Department of Information Technology

RJITC04

ARTIFICIAL INTELLIGENCE

Unit 1

OVERVIEW OF AI

Contents - Overview

- What is AI?
- History of AI
- Goals of AI
- Components of AI
- AI Techniques
- AI Applications
- Research areas
- AI classification
- Intelligence and its types
- Learning - difference between human and machine learning

Contents – Agents and Environment

- Introduction to different AI Agents
- Terminology
- Rationality
- Structure of AI agents
- Model based agents
- Goal based agents
- Utility based agents
- Environment
- Turing test

What is AI?

- Definitions of AI
  - *Artificial intelligence (AI) is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals, which involves consciousness and emotionality. (Wkipedia)*
  - *"The science and engineering of making intelligent machines, especially intelligent computer programs". (John McCarthy, Father of AI)*
  - *Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems.*
  - Artificial intelligence is a science and technology based on disciplines such as Computer Science, Biology, Psychology, Linguistics, Mathematics, and Engineering.
  - https://www.youtube.com/watch?v=UdE-W30oOXo


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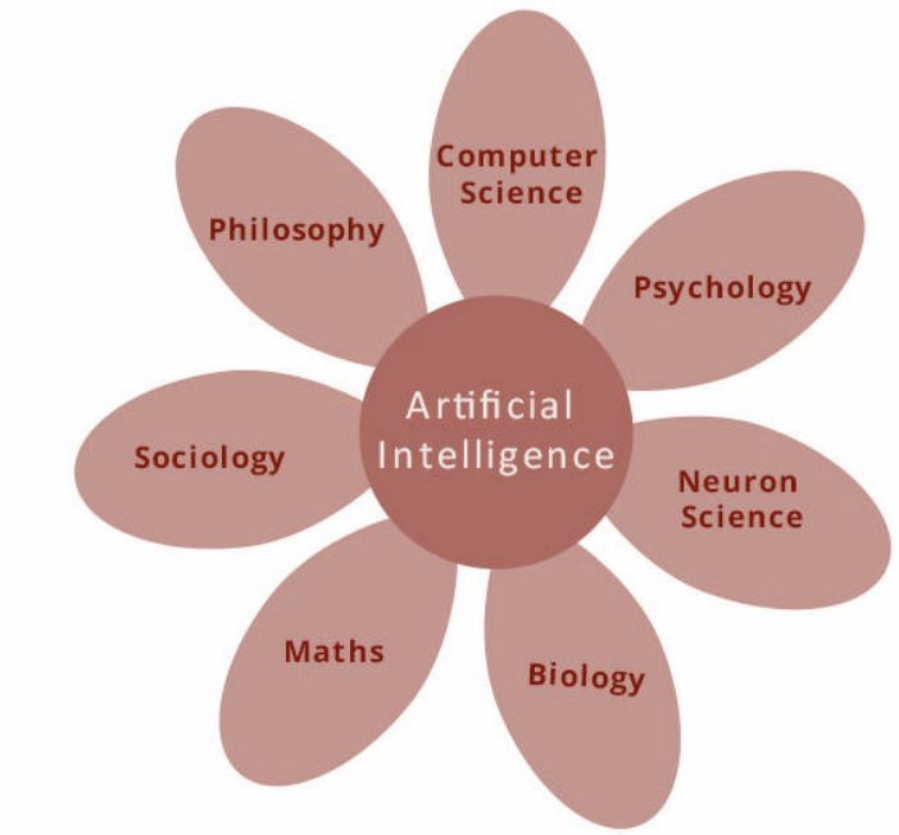
AI Philosophy

- *"Can a machine think and behave like humans do?"*
- *Help machine in –*
  - *Recognition*
  - *Decision making*
  - *Target accomplishment*
  - *Analysis*
  - *Learn*
  - *Explain*
- *Use algorithms for helping*

AI Goals & Components

- Create Expert systems
- implement human intelligence in machines



Programming with or without AI

Without AI	With AI
• Specific tasks are performed • Change in program may lead to change in structure • Modification to the program is not quick and easy • Program modification may affect the accuracy and efficiency of the program	• Generic tasks can be performed • Modifications are absorbed by putting highly independent pieces of information together. • Quick and easy program modification • Modification may not affect structure, accuracy and efficiency of the program

Properties of knowledge

Some unpleasant properties

- its volume is huge, next to unimaginable.
- It is not well-organized or well-formatted.
- It keeps changing constantly.

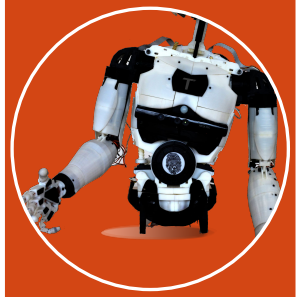
Use of AI to overcome the challenges

- It should be perceivable by the people who provide it.
- It should be easily modifiable to correct errors.
- It should be useful in many situations though it is incomplete or inaccurate.

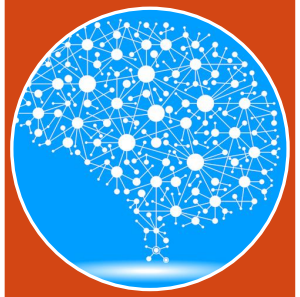
Applications of AI

Gaming	NLP	Expert Systems	Vision Systems	Speech Recognition	Handwriting Recognition	Intelligent Robot
• Strategic games – Chess, Tic Tac Toe, Poker • Machines can think of multiple possible option • Heuristic knowledge.	• Facilitates interaction with computer • Natural spoken language can be used.	• Applications that integrate machine, software, and special information • Impart reasoning and advising.	• Understand, interpret, and comprehend visual input on the computer.	• comprehending the language in terms of sentences and their meanings while a human talks to system. • It can handle different accents, slang words, noise in the background, change in human's noise due to cold, etc.	• Reads the text written on paper by a pen or on screen by a stylus. • It can recognize the shapes of the letters and convert it into editable text.	• sensors to detect physical data from the real world • Efficient processors, multiple sensors and huge memory, to exhibit intelligence. • capable of learning from their mistakes and they can adapt to the new environment.

