Dartmouth College The Dartmouth Conference of was organized by **Marvin Minsky**, **John McCarthy** and two senior scientists: **Claude Shannon** and **Nathan Rochester** of IBM. The proposal for the conference included this assertion: "every aspect of learning or any other feature of intelligence can be so precisely described that a machine can be made to simulate it".

1952-1956 Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist.

1959 Gelernter's Geometry Engine.

1961 James Slagle wrote a symbolic integration program, SAINT. It was written in LISP and solved calculus problems at the college freshman level.

1963 Thomas Evan's program Analogy was developed which could solve IQ test type analogy problems.

1965 Robinson's complete algorithm for logical reasoning.

1966-73 AI discovers computational complexity ,Neural network research almost disappears

1967 The **Dendral** program (Feigenbaum, Lederberg, Buchanan, Sutherland at Stanford) was demonstrated which could interpret mass spectra on organic chemical compounds. This was the first successful knowledge-based program for scientific reasoning

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1969-79 Early development of knowledge-based systems

1974 **MYCIN** demonstrated the power of rule-based systems for knowledge representation and inference in medical diagnosis and therapy.

1980 AI becomes an industry

1986 Neural networks return to popularity

1987 AI becomes a science

1995 The emergence of intelligent agents

1. ALVINN: Autonomous Land Vehicle In a Neural Network

In 1989, Dean Pomerleau at CMU created ALVINN. This is a system which learns to control vehicles by watching a person drive. It contains a neural network whose input is a 30x32 unit two dimensional camera image. The output layer is a representation of the direction the vehicle should travel.
The system drove a car from the East Coast of USA to the west coast, a total of about 2850 miles. Out of this about 50 miles were driven by a human, and the rest solely by the system.

2. Deep Blue

In 1997, the Deep Blue chess program created by IBM, beat the current world chess champion, Gary Kasparov.

3. Machine translation

A system capable of translations between people speaking different languages will be a remarkable achievement of enormous economic and cultural benefit. Machine translation is one of the important fields of endeavour in AI. While some translating systems have been developed, there is a lot of scope for improvement in translation quality.

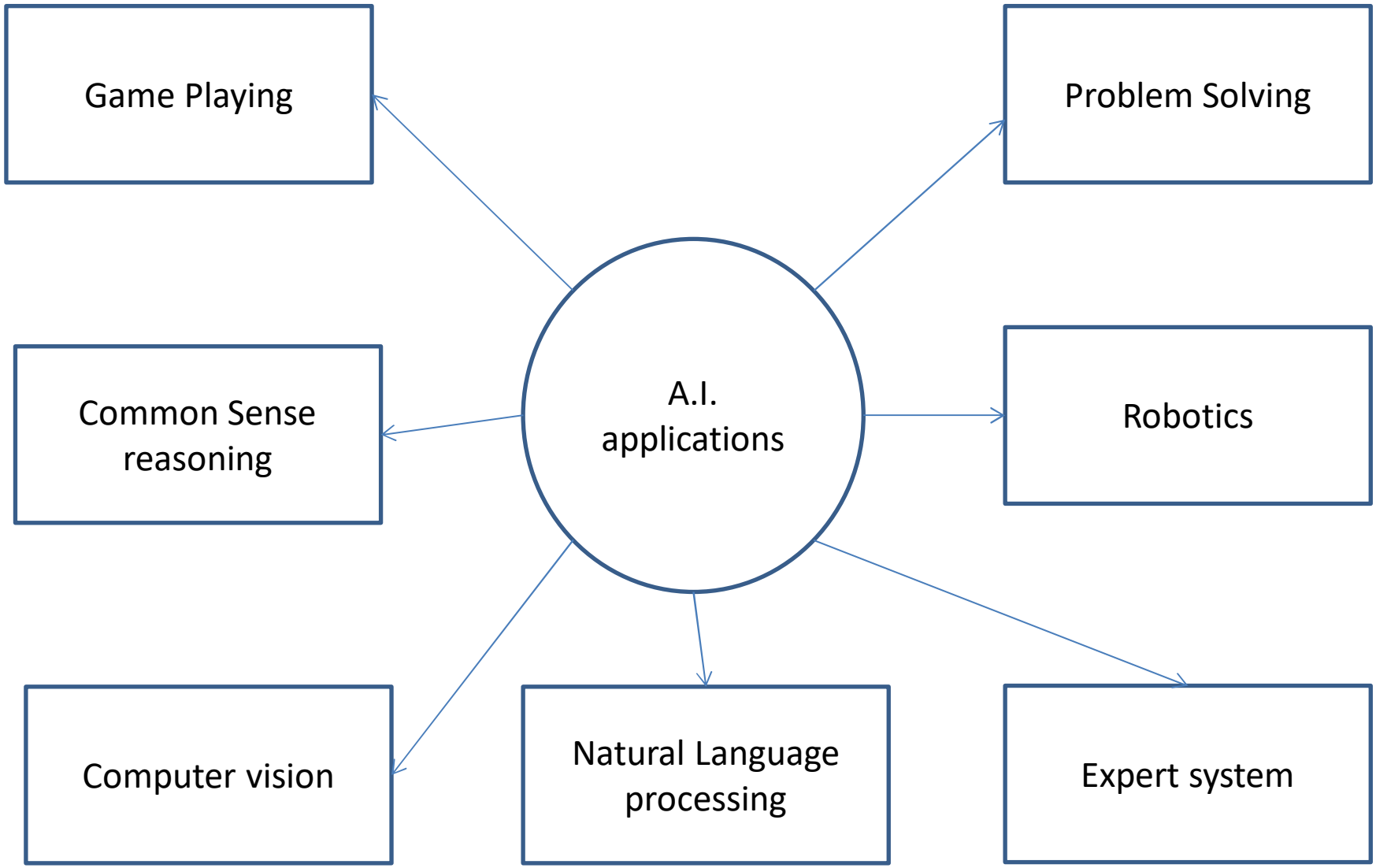
4. Autonomous agents

In space exploration, robotic space probes autonomously monitor their surroundings, make decisions and act to achieve their goals. NASA's Mars rovers successfully completed their primary three-month missions in April, 2004. The Spirit rover had been exploring a range of Martian hills that took two months to reach. It is finding curiously eroded rocks that may be new pieces to the puzzle of the region's past. Spirit's twin, Opportunity, had been examining exposed rock layers inside a crater.

