Unit -1: Introduction

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Intelligence

Intelligence

Artificial

The terms Artificial known as:

1. something that is created or produced by human beings
2. or Man mad things which looks like natural things

Intelligence

It is a mental capability that, involves the:

1. ability to learn form experience
2. ability to plan
3. ability to solve problems
4. ability to comprehend complex ideas
5. ability to reason
6. ability toplan and execute complex tasks

Artificial Intelligence(AI)

Artificial intelligence is the branch of computer science which concerned with designing intelligent computer systems that behave like humans intelligence.

John McCarthy

Artificial Intelligence (AI), a term coined by emeritus Stanford Professor John McCarthy in 1955, was defined as "the science and engineering of making intelligent machines".

Elaine Rich

"AI is the study of how to make computers do things at which, at the moment, people are better"

Artificial intelligence

Artificial intelligence (AI) refers to the intelligence of machines or computer systems that enables them to imitate or mimic human capabilities. The key aspects of AI include:

- **Humanly Contrived:** AI systems are created by humans, often in imitation of natural intelligence.
- **Problem-Solving:** AI uses algorithms and techniques like machine learning to process data, learn from it, and solve complex problems.
- **Natural Language Processing:** AI can understand and generate human language, enabling applications like chatbots and virtual assistants.
- **Computer Vision:** AI can identify and process images and videos, similar to human vision.
- **Narrow vs. General AI:** Current AI is mostly "narrow" or specialized, while the concept of "general AI" with human-level intelligence remains theoretical.

Types of AI

There are generally 3 types of AI.

1. **Weak AI:** Weak AI is also known as narrow AI. It Focuses on one task and cannot perform beyond its limitations (common in our daily lives).
   Eg. IBM's Watson,Siri and Alexa are weak AI. This categorization happens with the help of unsupervised programming.

2. **Strong AI:** Strong AI is more like the human brain and is also known as artificial general intelligence. It has cognitive abilities that help to perform unfamiliar tasks and commands. Can understand and learn any intellectual task that a human being can.
   Eg. Visual perception, speech recognition, decision making, and translations between languages.

3. **Super AI:** Super AI is AI that to go beyond in excellencethan human intelligence and ability. It's also known as artificial superintelligence (ASI) or superintelligence. It surpasses human intelligence and can perform any task better than a human
   Eg. It's the best at everything: maths, science, medicine, etc.

Advantages and Disadvantaes of Artificial Intelligence

Advantages

- Reduce human errors
- improve productivity, efficiency and accuracy
- Unbiased Decisions
- Perform Repetitive Jobs

Disadvantaes

- High Costs
- Unemployment
- No Creativity
- Emotionless

AI Perspective

There are mainly four ways to approach of AI:

- Acting humanly (The Turing Test Approach)
- Thinking humanly (Cognitive modeling approach)
- Acting rationally (The rational Agent approach)
- Thinking rationally (The Law of thought approach)
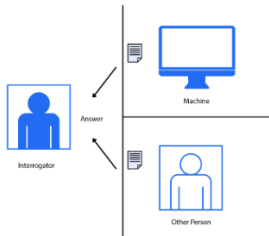
Acting humanly (The Turing Test Approach)

Figure: Turing Test

- The Turing Test, proposed by Alan Turing (1950), was designed to provide a satisfactory operational definition of intelligence.
- This test is used to evaluate a computer acting like humanly.
- A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer.

Acting humanly (The Turing Test Approach)

To pass a Turing test, a computer must have following capabilities:

- **Natural Language Processing:** Must be able to communicate successfully.
- **Knowledge representation:** To store what it knows and hears.
- **Automated reasoning:** Answer the Questions based on the stored information.
- **Machine learning:** Must be able to adapt in new circumstances.

To pass the total Turing test computer must have following additional capabilities:

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

Thinking humanly (Cognitive modeling approach)

If we are going to say that a given program thinks like a human, we must have some way of determining how humans think. We need to get inside the actual workings of human minds.

There are 3 ways.

1. **Through introspection:** trying to catch our own thoughts as they go by,

2. **Through psychological experiments:** observing a person in action,

3. **Through brain imaging:** observing the brain in action

Acting rationally (The rational Agent approach)

- All computer programs do something, but computer agents are expected to do following:
  - operate autonomously
  - perceive their environment
  - persist over a prolonged time period
  - adapt to change
  - create and pursue goals
- **An agent** is just something that acts.
- **A rational agent** is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.
- **Rational Behaviour** is doing the right thing which is expected to maxmize goal achievement , given the available information.
- In the "laws of thought" approach to AI, the emphasis was on correct inferences, On the other hand, correct inference is not all of rationality; in some situations, there is no provably correct thing to do, but something must still be done.