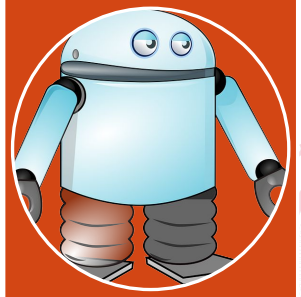
History of AI



1923 – First use of the word “Robot”



1943 – Neural Network

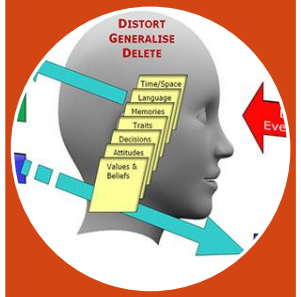


1945 – the term “Robotics” was born

1950 – Inception of Turing Test for evaluation of intelligence and published Computing Machinery and Intelligence

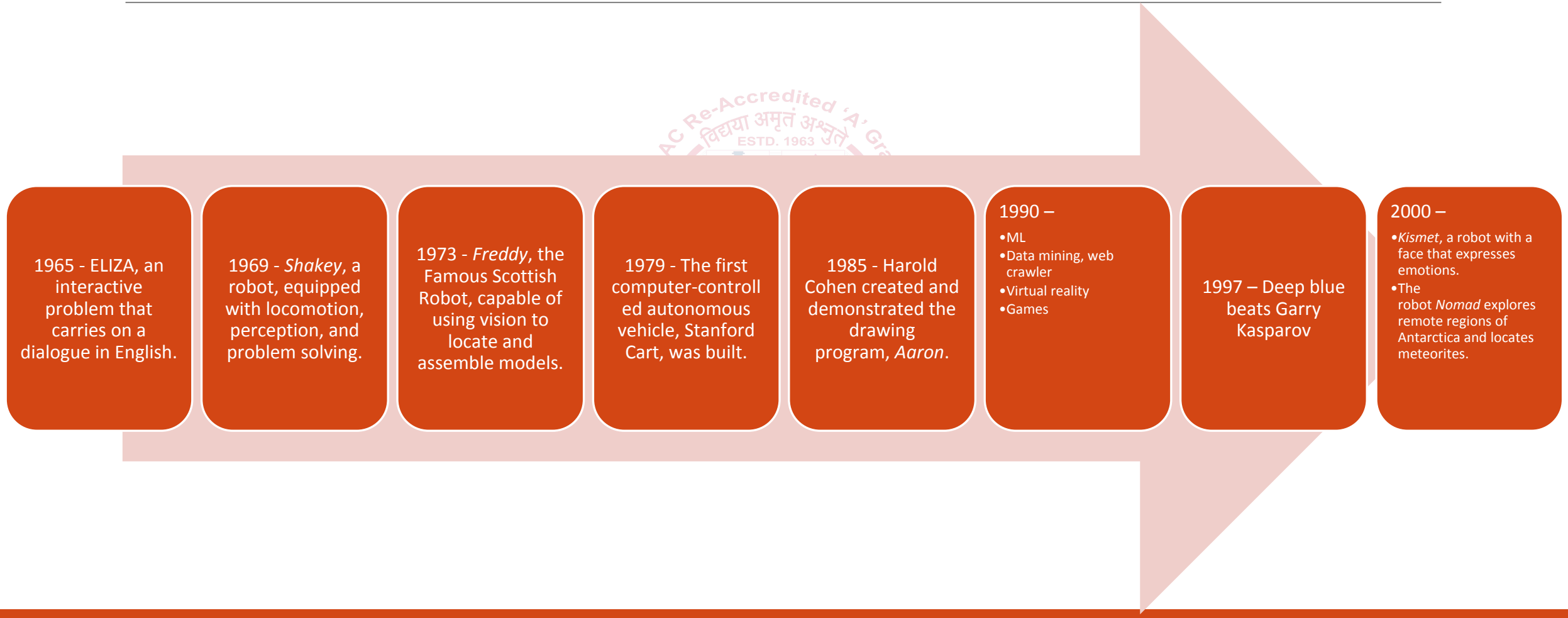
1956 - John McCarthy coined the term Artificial Intelligence. Demonstration of the first running AI program at Carnegie Mellon University.

1958 - John McCarthy invents LISP programming language for AI.



1964 - Danny Bobrow proposed that computers can understand natural language well enough to solve algebra word problems correctly.