5. Internet agents

The explosive growth of the internet has also led to growing interest in internet agents to monitor users' tasks, seek needed information, and to learn which information is most useful.

APPLICATION OF AI



Game playing:

Game playing has played important role in the history of AI for of e.g. chess and tic-tac-toe are such type of game which display intelligence.AI system provide the mechanism that can be used to explore a large number of solution paths and then select the best one.

Problem Solving:

In problem solving AI play an important role to solve several problem such as water jug problem, tower of Hanoi problem,TSP ,monkeys and bananas etc.

Natural language processing(NLP):

In order to understand NL it must know how to generate ,understand and translate ,to the language by using different techniques like encoding,decoding,parsing translating and AI ideas about structure for representing contextual knowledge and certain technique for making inferences from that knowledge then computer system is capable to understand NL.

Common sense reasoning:

AI focus on the sort of problem solving that we do everyday. When we decide how to get to work during whole day is often called common sense reasoning. It include reasoning about physical objects and their relationship.

In fact common sense derives from our knowledge and our ability to access relevant knowledge quickly,effortlesslly and at the right time.

Robotics:

It is developing computer system that can perform the ability to move and act in the world, possibly responding to new perception .Robotics is a field of engineering attempt to maintain human metal abilities .They differ from AI program which usually operate in computer simulated

World where as Robotics operate in physical world.

Computer Vision:

The world is composed of 3D objects, but the inputs to the human eye and computers' TV cameras are 2D. Some useful programs can work solely in two dimensions, but full computer vision requires partial 3D information that is not just a set of 2D views. At present there are only limited ways of representing 3D information directly, and they are not as good as what humans evidently use.

Expert System:

These are AI program which act as intelligence advisor or consultant in a specific domain or a specified area .There are two initial expert system DENDRAL and MYCIN.

DENDRAL the first knowledge based expert system developed by J. Laderberg .It was a chemical analysis expert system. It was to infer molecular structure from the information provided by a mass spectrometer.

MYCIN in 1974 was developed by Feigenbaum and Buchanan, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. MYCIN used 450 rules acquired from the information given by expert.

Some Other application:

- **Speech recognition**
- **Weather forecasting**
- **Auto Pilot mode in Aviation**
- **AI in Heavy Industries and space**
- **Intelligent personal Assistants(smart phone & mobile device)-Google Now & siri**

Branches of AI: There are some branches of AI -

- **Knowledge Representation**
- **Heuristic search**
- **Natural language Processing**
- **Machine Learning**
- **Pattern and speech Recognition**
- **Commonsense knowledge and reasoning**
- **Bayesian and Neural Network**
- **Inference Theory**
- **Learning from Experience**
- **Genetic programming**
- **Epistemology**
- **Ontology**
- **Planning**

Intelligent Agent:

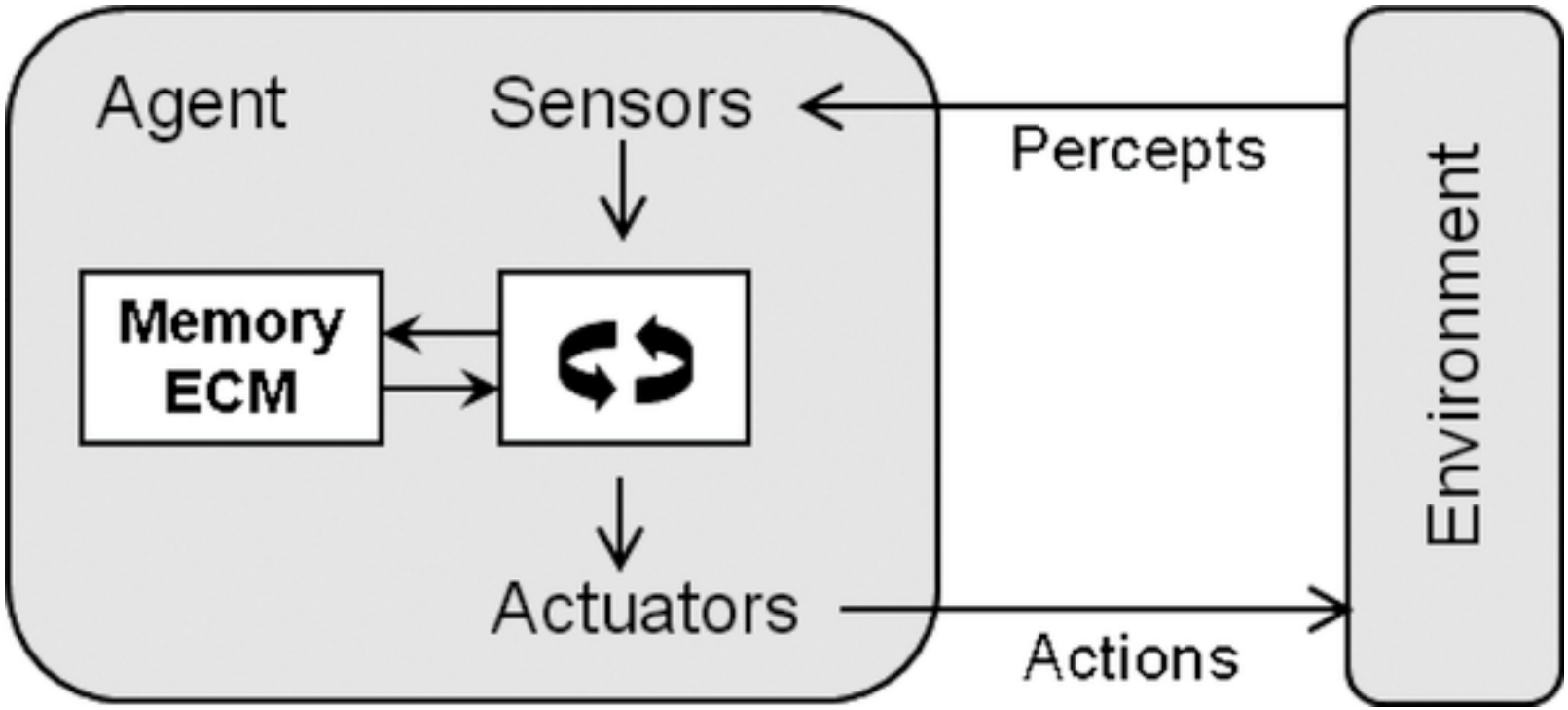
In artificial intelligence, an **intelligent agent** (**IA**) is an autonomous entity which observes through sensors and acts upon an environment using actuators .Intelligent agents may also learn or use knowledge to achieve their goals.