Thinking rationally (The Law of thought approach)

- Aristotle was one of the first to attempt to codify "right thinking" that is, irrefutable reasoning processes.
- His syllogisms provided patterns for argument structuresthat always yielded correct conclusions when given correct premises.

Eg.: If Hari is man
All men are mortal
Then Hari is mortal

Thinking rationally (The Law of thought approach)

- This study initiated the field of logic.
- The logicist tradition in AI hopes to create intelligent systems using logic programming.

There are 2 obstacles to this approach

1. It is not easy to take informal knowledge and state in the formal terms required by logical notation, particularly when knowledge is not 100% certain.

2. solving problem principally is different from doing it in practice. Even problems with certain dozens of fact may exhaust the computational resources of any computer unless it has some guidance as which reasoning step to try first.

History of AI

The history of artificial intelligence (AI) dates back thousands of years, with early concepts and ideas appearing in ancient myths and stories. However, AI as a formal field of study emerged in the mid-20th century.

- **Origins and Early Foundations:**
  - AI as a formal field of study emerged in the mid-20th century.
  - In 1943, a model of artificial boolean neurons to perform computation was invented.
  - Pioneering researchers like John McCarthy, Marvin Minsky, Allen Newell, and Herbert Simon laid the groundwork for AI research in the 1950s.
  - The term "artificial intelligence" was coined in 1956 at the Dartmouth Summer Research Project on Artificial Intelligence, considered the founding event of the field.
- **Periods of Enthusiasm and Disillusionment:**
  - In the 1950s and 1960s, Researchers made progress in areas like chess-playing programs, theorem-proving, and early neural networks.
  - However, by the 1970s, the field hit a period of disillusionment known as the "first AI winter", as the technology failed to live up to the high expectations. Funding and interest declined.

History of AI

- **Resurgence:**
  - The 1980s saw a resurgence of AI, with the development of "expert systems" that could capture and apply the knowledge of human experts.
  - In the 1990s and 2000s, AI research shifted towards more practical, task-oriented approaches like machine learning and natural language processing. Breakthroughs in areas like computer vision, speech recognition, and game-playing algorithms reignited interest and investment in AI.
- **Recent Advancements:**
  - The 2010s saw rapid advancements in AI, fueled by the availability of large datasets, increases in computing power, and new deep learning techniques.
  - Today, AI is being applied to an ever-widening range of domains, from healthcare and finance to transportation and entertainment.

Foundation of AI

Philosophy

- Artificial intelligence has close connections with philosophy because both share several concepts like intelligence, action, consciousness, reasoning.
- The philosophy of artificial intelligence attempts to answer the such questions:
    - Where does knowledge come from?
    - Can a machine act intelligently?
    - Can it solve any problem that a person would solve by thinking?
    - Are human intelligence and machine intelligence the same?

Mathematics

- Here, both deals about formal representation of knowledge and proof, algorithms, computation, probability etc.
- It attempt to answer following questions:
    - How algorithms, computation, inferencing are used?

Foundation of AI

Mathematics

- What are the formal rules to draw the valid conclusions?
  - What can be computed?
  - How do we reason with uncertain information?

Psychology

- Psychology is the scientific study of the human mind and its functions, especially those affecting behavior in a given context.
- The psychology in artificial intelligence attempts to answer such questions:
  - How humans think and act?
  - How different context makes the difference?

Foundation of AI

Economics

- This is the knowledge concerned with the production, consumption and wealth.
- It attempt to answer following questions:
    - How should we make decisions so as to maximize payoff?
    - How should we do this when the payoff may be far in future?
    - How should we do this when others may not go along?

Linguistics

- It is the study of language and its structure, including the study of grammar, and syntax.
- It attempt to answer following questions:
    - How does language relate to thought

Foundation of AI

Neuroscience

- It is the study of biological nervous system.
- It attempt to answer following questions:
  - How do brains process information?
  - If the theory can be extracted?

Control Theory

- In control theory a system of differential equations are given that describe a physical system like robot or an aircraft.
- It attempt to answer following questions:
  - How can artifacts operate under their own control?

Application of AI

- Healthcare
- Robotics
- Gaming
- Autonomous Planing and Scheduling
- Finance
- Education
- Entertainment
- Recommendation