History of AI continued

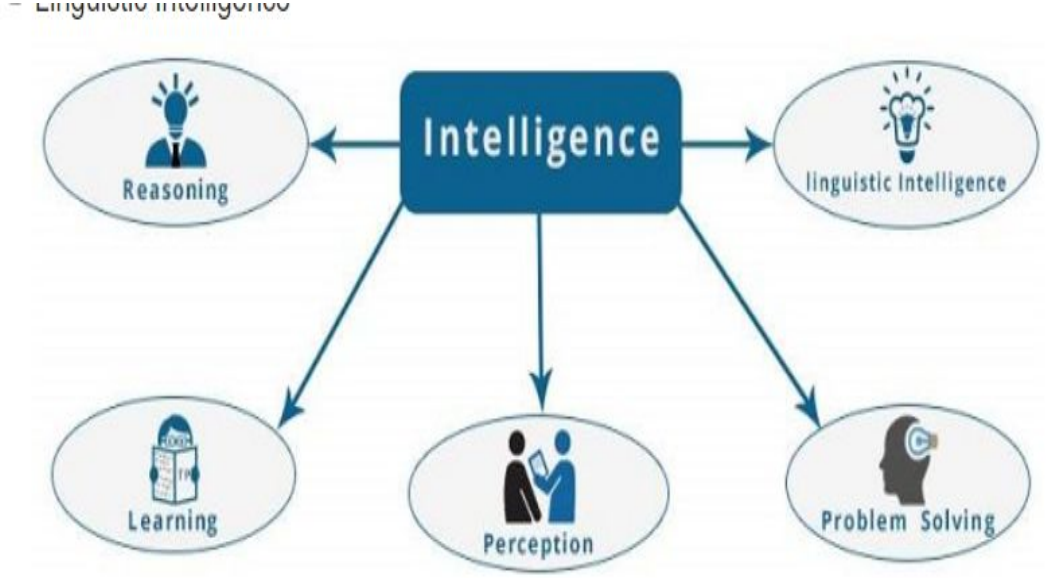


Intelligence & its types

"The ability of a system to calculate, reason, perceive relationships and analogies, learn from experience, store and retrieve information from memory, solve problems, comprehend complex ideas, use natural language fluently, classify, generalize, and adapt new situations."

- Multifold Intelligence –
  - Linguistic Intelligence – Syntax & Scemantics
  - Musical Intelligence – Pitch & Rythm
  - Logical-mathematical intelligence – Relations in absence of actions
  - Spatial Intelligence – recreate visual 3D images
  - Bodily Kinematic Intelligence – fine and coarse motor skills
  - Intra Personal Intelligence – understanding of feelings, intentions and motivation
  - Interpersonal Intelligence – others feeling, intentions

Components of Intelligence



Intelligence is Intangible and consists of –

- Reasoning
- Learning
- Problem solving
- Perception
- Linguistic Intelligence

Reasoning

- It is the processes that enables us to provide basis for judgement, making decisions, and prediction.
- Inductive
  - It conducts specific observations to makes broad general statements.
  - Even if all of the premises are true in a statement, inductive reasoning allows for the conclusion to be false.
- Deductive
  - It starts with a general statement and examines the possibilities to reach a specific, logical conclusion.
  - If something is true of a class of things in general, it is also true for all members of that class.

Learning

"Activity of gaining knowledge or skill by studying, practising, being taught, or experiencing something."

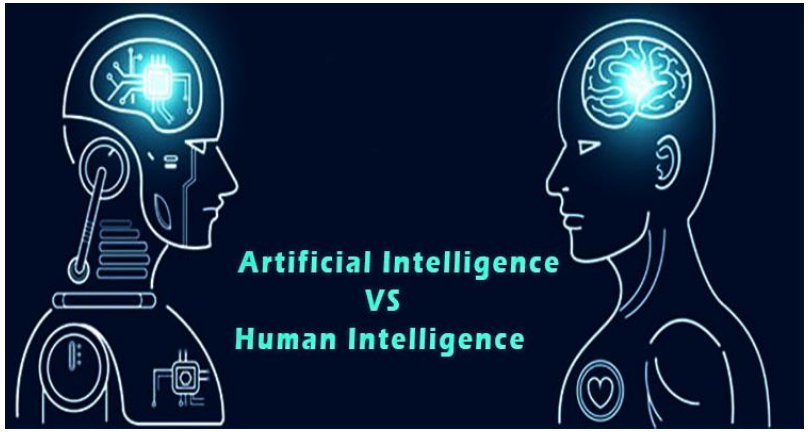
Learning enhances the awareness of the subjects of the study.

- Learning is categorized as −
  - **Auditory Learning** − It is learning by listening and hearing.
  - **Episodic Learning** − To learn by remembering sequences of events that one has witnessed or experienced.
  - **Motor Learning** − It is learning by precise movement of muscles.
  - **Observational Learning** − To learn by watching and imitating others.
  - **Perceptual Learning** − It is learning to recognize stimuli that one has seen before.
  - **Relational Learning** − It involves learning to differentiate among various stimuli on the basis of relational properties, rather than absolute properties.
  - **Spatial Learning** − It is learning through visual stimuli such as images, colors, maps, etc.
  - **Stimulus-Response Learning** − It is learning to perform a particular behavior when a certain stimulus is present.

Other components

- Problem Solving
  - It is the process in which one perceives and tries to arrive at a desired solution from a present situation by taking some path, which is blocked by known or unknown hurdles.
  - Involves decision making
- Perception
  - It is the process of acquiring, interpreting, selecting, and organizing sensory information.
  - presumes sensing.
- Linguistic Intelligence
  - It is one's ability to use, comprehend, speak, and write the verbal and written language. It is important in interpersonal communication.