"An agent is anything that can be viewed as perceiving its environment through sensors and acting upon that environment through effectors or actuators."

A discrete agent receives **percepts** one at a time, and maps this percept sequence to a sequence of discrete **actions**.

Properties

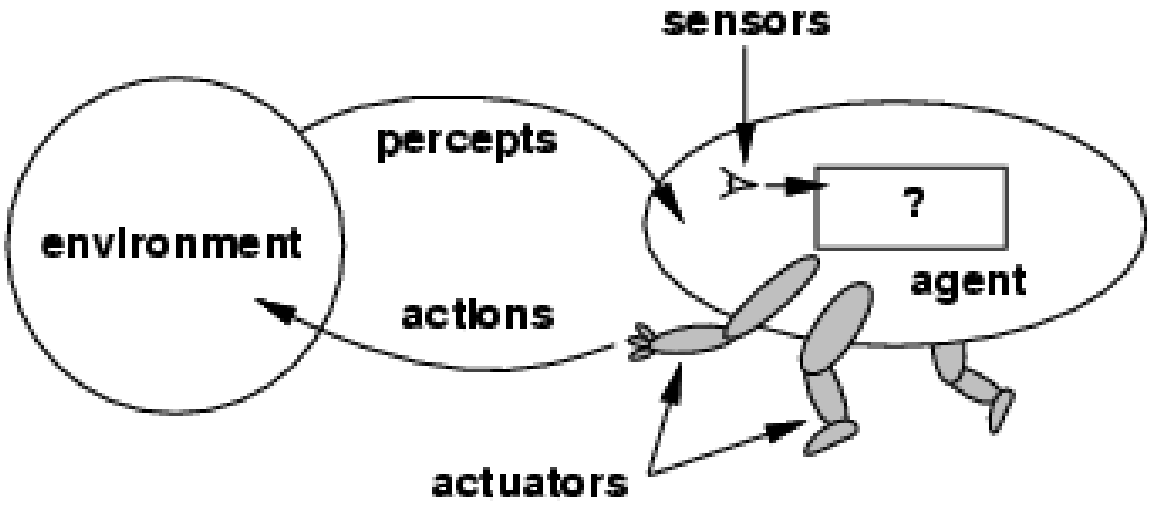
1. Autonomous
2. Reactive to the environment
3. Pro-active (goal-directed)
4. Interacts with other agents via the environment


Agent
Sensors
Memory
ECM
Actuators
Percepts
Actions
Environment

Human agent: eyes, ears, and other organs for sensors; hands, legs, mouth, and other body parts for actuators

Robotic agent: cameras and infrared range finders for sensors; various motors for actuators

Structure of Agents : The job of AI is to design the agent program a function that implements the agent mapping from percepts to action. The term percept to refer to the agent's perceptional inputs at any given instant.



The agent function maps from percept histories to actions:

$$[f: P^* \rightarrow A]$$

A- action,

p*-all possible percept sequence and recording which action the agent does in response.

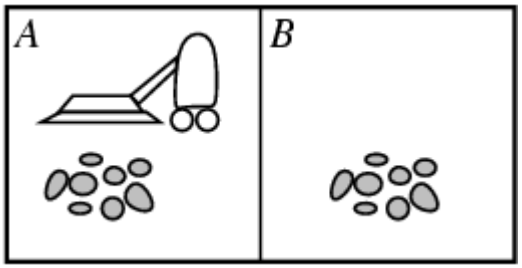
The agent program runs on the physical architecture to produce *f* .

Agent= Architecture + Program

Architecture: plain computer that make percept from sensor for program + run choose action

Program=software that provide of insulation between the raw computer & agent program

Vacuum-cleaner world:



Percepts: location and contents, e.g., [A, Dirty]
Actions: *Left*, *Right*, *Suck*, *NoOp*

Rational Agent: For each possible percept sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the percept sequence and whatever built-in knowledge the agent has.

- Rationality is distinct from omniscience (all-knowing with infinite knowledge)
- Agents can perform actions in order to modify future percepts so as to obtain useful information (information gathering, exploration)
- An agent is autonomous if its behavior is determined by its own experience (with ability to learn and adapt)

PEAS: **Performance measure, Environment, Actuators, Sensors**

Must first specify the setting for intelligent agent design. Ex.

The task of designing an automated taxi driver:

- **Performance measure**: Safe, fast, legal, comfortable trip, maximize profits
- **Environment**: Roads, other traffic, pedestrians, customers
- **Actuators**: Steering wheel, accelerator, brake, signal, horn
- **Sensors**: Cameras, sonar, speedometer, GPS, odometer, engine sensors, keyboard

Agent: Medical diagnosis system
Performance measure: Healthy patient, minimize costs, lawsuits
Environment: Patient, hospital, staff
Actuators: Screen display (questions, tests, diagnoses, treatments, referrals)

Sensors: Keyboard (entry of symptoms, findings, patient's answers)

Agent: Part-picking robot
Performance measure: Percentage of parts in correct bins
Environment: Conveyor belt with parts, bins
Actuators: Jointed arm and hand
Sensors: Camera, joint angle sensors

Agent: Interactive English tutor
Performance measure: Maximize student's score on test
Environment: Set of students
Actuators: Screen display (exercises, suggestions, corrections)
Sensors: Keyboard.

Agent functions and programs : An agent is completely specified by the agent function mapping percept sequences to actions. One agent function (or a small equivalence class) is rational

Agent types: There are four basic types in order of increasing generality:

