

# Overview of AI

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## What is AI?

- Artificial Intelligence is concerned with the design of intelligence in an artificial device.

There are two ideal definitions of AI:

- The study of the computations that make it possible to perceive, reason, and act.
- The study of how to make computers do things at which, at the moment, people are better.

## Goals of AI

- To create expert systems which exhibit intelligent behavior with the capability to learn, demonstrate, explain and advice its users.
- To implement human intelligence in machines.

## AI Foundations

- Mathematics: Logic, Probability, Statistics, Calculus, Algebra, Graph Theory, etc.
- Computer Science: Algorithms, Data Structures, Programming Languages, etc.
- Linguistics: Syntax, Semantics, Pragmatics, etc.
- Psychology: Perception, Emotion, Learning, etc.
- Philosophy: Mind, Consciousness, etc.

## AI Feilds

- Speech Recognition
- Natural Language Processing
- Computer Vision
- Robotics
- Expert Systems
- Machine Learning
- Neural Networks
- Fuzzy Logic

## The Turing Test

IMPORTANT

- The Turing Test is a test of a machine's ability to exhibit intelligent behavior equivalent to, or indistinguishable from, that of a human.
- The test was introduced by Alan Turing in his 1950 paper "Computing Machinery and Intelligence," which he called the "imitation game."
- The test is named after Alan Turing, the founder of computer science.

## History of AI

- 1943: McCulloch and Pitts proposed a model of artificial neurons.
- 1951: Marvin Minsky built the first neural network computer, SNARC.
- 1956: John McCarthy coined the term "Artificial Intelligence" at the Dartmouth Conference.
- 1952-1969: Early AI programs, including Samuel's checkers program, Newell and Simon's Logic Theorist, Gelernter's Geometry Engine.
- 1969-1979: Early development of knowledge-based systems, including MYCIN, DENDRAL, and others.
- 1980: The first commercial expert system, R1, introduced by Digital Equipment Corporation.
- 1985: The emergence of the connectionist approach to AI, including the introduction of the back-propagation learning algorithm.
- 1988: The emergence of the probabilistic approach to AI, including the introduction of the belief network.

## AI Applications

- Gaming
- Natural Language Processing
- Expert Systems
- Vision Systems
- Speech Recognition
- Handwriting Recognition
- Intelligent Robots
- Neural Networks
- Heuristic Classification
- Intelligent Computer-Aided Instruction
- Medical Diagnosis

## Intelligent Agent

- An intelligent agent is an autonomous entity which observes through sensors and acts upon an environment using actuators and directs its activity towards achieving goals.

Agent	Environment
Robot	Room
Chatbot	Chatting
Vehicle	Road
Program	Data and Rules

Agent	Environment
Machine	Working Field

### Examples:

1. **Human Agent:** Eyes, Ears, and Other Organs are sensors and Hands, Legs, Mouth, and Other Body Parts are actuators.
2. **Robotic Agent:** Cameras, Temperature Sensors, and Other Sensors are sensors and Motors, Lights, and Other Actuators are actuators.
3. **Software Agent:** Keyboard, Mouse, and Other Input Devices are sensors and Monitor, Printer, and Other Output Devices are actuators.

### Agent Terminology:

- **Performance Measure of Agent:** It is the criteria which determines how successful an agent is.
- **Behaviour of Agent:** It is the action taken by the agent in response to a given sequence of percepts.
- **Percept:** It is the agent's perceptual inputs at any given instant.
- **Percept Sequence:** It is the complete history of everything the agent has ever perceived.
- **Agent Function:** It maps any given percept sequence to an action.

**What is an Intelligent Agent:** It is an agent which is capable of perceiving its environment and acting accordingly to achieve its goals.

- It is an autonomous entity which observes through sensors and acts upon an environment using actuators and directs its activity towards achieving goals.
- **Fundamental Facilities of an Intelligent Agent:** It should be reactive, proactive, social, and goal-oriented.
- **Goal:** Design rational agents that do a "Good Job" of acting in their environments.

### What is a Rational Agent:

- It is an agent which always selects 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.
- AI is about building rational agents.
- An agent should strive to "do the right thing," based on what it knows and what it perceives.
- An agent is something that perceives and acts in an environment.
- A rational agent is one that does the right thing.

**Perfect Rationality:** It is the ideal concept of rationality in which the agent always selects the action that maximizes its performance measure, given its percept sequence.

**Bounded Rationality:** It is the concept of rationality in which the agent selects the action that it believes will maximize its performance measure, given the evidence provided by the percept sequence and the built-in knowledge the agent has.

## PEAS Analysis

- PEAS stands for Performance Measure, Environment, Actuators, and Sensors.

- To design a rational agent, we must specify the task environment in which it will operate by defining PEAS.

Example	Performance Measure	Environment	Actuators	Sensors
Medical Diagnosis System	Healthy Patient, Low Cost	Hospital, Patient	Screen, Keyboard	Keyboard, Patient
Part-Picking Robot	Percentage of Parts Correctly Picked	Factory, Conveyor Belt, Bins, Boxes	Jointed Arm, Suction Gripper	Camera, Joint Angle Sensors, Joint Angle Sensors

**Question:** To design a rational agent, we must specify the task environment. Consider, e.g., the task of designing an Self Driving Car:

Example	Performance Measure	Environment	Actuators	Sensors
Self Driving Car	Safe, Comfortable, Profitable	Roads, Other Traffic, Pedestrians, Customers	Steering Wheel, Accelerator, Brake, Signal, Horn	Cameras, Sonar, Speedometer, GPS, Gyro, Engine Sensors

**Question:** To design a rational agent, we must specify the task environment. Consider, e.g., the task of designing an Online Shopping Agent:

Example	Performance Measure	Environment	Actuators	Sensors
Online Shopping Agent	Cheap, Correct	Internet, Customer, Seller	Browser, Keyboard, Mouse	Keyboard, Mouse, Screen, Internet