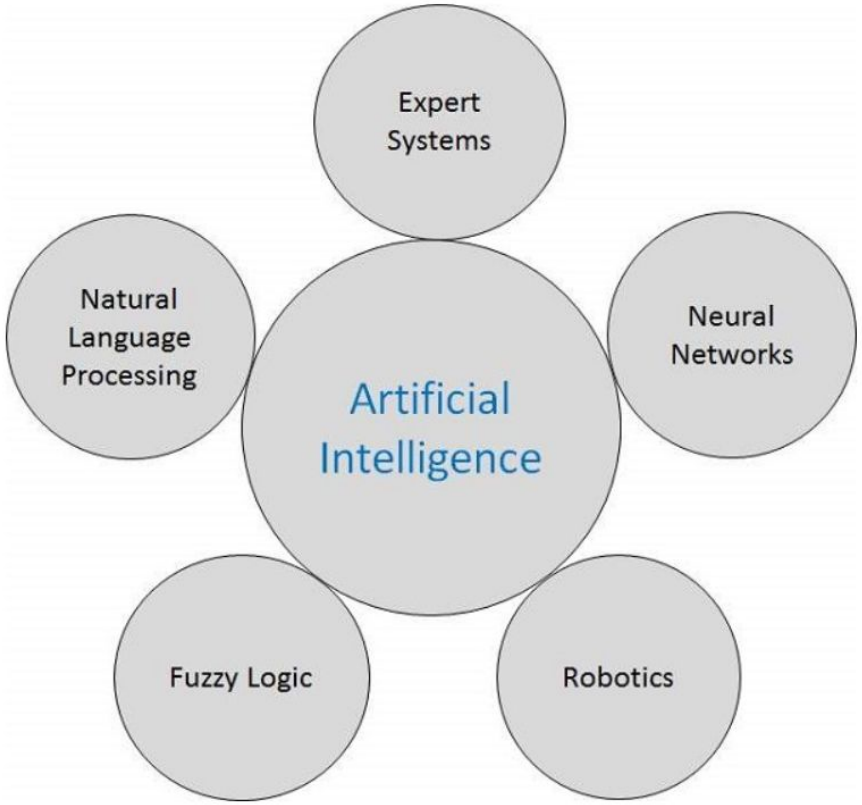
Difference between machine and human intelligence



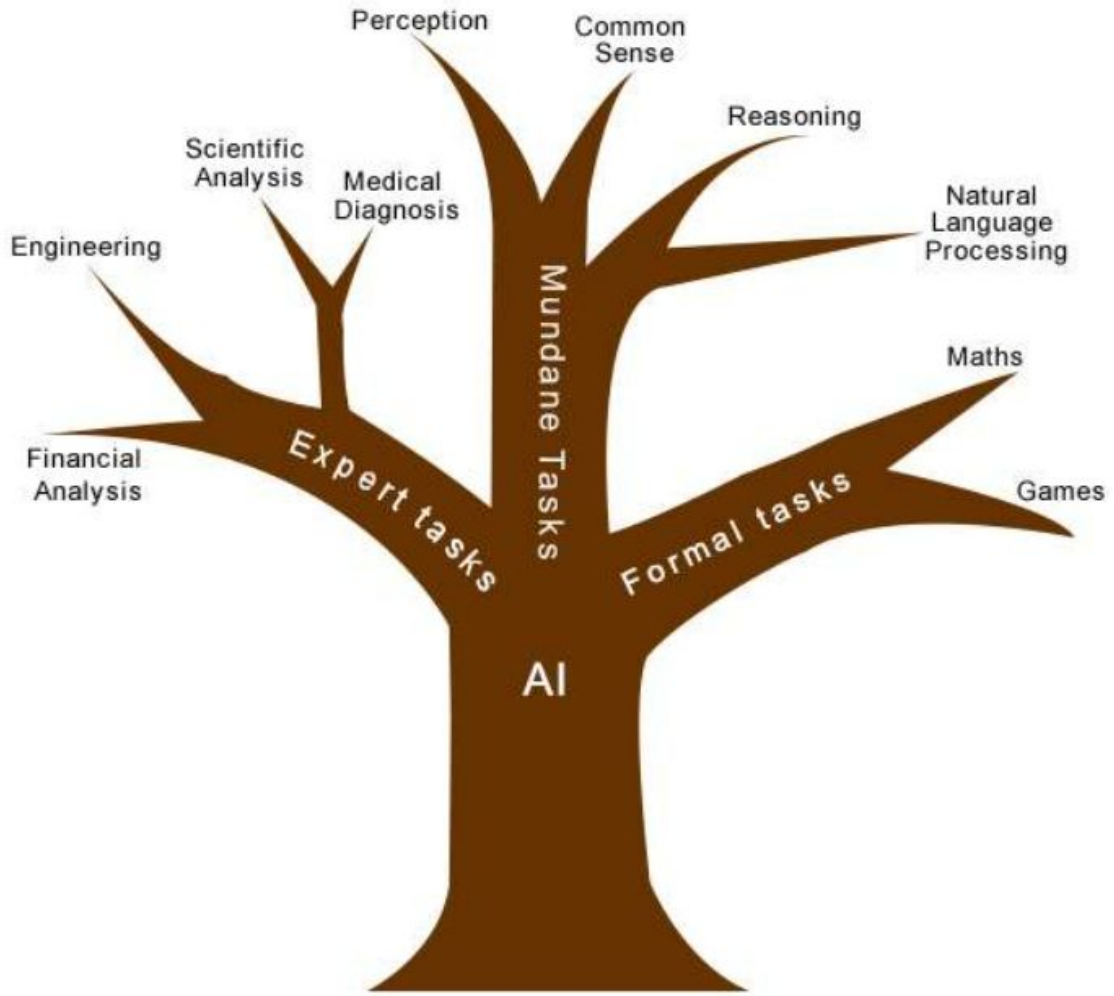
Pros

Human Intelligence	Artificial Intelligence
• Intuition, Common sense, Judgement, Creativity, Beliefs etc	• Ability to simulate human behavior and cognitive processes
• The ability to demonstrate their intelligence by communicating effectively	• Capture and preserve human expertise
• Reasoning and Critical thinking	• Fast Response. The ability to comprehend large amounts of data quickly.