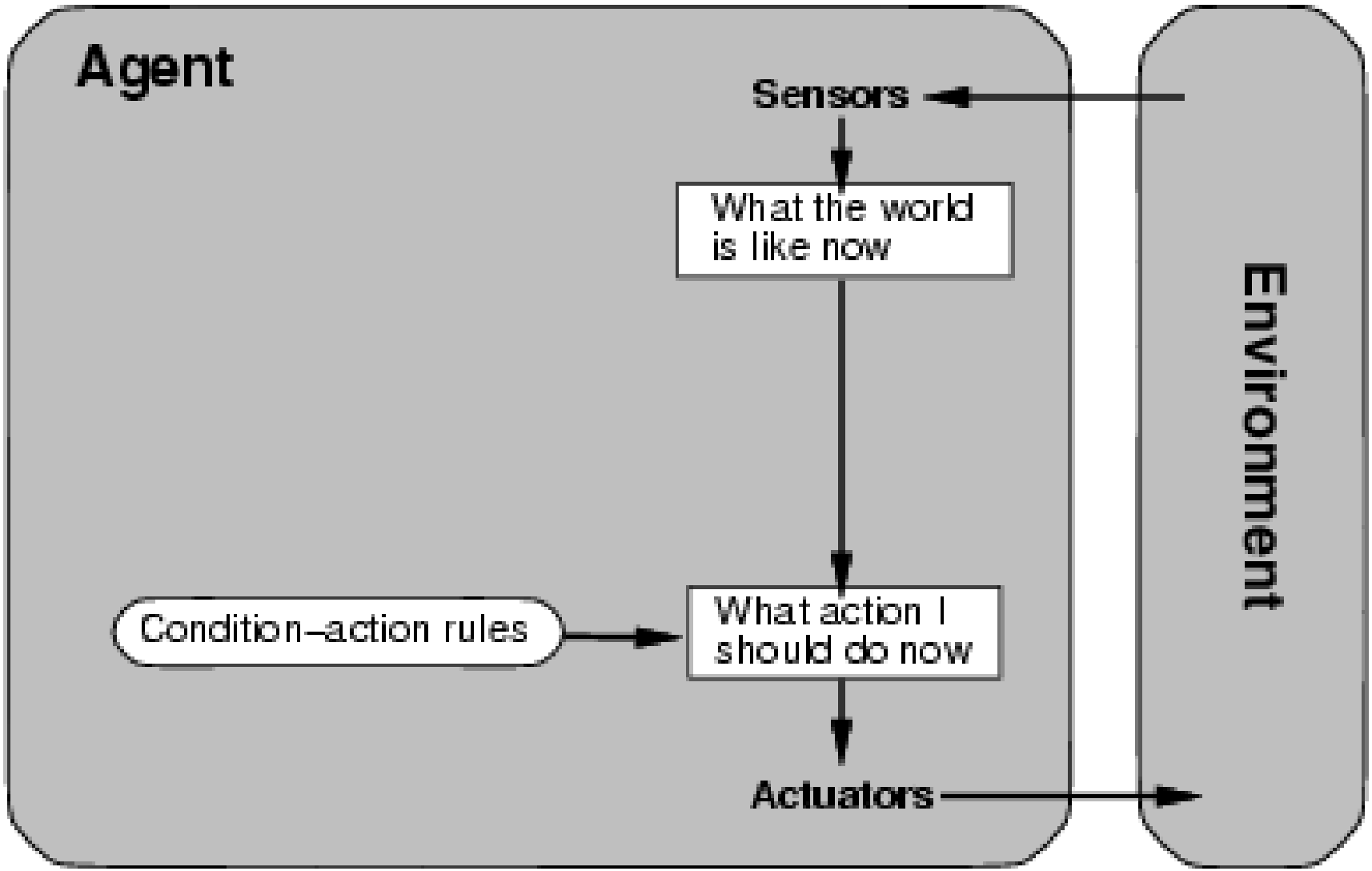
1. Simple reflex agents
2. Model-based reflex agents
3. Goal-based agents
4. Utility-based agents

Simple reflex agents:

This agent selects actions based on the agents current perception or the world and not based on past perceptions. The agent function based on the condition-action rule: if condition then action(**if** hand is in fire **then** pull away hand) . The simple reflex agent has a library of such rules so that if a certain situation should arise and it is in the set of Condition-action rules the agent will know how to react with minimal reasoning.

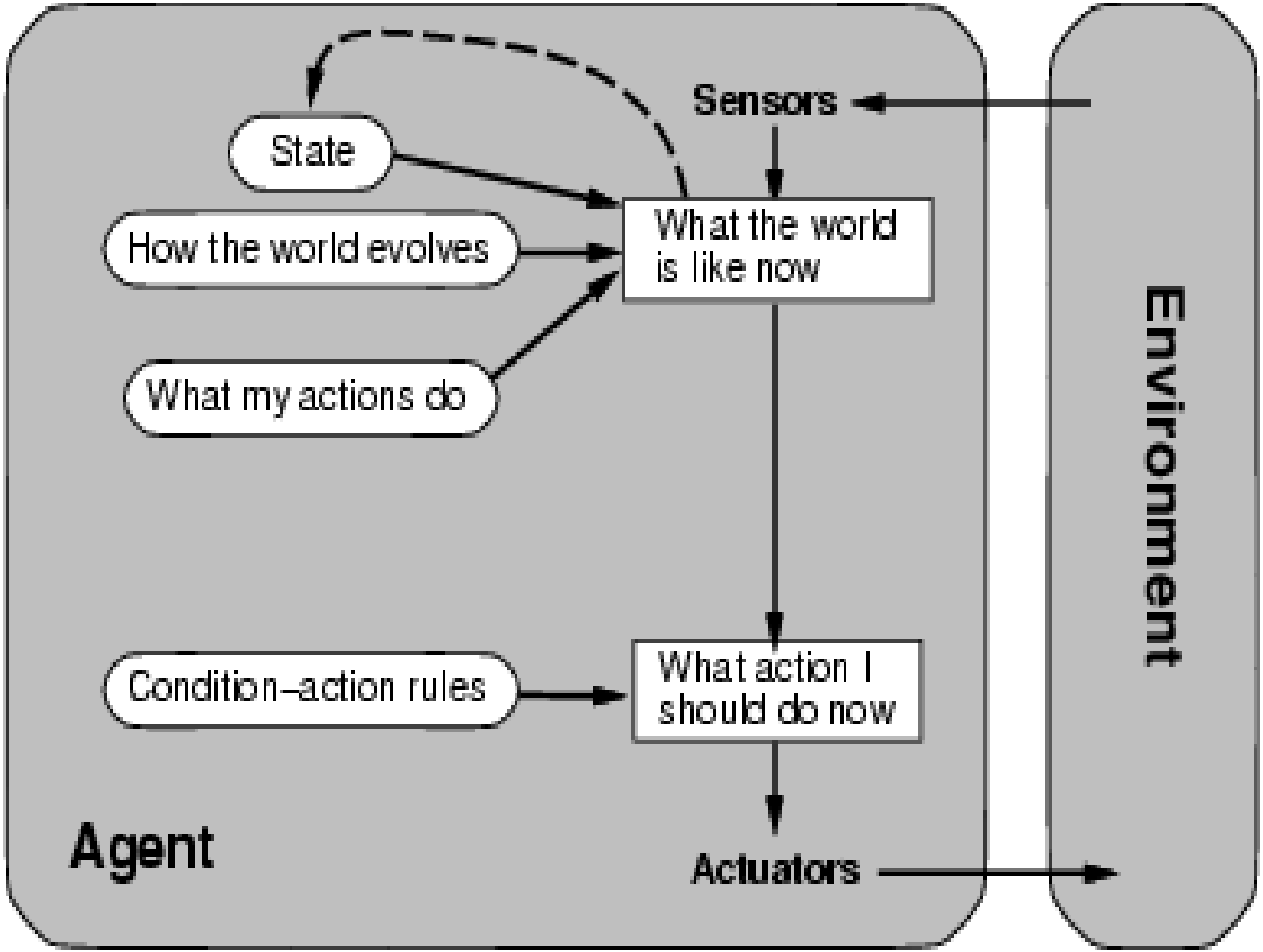
This will only work if the environment is fully observable. This is useful for when a quick automated response is needed. Infinite loops are often unavoidable for simple reflex agents operating in partially observable environments

