Introduction to Artificial Intelligence
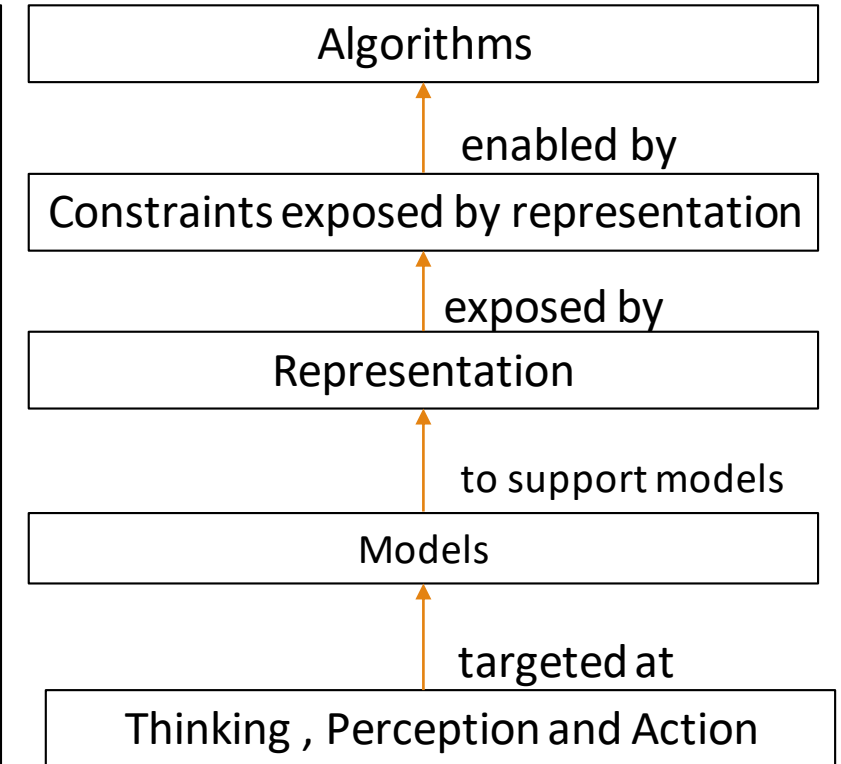
Introduction

Artificial

- Borrowing characteristics from human
- Thinking
- Perception
- Action

Intelligence

- find solutions to complex problems

Introduction

- The phenomenon of decoding human intelligence to machines.

- Design the intelligent machines

- Also known as *machine intelligence.*

Algorithms

↑ enabled by

Constraints exposed by representation

↑ exposed by

Representation

↑ to support models

Models

↑ targeted at

Thinking , Perception and Action

Types of AI

❑ **Weak AI / Artificial Narrow Intelligence**

when machines has limited range of abilities.

❑ **Strong AI/ Artificial General Intelligence**

machines work at par with humans.

❑ **Artificial Super Intelligence**

machines match and surpass the human mind.

Weak Vs Strong AI

Weak AI	Strong Al
Intelligent behaviour can be modelled.	Hypothetical machine that can exhibits human abilities
Accomplish specific problems only.	Machine having their own mind which can think and accomplish complex tasks on their own.
Alexa and Siri Google search engine Image Recognition softwares Self driving cars IBM Watson	This does not exists yet.

History of AI

1940-1950: Early days

Warren McCulloch & Walton Pits

They proposed a *model of Artificial neurons*

1950

Alan Turing proposed *TURING TEST*

Gave a method to distinguish between machine and human.

Can machines talk like human?

Can we figure out whether or not a machine answer the query in a more human manner.

1951

Scientists start thinking *Games on Machine*

Machine named as Ferranti Mark 1 was designed and a program was developed on this machine for *checker game.*

1956

Time when term *AI was actually Coined by* **John** McCarthy in Dartmouth conference.

Two month workshop was held with 10 attendees.

Their agreement gave rise to the outcome of the term AI

AI is the science and engineering of making intelligent machines*.*

1959

Research in AI was raised to the upper level.

MIT lab started research in AI at the broader level.

1960-1961

George Devol

Developed first *AI robot(Unimate)* in 1961. *It was the first industrial robot.*

1997

IBM Deep Blue won the chess championship.

Great achievement of AI

2005

Stanley Robotic car was launched.

It won the Darpa Vehicle Grand Challenge.

2016

Hanson Robotics developed first *Humanoid Robot Sophia.*

Sophia is a social robot

AI is on the rise Nowadays

A) Greater Computational Power

B) Availability of Huge Data.