Research Areas



AI Tasks



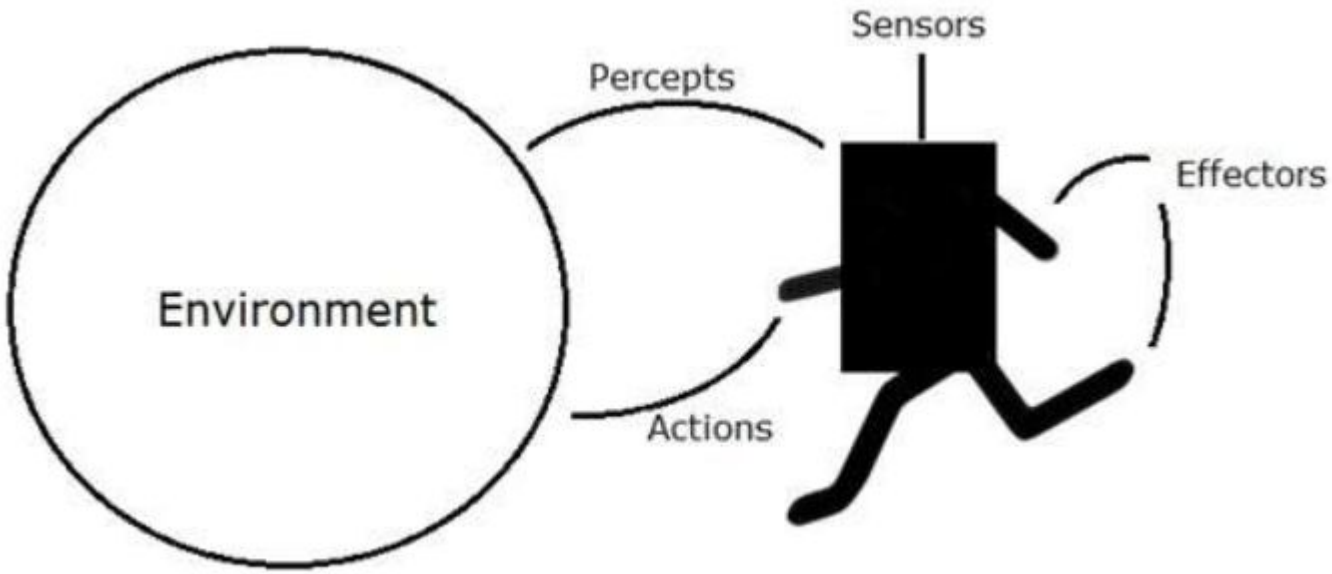
Task Domains of Artificial Intelligence

AI Tasks

Task Domains of Artificial Intelligence		
Mundane (Ordinary) Tasks	**Formal Tasks**	**Expert Tasks**
Perception ▪ Computer Vision ▪ Speech, Voice	▪ Mathematics ▪ Geometry ▪ Logic ▪ Integration and Differentiation	▪ Engineering ▪ Fault Finding ▪ Manufacturing ▪ Monitoring
Natural Language Processing ▪ Understanding ▪ Language Generation ▪ Language Translation	Games ▪ Go ▪ Chess (Deep Blue) ▪ Ckeckers	Scientific Analysis
Common Sense	Verification	Financial Analysis
Reasoning	Theorem Proving	Medical Diagnosis
Planing		Creativity
Robotics ▪ Locomotive		

Agents and Environments

- AI system is composed of an Agent and their environment
  - **“agent”** is anything that can perceive its environment through **sensors** and acts upon that environment through **effectors / Actuators.**
    - **Human**
    - **Software**
    - **Robot**



Agent terminology

- **Performance Measure of Agent** − It is the criteria, which determines how successful an agent is.
- **Behavior of Agent** − It is the action that agent performs after any given sequence of percepts.
- **Percept** − It is agent's perceptual inputs at a given instance.
- **Percept Sequence** − It is the history of all that an agent has perceived till date.
- **Agent Function** − It is a map from the precept sequence to an action.