Note: If the agent can randomize its actions, it may be possible to escape from infinite loop

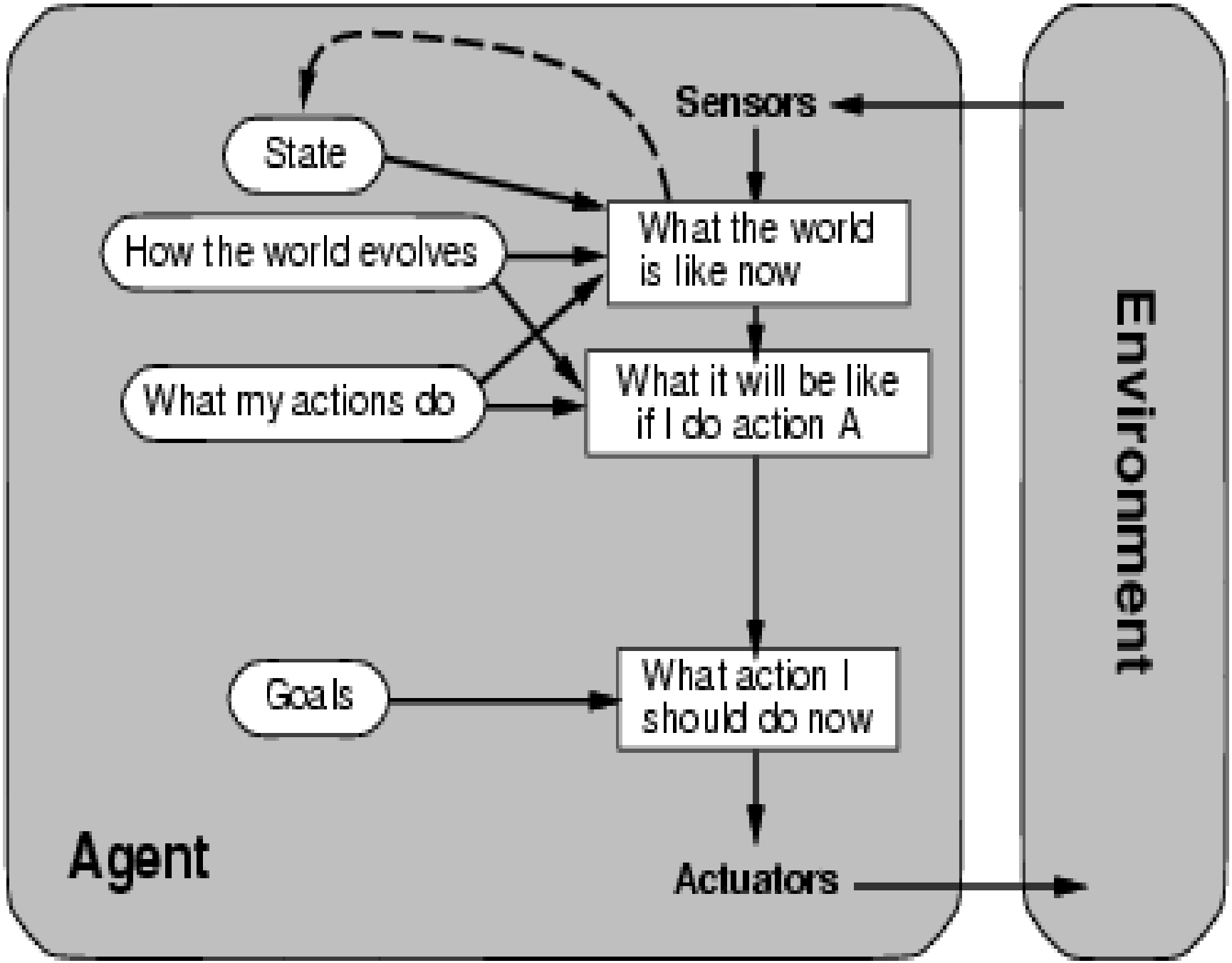

Agent
Sensors
What the world is like now
Environment
Condition–action rules
What action I should do now
Actuators

Model-based reflex agents :