C) Best Algorithms

Approaches of AI

Systems that think like humans	Systems that think rationally
Systems that act like humans	Systems that act rationally

Definitions of AI

Systems that think like humans:	Systems that think rationally:
1. "The exciting new effort to make computers think. *Machines with minds*, in the full and literal sense." (Haugeland, 1985) 2. The automation of activities that we associate with human thinking tasks such as decision-making, learning, problem solving, etc. (Bellman 1978)	1. The study of mental faculties (power) through the use of computational models. (Charmaik and McDermott, 1985) 2. The study of computations that make it possible to perceive, reason, and act." (Winston, 1992)
Systems that act like humans 1. **"The art of creating machines that perform functions that require intelligence when performed by people." (Kurzwell, 1990).** 2. **"The study of how to make computers do things at which, at the moment, people do better." (Rich and Knight, 1991)**	Systems that act rationally: 1. "Computational Intelligence is the study of design of intelligent agents." (Poole et al., 1998) 2. AI is concerned with intelligent behaviour in the artifacts (articles /products created by human) (Nilsson, 1998)

THINKING HUMANLY

THE COGNITIVE MODELING APPROACH

➢ need to get inside the actual working of human minds.
   ⌗ There are two ways to study actual working of human minds:
1) Through introspection
2) Through Psychological experiments

THE COGNITIVE MODELING APPROACH CONTD……

1) Through introspection:

- try to catch our own thoughts as they go by. Once we have a sufficiently precise theory of mind, it becomes possible to express the theory as a computer program.

- If the program's input/output and timing behaviors match corresponding human behavior then it implies that some of the program's mechanisms could also be operating like humans.

THE COGNITIVE MODELING APPROACH CONTD……

2) Through Psychological experiments

- The interdisciplinary field of **cognitive science** brings together the models from AI and experimental techniques from psychology to construct precise and testable theories of the workings of minds.

- **Cognitive science** is the interdisciplinary, scientific study of the mind and its processes. It examines the nature, the tasks, and the functions of cognition.

- Cognitive scientists study intelligence and behavior, with a focus on how nervous systems represent, process, and transform information.

THINKING RATIONALLY

➤ **THE "LAWS OF THOUGHTS/ LOGIC" APPROACH**

The Greek Philosopher Aristole was the first to attempt "the right thinking" approach for reasoning process.

▪ **syllogisms approach i.e.** form of reasoning in which a conclusion is drawn from two given or assumed propositions.

For example, John is a man. All men are mortal.

Therefore, John is mortal.

These laws of thought were supposed to govern the operation of mind and their study initiated the field called **logic.**

The **logistic tradition** within AI build programs to create human intelligence.

THE "LAWS OF THOUGHTS/ LOGIC" APPROACH CONTD…

☐ There are two main obstacles to logic approach:

- It is not always possible to take informal knowledge and state it in logical notation; especially for uncertain knowledge.

- Large Computational resources to reach a conclusion. Even problems with just few dozens facts exhaust the computational resources of a computer unless it has guidance as to which reasoning steps to follow first.

ACTING HUMANLY

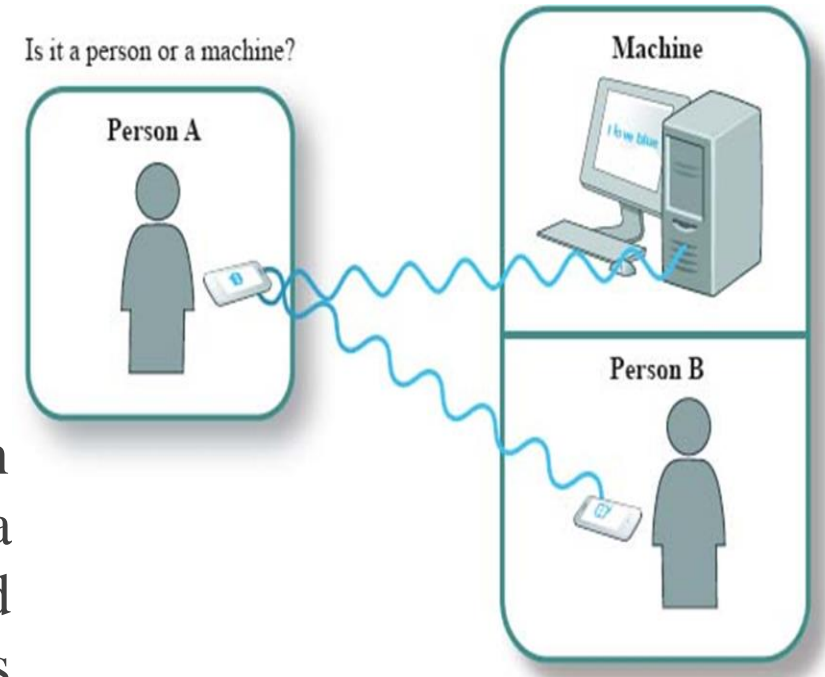**THE TURING TEST APPROACH**

☐ Proposed by Alan Turing (1950)

- The test was designed to provide a satisfactory and operational definition of intelligence.