Rational Agent

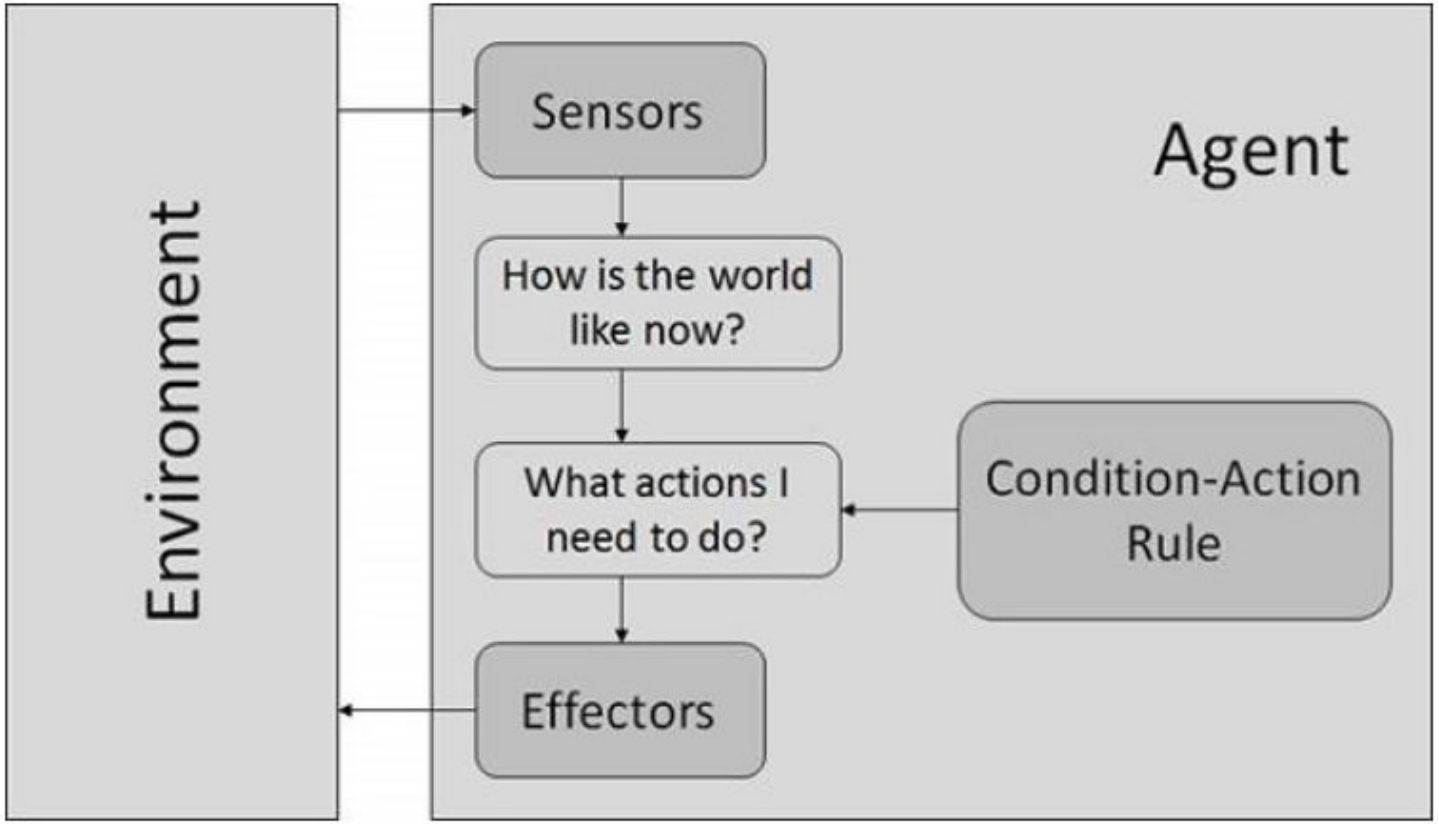
- Status of being reasonable, sensible, and having good sense of judgment.
- Expected actions and results depending upon what the agent has perceived.
- ideal rational agent has base of --
  - Its percept sequence
  - Its built-in knowledge base
- Rationality of an agent depends on the following −
  - The **performance measures**, which determine the degree of success.
  - Agent's **Percept Sequence** till now.
  - The agent's **prior knowledge about the environment**.
  - The **actions** that the agent can carry out.

The Structure of Intelligent Agents

- Agent = Architecture + Agent Program
- Architecture = the machinery that an agent executes on.
- Agent Program = an implementation of an agent function.

- Simple Reflex Agents
  - They choose actions only based on the current percept.
  - They are rational only if a correct decision is made only on the basis of current precept.
  - Their environment is completely observable.

Condition action Rule



Model Based Reflex Agents

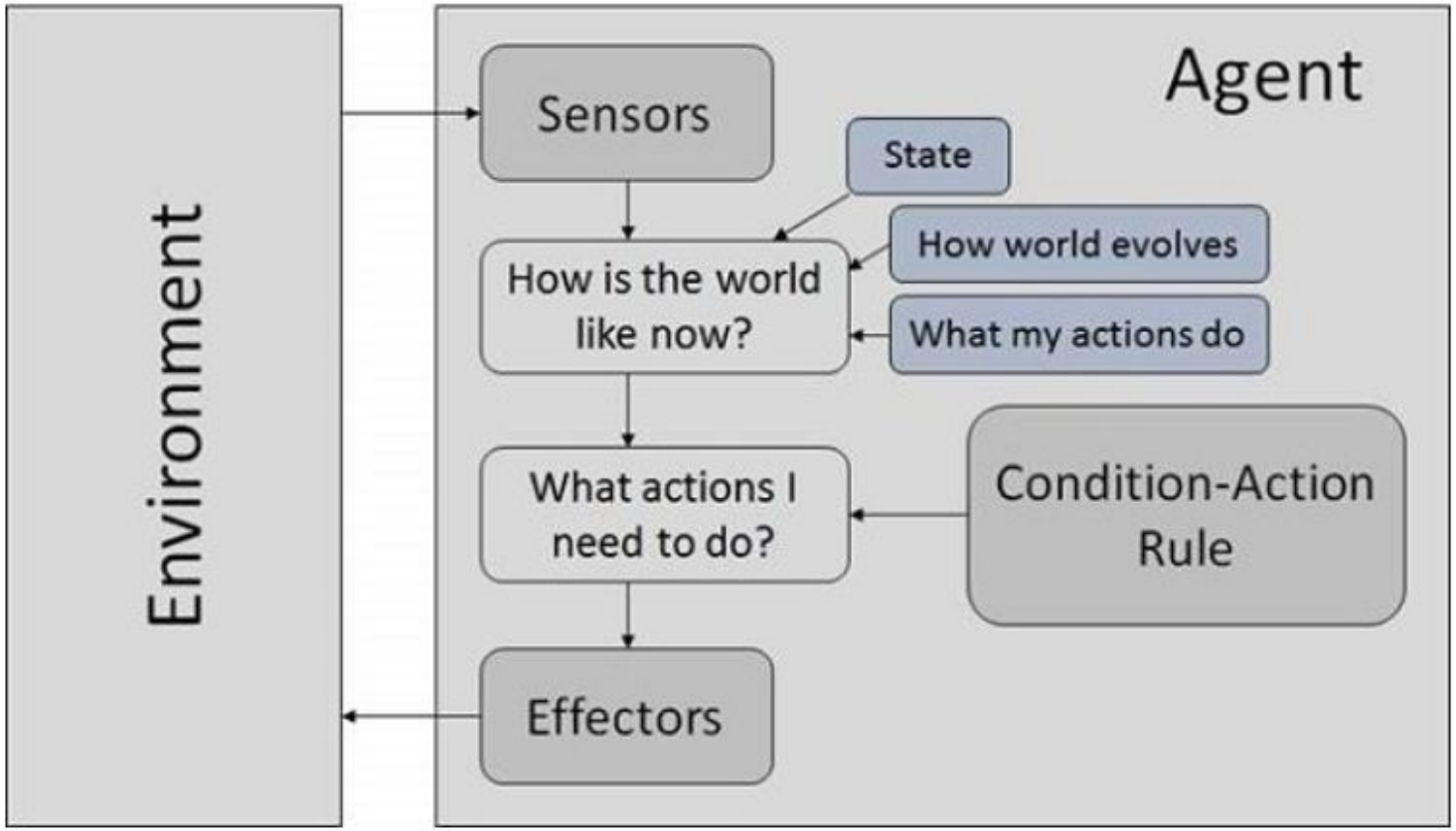
They use a model of the world to choose their actions. They maintain an internal state.