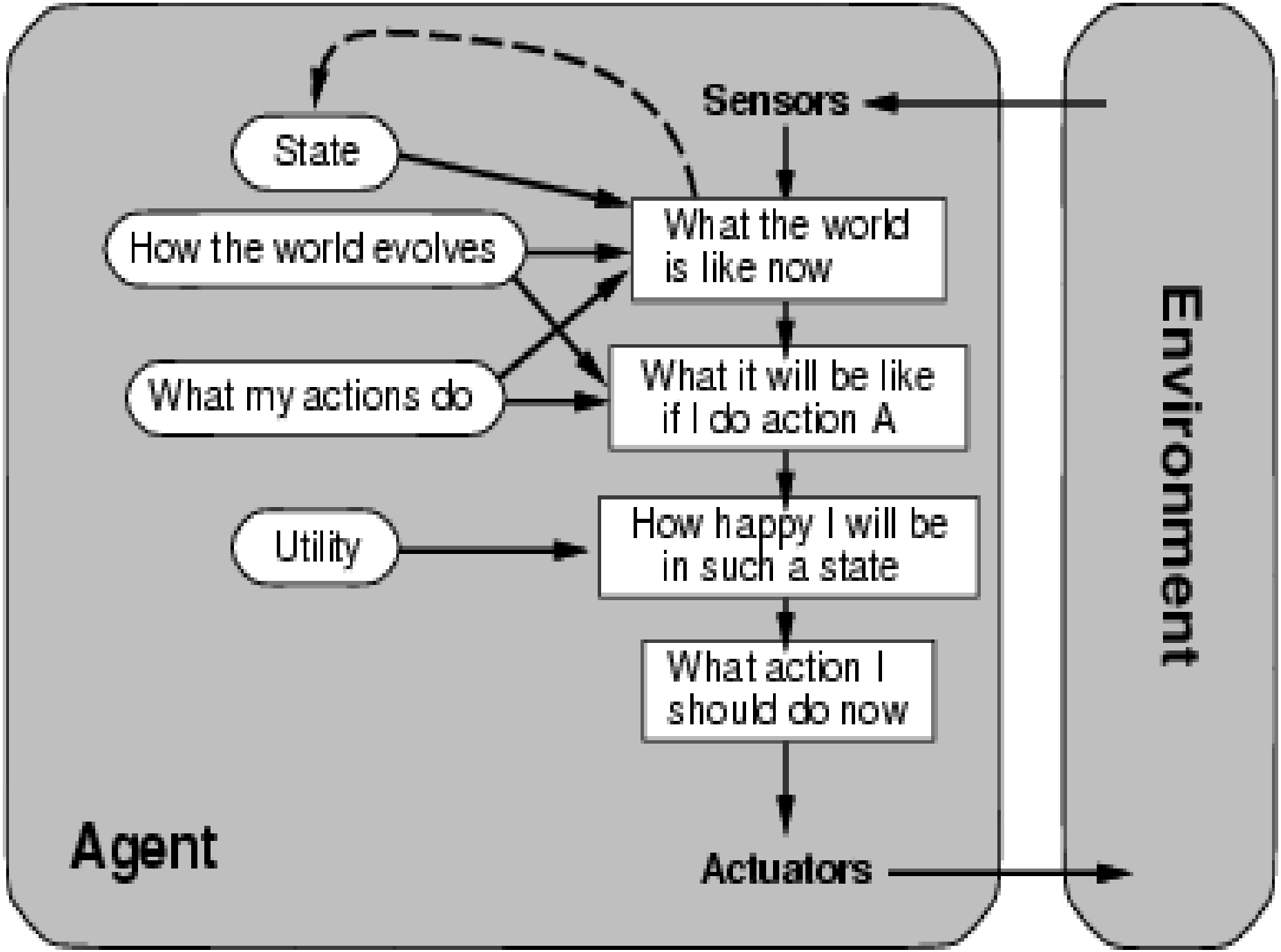
A model based agent can handle partially observable environment. Its current state is stored inside the agent. Maintaining some kind of structure which describe the part of the word which cannot seen. This knowledge about "how the world works" is called a model of the world ,hence the name "model -based agent". It should maintain some sort of internal model that depend on the percept history and thereby reflects at least some of the unobserved aspects of the current state.


Sensors
State
How the world evolves
What my actions do
What the world is like now
Condition–action rules
What action I should do now
Actuators
Agent
Environment

Goal-based agents: It further expand on the capabilities of the model - based agent, by using “goal” information. So in an intelligent agent having a set of goals with desirable situations are needed. The agent can use these goals with a set of actions and their predicted outcomes to see which action achieve our goal.


Sensors
State
How the world evolves
What the world is like now
What my actions do
What it will be like if I do action A
Goals
What action I should do now
Agent
Actuators
Environment

Utility-based agents: Goal-based agent only distinguish between goal state and non-goal state . It is possible to define a measure of how desirable a particular state is. A utility function maps each state after each action to a real number representing how efficiently each action achieves the goal. This is useful when we either have many actions all solving the same goal or when we have many goals that can be satisfied and we need to choose an action to perform.


Sensors
State
How the world evolves
What my actions do
What the world is like now
What it will be like if I do action A
Utility
How happy I will be in such a state
What action I should do now
Agent
Actuators
Environment

Learning agents: Learning agent has an advantage that it allows the agents to initially operate in unknown environment and become more competent than its initial knowledge.

1.The **learning element** is responsible for improvements this can make a change to any of the knowledge components in the agents.

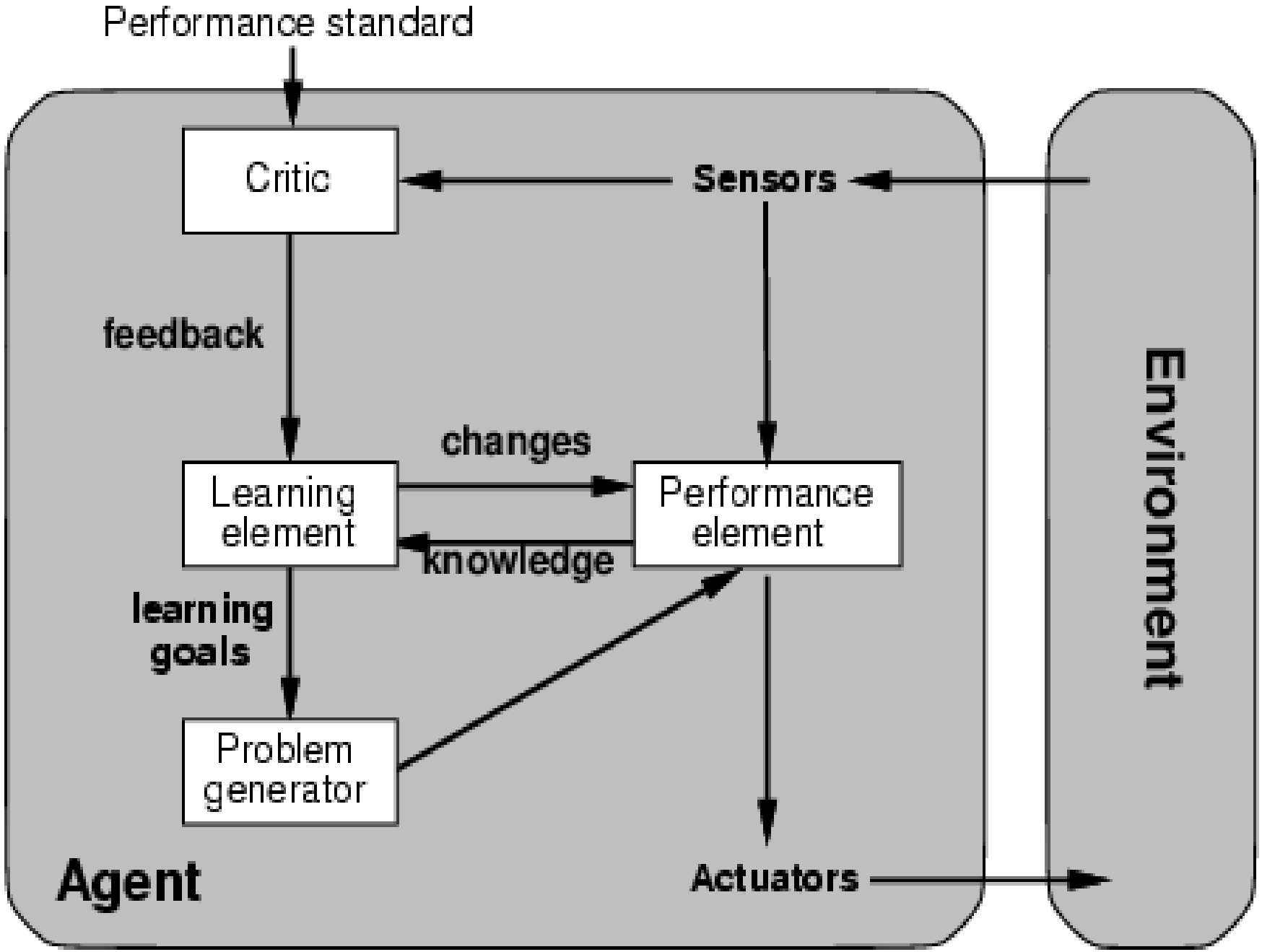
2.The **performance element** is responsible for selecting external action.