- He suggested a test for determining whether or not a computer is capable of thinking like a human.

- In the basic Turing Test, there are three terminals. Two of the terminals are operated by humans, and the third terminal is operated by a computer.

ACTING HUMANLY:
THE TURING TEST APPROACH

☐ Each terminal is physically separated from the other two.

- One human is designated as the interrogator. The other human and the computer are designated the respondents.

- The questioner interrogates both the human respondent and the computer according to a specified format, within a certain subject area and context, and for a preset length of time (such as 10 minutes).

Is it a person or a machine?

Person A

Machine

Person B

ACTING HUMANLY:
THE TURING TEST APPROACH

After the specified time, the questioner tries to decide which terminal is operated by the human respondent, and which terminal is operated by the computer. The test is repeated many times.

⚐ If the questioner cannot reliably distinguish the machine from the human, the machine is said to have passed the test.
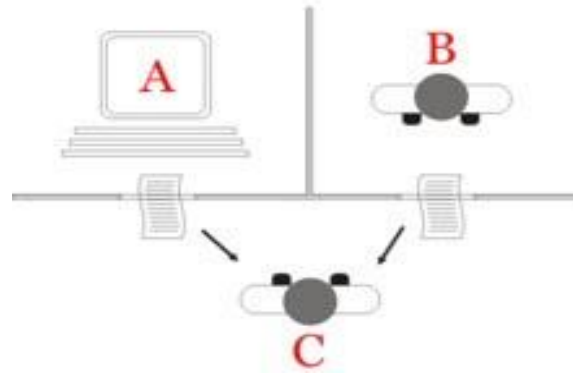

Figure 1: The "standard interpretation" of the Turing Test, in which player C, the interrogator, is given the task of trying to determine which player – A or B – is a computer and which is a human. The interrogator is limited to using the responses to written questions to make the determination

CRICTICISM/LIMITATION OF TURING TEST

The Turing Test has been criticized due to:

the fact that the nature of the questioning must be limited in order for a computer to exhibit human-like intelligence.

For example, a computer might score high when the questioner formulates the queries so they have "Yes" or "No" answers and pertain to a narrow field of knowledge, such as mathematical number theory.

If response to questions of a broad-based, conversational nature, however, a computer would not be expected to perform like a human being. This is especially true if the subject is emotionally charged or socially sensitive.

REQUIREMENTS FOR MACHINE TO PASS TURING TEST

The computer need to process the following capabilities in order to pass the Turing Test:

- **Natural Language Processing**: In order to communicate successfully in naturally language with the machine.

- **Knowledge Representation**: to store what the machine knows or hears.

- **Automated Reasoning**: to use the stored information to answer questions and to draw new conclusions.

- **Machine Learning**: to detect and extrapolate patterns and to adapt new circumstances.

FULL TURING TEST

⚐ Turing test does not allow (deliberately avoided) physical interaction between the interrogator and the computer as it assumes that physical simulation is not necessary for intelligence.

⚐ The total turing test includes a video signal so that the interrogator can test the subject's perceptual abilities and the ability for the interrogator to pass physical simulations.

⚐ In order to pass the total turing test, a machine must possess:

- **Computer Vision**: to perceive objects.
- **Robotics**: to manipulate and move objects.

ACTING RATIONALLY
THE RATIONAL AGENT APPROACH

- An agent is something that acts.

- Computer agents are different from programs as they operate under autonomous control, perceiving their environment, adaptable to change, etc.

- A **rational agent** is one that acts so as to achieve the best outcome.

THE RATIONAL AGENT APPROACH ADVANTAGES:

1) It is more general than "laws of thought" approach.

   "Laws of thought" approach deals with correct inference and making correct inference is part of rational agent. One way to act rationally is to reason logically to the conclusion.

2) It is more amenable to scientific development than the approaches based on human behavior or human thought.

   Standard of rationality is general where as human behavior is well adapted to specific environment.

Figure 1

Figure 2

Figure 3

Rationality

The term **rational** in a very specific, technical way:

- Rational: maximally achieving pre-defined goals
- Rationality only concerns what decisions are made (not the thought process behind them)
- Goals are expressed in terms of the **utility** of outcomes
- Being rational means **maximizing your expected utility**

Scope of Artificial Intelligence

➢Medical Domain

   Early detection of cancer

➢Online Gaming

➢ Future Predictions

      weather prediction

➢Marketing

      Sales Prediction

➢Banking

      Chatbot for handling customer queries

Scope Conti…..

➢Agriculture Domain

Identifies potential defects and nutrient deficiencies in the soil through images.

➢ Society

Translating languages in real life

➢Autonomous Vehicles

Self Driving Cars

➢Social Media

Appearance of Ads based on your interests