- **Model** − knowledge about “how the things happen in the world”.
- **Internal State** − It is a representation of unobserved aspects of current state depending on percept history.

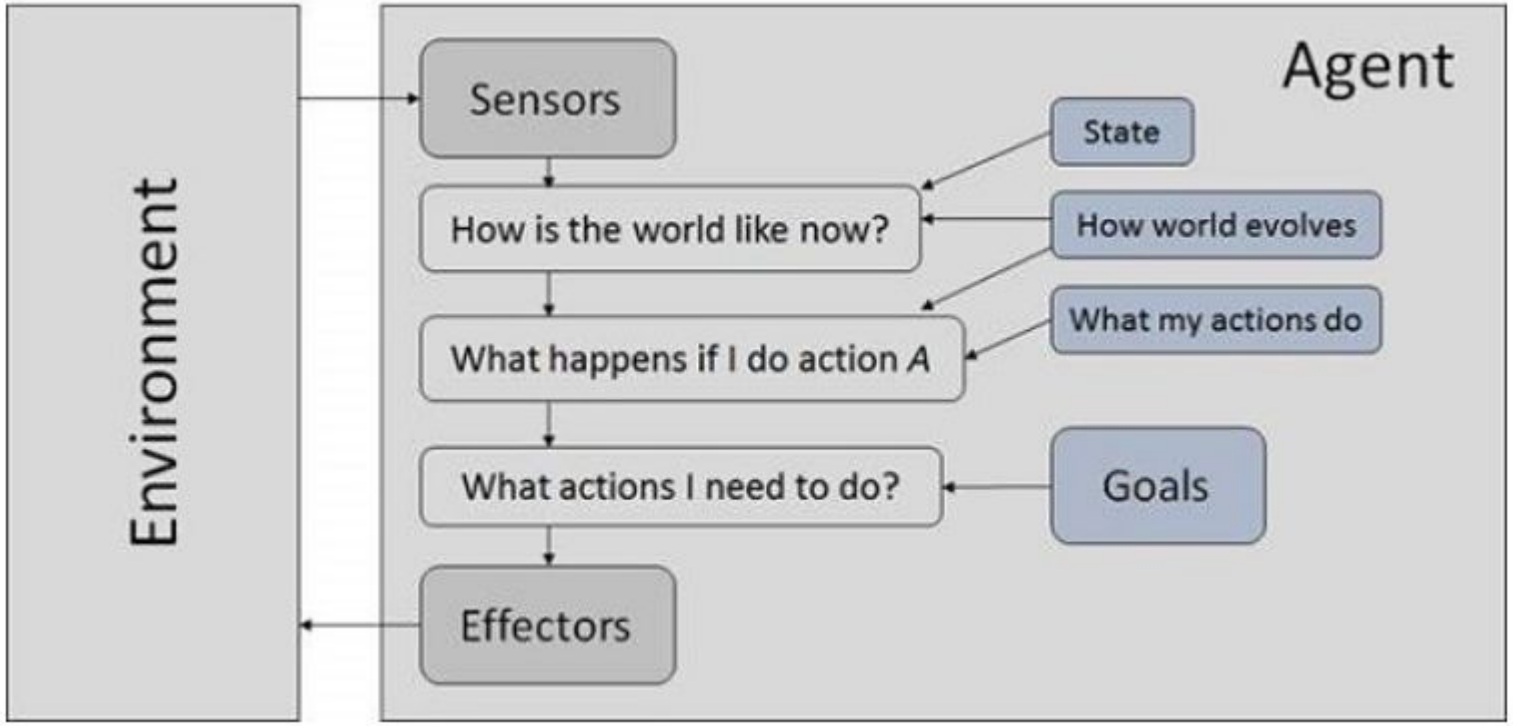
Updating the state requires the information about −

- How the world evolves.
- How the agent’s actions affect the world.