3.The **learning agent** gains feedback from the critic on how well the agent is doing and determines how the performance element should be modified if at all to improve the agent.
4.The **problem generator** only suggests actions that it can already do so we need a way of getting the agent to experience new situations, and this is what the performance generator is for.

Summary:

- An **agent** perceives and acts in an environment, has an architecture and is implemented by an agent program.
- An **ideal agent** always chooses the action which maximizes its expected performance, given percept sequence received so far.
- An **autonomous agent** uses its own experience rather than built-in knowledge of the environment by the designer.
- An **agent program** maps from percept to action & updates its internal state.
  - **Reflex agents** respond immediately to percpets.
  - **Goal-based agents** act in order to achieve their goal(s).
  - **Utility-based agents** maximize their own utility function.
- **Representing knowledge** is important for successful agent design.

Some **environments** are more difficult for agents than others. The most challenging environments are inaccessible, nondeterministic, nonepisodic, dynamic, and continuous.


Performance standard
Critic
Sensors
feedback
changes
Learning element
Performance element
knowledge
learning goals
Problem generator
Agent
Actuators
Environment

Computer vision: computer vision is the science and technology of obtaining models ,meaning and control information from visual data .Commuter vision is the field of Artificial Intelligent. The main field of computer vision are-

1- computational vision: It has to do with simply recording and analyzing the visual perception, and try to understand it.

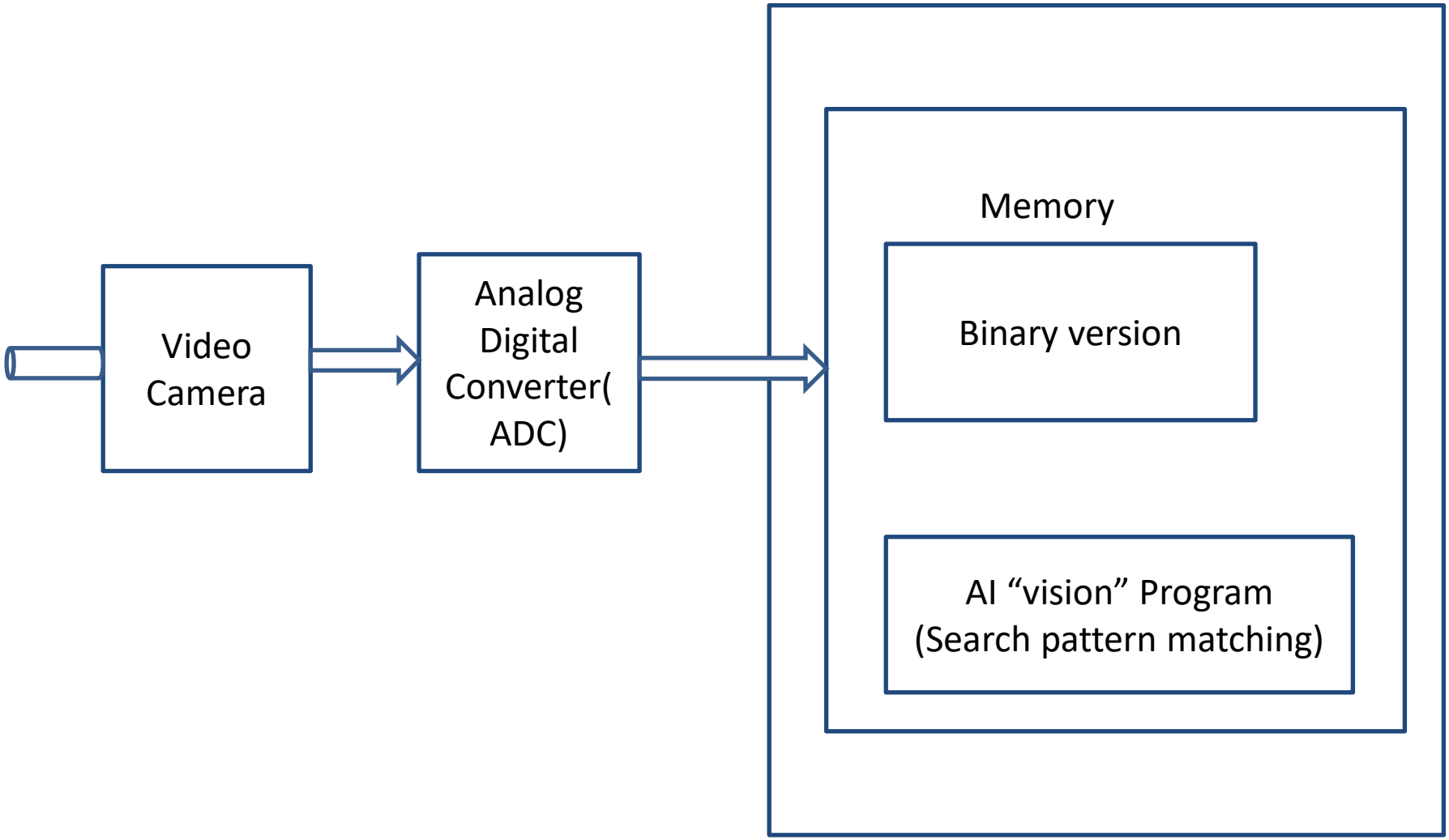
2- Machine vision: It has to do with using what is found from computational vision and apply it to benefit , people ,animal, environment , ect.