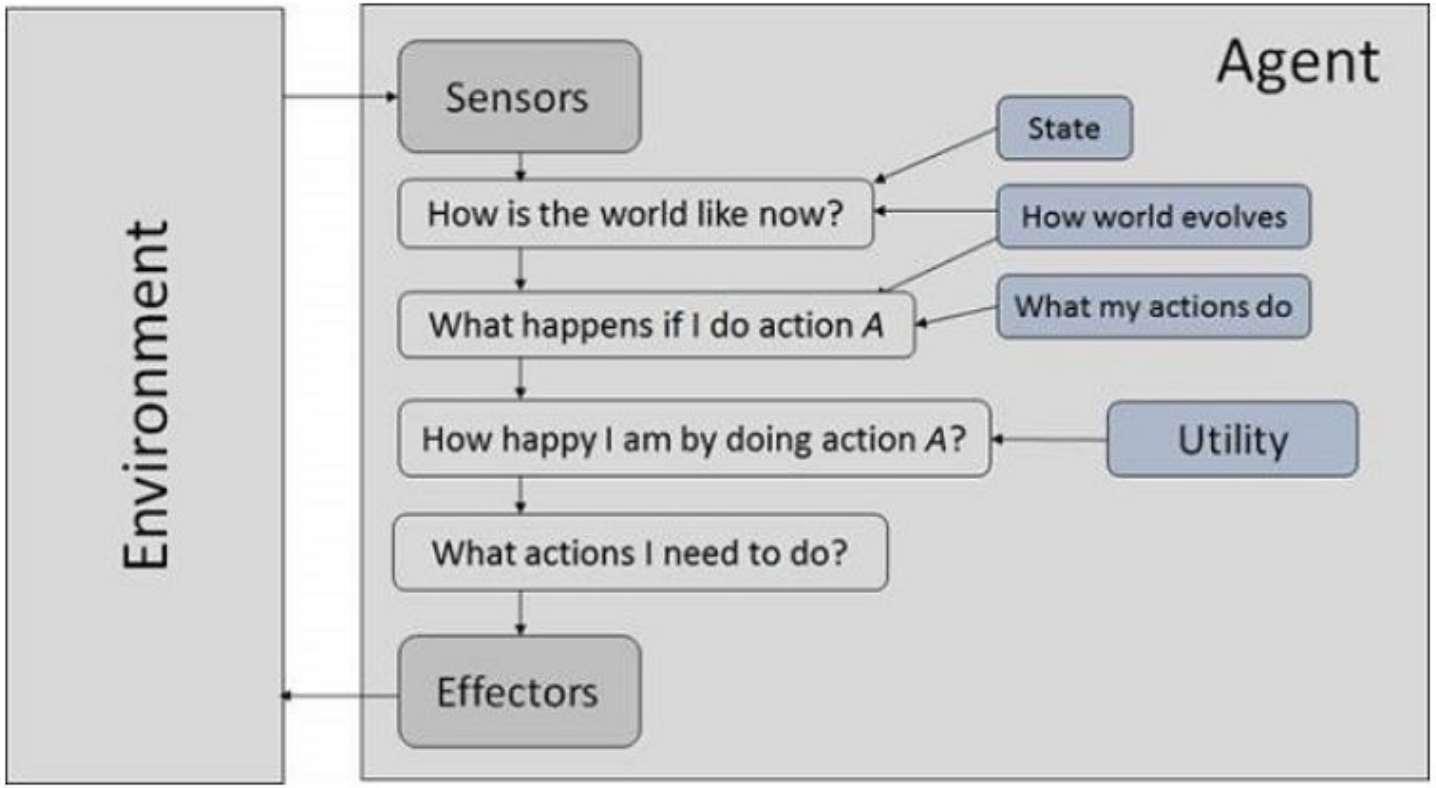
Model based reflex agents



Goal based agents



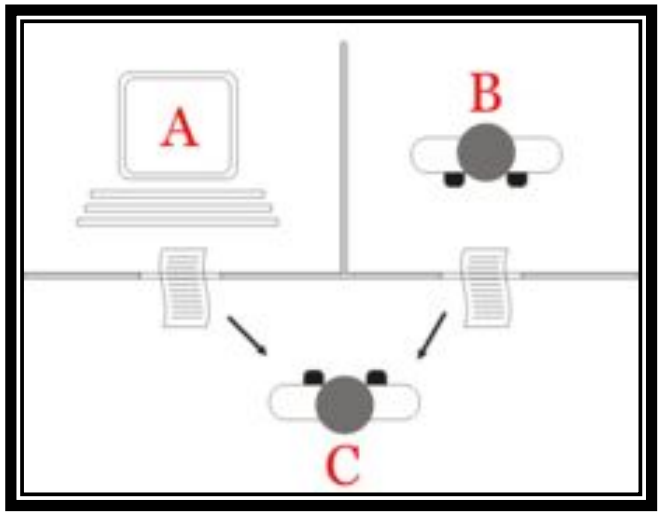
Utility Based agents



Turing Test

- The Turing test, originally called the imitation game by Alan Turing in 1950 is a test of a machine's ability to exhibit intelligent behaviour equivalent to, or indistinguishable from, that of a human.

"A human evaluator would judge natural language conversations between a human and a machine designed to generate human-like responses. The evaluator would be aware that one of the two partners in conversation is a machine, and all participants would be separated from one another. The conversation would be limited to a text-only channel such as a computer keyboard and screen so the result would not depend on the machine's ability to render words as speech."



Case study

- https://www.youtube.com/watch?v=LzdXpUAsO98&t=113s

Resources

Web References:

- **Tutorialspoint.com**
- https://www.researchgate.net/publication/236346414_AN_OVERVIEW_OF_ARTIFICIAL_INTELLIGENCE
- https://tutorials.one/artificial-intelligence-vs-human-intelligence/

Text References:

- **Artificial Intelligence: A Modern Approach by Stuart Russal & Peter Norvig**
- **Artificial Intelligence for Humans by Jeff Heaton**
- **Artificial Intelligence the basics by Kevin Warwick**