Exp- Robocop Tournament, robot dog play soccer.

ASIMO is robot created by Honda, it use camera to visualize computationally what is in its surrounding ,then achieve its goal.

Use:

1. AI can also use computer vision with humans.
2. AI also use computer vision to recognize hand written Text and drawing.
3. AI use computer vision for passive observation and analysis ,to observe & analysis certain object over time(Moving Car).



A computer vision System

Application:	**example**
Controlling processor-	industrial robot
Navigation-	an autonomous vehicle or mobile robot.
Detecting events-	visual surveillance or people counting.
Organized information-	for indexing database of images and image sequence
Modeling object or environment-	Medical image analysis
Interaction-	For computer human Interaction
Automatic Inspection -	in manufacturing application

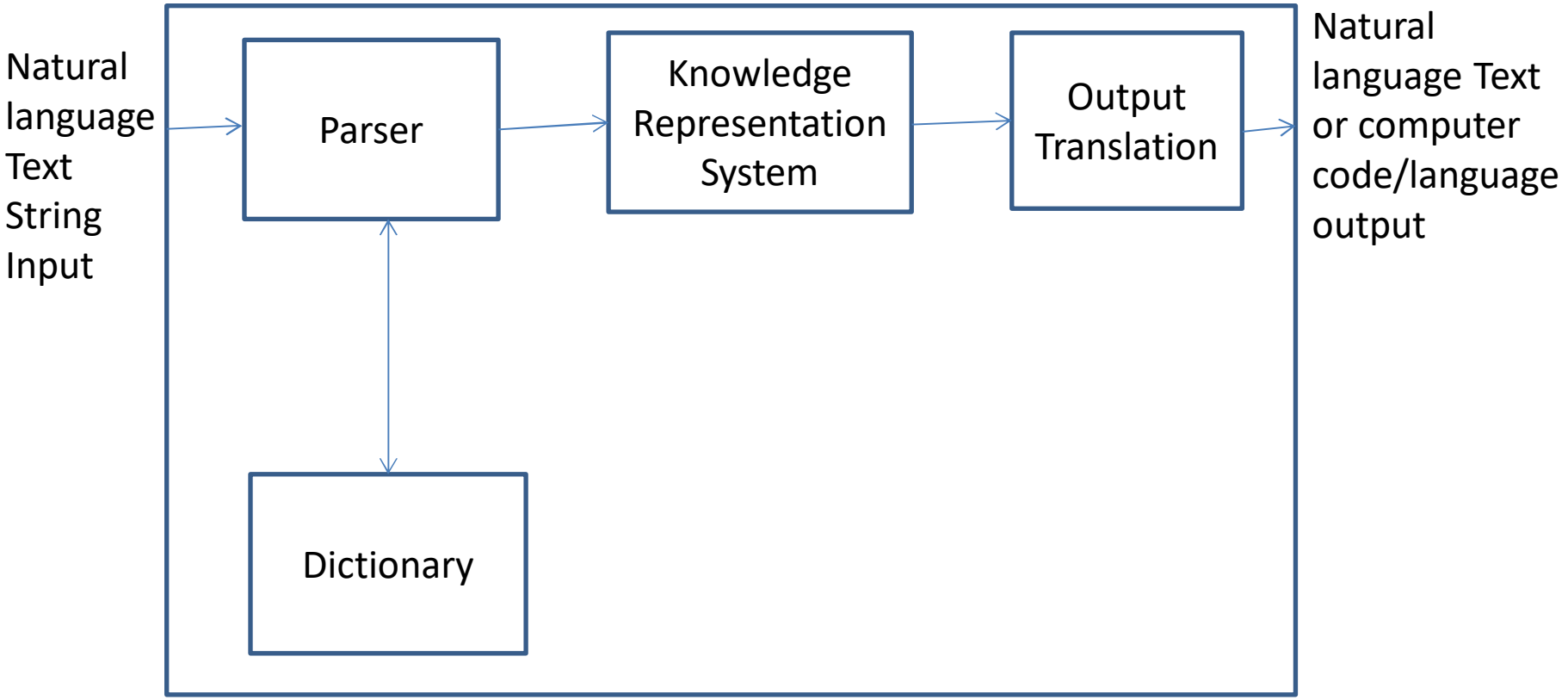
NATURAL LANGUAGE PROCESSING(NLP):

The history of NLP generally starts in the 1950s, Alan Turing published an article titled "Computing Machinery and Intelligence" which proposed what is now called the Turing test.

Natural language processing (NLP) is the ability of a computer program to understand human speech as it is spoken. NLP is a component of artificial intelligence (AI). In order to understand natural language it must know how to generate ,understand, translate.

It is a difficult task. It require a knowledge of how we maintain the vocabulary in the system such that it can give result in natural form. So it also considered as the automation of intelligent behavior. It require a knowledge of grammar and syntax and it requires a program that transform a sentences occurring as part of dialogue into data structure which convey the intended meaning of the sentences to a reasoning program

Current approaches to NLP are based on machine learning, a type of artificial intelligence that examines and uses patterns in data to improve a program's own understanding



A Natural language Processing System

Area of Natural language:

Text processing:

Parsing: identify sentence structure

S-→NP+VP

Stemming: running--→Run

Machine translation: translating content in one natural language to another natural language.

Speech processing:

Text to Speech : Converting Electronic text to digital speech

Automatic Speech Recognition(ASR):Automatic transcription of spoken content to electronic text

Speech to speech translation : Translating spoken content from one language to another in real time or off time.

Natural Language Generation (NLG): convert information from computer data base into readable human language

Optical character recognition: Given an image representing printed text, determine the corresponding text.