

## 9. Introduction to Artificial Intelligence

Introduction, History of Artificial Intelligence, Intelligent systems: categories of AS, components of AI program, Foundation of AI, Sub Areas of AI, Applications of AI, Current trends of AI.

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The term Artificial Intelligence (AI) was introduced by John McCarthy in 1955. He defined AI as "The science and engineering of making intelligence machine."

Artificial Intelligence is composed of two words Artificial and Intelligence where Artificial defines "man-made" and intelligence defines "thinking power", hence AI means "a man-made thinking power."

In simple words, AI system works like a Human Brain, where a machine or sw shows intelligence while performing given tasks. Such systems are called Intelligent systems or expert systems. You can say that these systems can "think" while generating output.

AI is one of the newest fields in science and engineering and has a wide variety of applications. AI applications range from the general fields like learning, perception and prediction to the specific field, such as writing stories, proving mathematical theorems,

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~~Diagnosing diseases and playing chess~~

~~\*\* Foundation of AI :-~~

- AI is the study of how to make machines do things which at the moment people do better. Following are the four approaches to define AI.

Thought  
Process & →  
Reasoning

Thinking  
Humanly

Thinking  
Rationally

Behaviour →

Acting  
Humanly

Acting  
Rationally

2. Thinking Humanly: The cognitive modelling Approach.

- In order to make machine think like human, we need to first understand how human think. Research showed that there are 3 ways using which human's thinking pattern can caught.

2. Introspection through which human can catch their own thought as they go by.

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3. Psychological experiments - can be carried out by observing a person in action.

3. Brain imaging - can be done by observing the brain in action

### 3. Acting Humanly : The Turing Test Approach

- To judge whether the system can act like a human, Sir Alan Turing had designed a test known as Turing test.

- Turing test - a computer needs to interact with a human interrogator by answering his questions in written format. Computer passes the test if a human interrogator, cannot identify whether the written responses are from a person or a computer.

- To pass total Turing test, the computer will also need to have computer vision which is required to perceive objects from the environment and Robotics to manipulate those objects.

- Natural Language processing

- Knowledge Representation

- Automated Reasoning

- ML, - computer vision - Robotics.

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3. Thinking Rationally: The 'Laws of Thought' Approach

- The laws of thought are supposed to implement the operation of the mind & their study initiated the field called logic. It provides precise notations to express facts of the real world.

- It also includes reasoning and "right thinking" that is infallible thinking process. Also computer programs based on those logic notations were developed to create intelligent system.

4. Acting Rationally: The Rational Agent Approach

- Agents perceive their environment through sensors over a prolonged time period and adapt to change to create and pursue goals and take actions through actuators to achieve those goals. A rational agent is the one that does 'right' things and acts rationally so as to achieve the best outcome even when where

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is uncertainty in knowledge.

- The 2 approaches namely, thinking humanly and thinking rationally are based on the reasoning expected from intelligent system while, the other two acting humanly and acting rationally are based on the intelligent behaviour expected from them.

### \*\* Categorization of Intelligent Systems

There are three main categories.

1. Artificial Narrow Intelligence / weak AI

2. Artificial General Intelligence / strong AI

3. Artificial Super Intelligence.

#### 1. Artificial Narrow Intelligence / weak AI.

An intelligent agent is built to solve a particular problem or to perform a specific task is termed as narrow intelligence or weak AI. [Predefine Fun]

Example It took years of AI development to be able to beat the chess grandmaster and since then we have not been able to beat the machines at chess.

- Flying machine      - Using logic.

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### 2. Artificial General Intelligence / Strong AI.

- Strong AI or general AI refers to intelligence demonstrated by machine in performing any intellectual task that human can perform.

- Developing strong AI is much harder than developing weak AI. Using artificial general intelligence machine can demonstrate human abilities like reasoning, planning, problem solving, learning from self experience etc.

- Many companies, corporates are working on developing a general intelligence but they are yet to complete it.

### 3. Artificial Super Intelligence.

- As defined by a leading AI thinker Nick Bostrom, Super intelligence is an intellect that is much smarter than the best human brains in practically every field, including scientific creativity, general wisdom & social skills.

- Hypothetical concepts

- Human  $\rightarrow$  machine  $>$  Human

- [machine  $\leftrightarrow$  machine] common own Language

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- Super intelligence ranges from a machine which is just a little smarter than a human to a machine that is trillion times smarter.

Artificial super intelligence is the ultimate power of AI.

### \*\* Components of AI Program:-

#### 1. Perception.

In order to work in the environment intelligent agents need to scan the environment and the various objects in it. Agent scans the environment using various sense organs like camera, temperature sensor etc. This is called as perception.

#### 2. Knowledge representation.

There are various knowledge representation techniques like propositional logic & first order logic.

#### 3. Learning -

- Learning is a very essential part of AI and it happens in various forms.  
- Similar to human, computer program also learn in different manners.

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- The simplest form of learning is by trial and error.

#### 4. Reasoning

- Reasoning is also called as logic or generating inference from the given set of facts.

- The ability to differentiate makes reasoning one of the essential components of AI.

- Reasoning is carried out based on strict rule of validity to perform a specific task.

- Reasoning can be of two types deductive or inductive.

#### 5. Problem solving

- The problem solving agent performs precisely by defining problem and several sol.

- It address huge variety of problems.

- For example finding out winning moves on the board games, planning actions in order to achieve the defined task, identifying various objects from given images etc.

- Problem solving methods are

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mainly divided into i) general purpose methods and ii) special purpose methods

i) general purpose method are applicable to wide range of problem

ii) special purpose method are customized to solve particular type of problem.

#### 6. Natural Language processing.

- Natural language processing involve machines or robots to understand and process the language that human speak and infer knowledge from the speech i/p

- NLP aims at the text or verbal i/p from the machine or robot.

#### \* Sub Areas / Domains of AI :-

sub domains in intelligent system can be given as follows.

i) Natural Language processing.

ii) Robotics

iii) Neural NW

iv) Fuzzy logic.

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### 2. Natural language Processing

- NLP enables interaction bet<sup>n</sup> computer and human (Natural) language
- Practical appl<sup>n</sup> of NLP are in machine translation, information retrieval, text categorization, etc.
- Few more appl<sup>n</sup> are extracting 3D information using vision, speech recognition, perception, image information

### 3. Robotics

- one more major appl<sup>n</sup> of AI is in Robotics
- Robots can be used in manufacturing and handling material in medical field, in military etc.

### 3. Neural NW:-

- Neural NW is a system that works like human brain / nervous system. It can be useful for stock market analysis, in character Recognition (OCR), etc., in image compression in security, face recognition, handwriting recognition, optical character Recognition (OCR), etc.

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#### 4. Fuzzy logic -

- Apart from these AI system are developed with the help of Fuzzy logic.
- Fuzzy logic can be useful in making approximations rather than having a fixed and exact reasoning for a problem.
- You must have seen systems like AC, fridge, washing machines which are based on fuzzy logic.

#### \* \* Applications of Artificial Intelligence

- AI is commonly used for problem solving by analyzing or predicting output for a system. AI can provide solution for constraint satisfaction problems.
- It is used in wide range of fields for e.g. diagnosing diseases, in business, in education, in controlling robots, in entertainment field.

#### 9. Healthcare

- In the last, five to ten years, AI becoming more advantages for the healthcare industry and going to have a important impact on this industry.
- Healthcare industries are applying AI to make a better and faster diagnosis than human.

e.g - Fast Diagnosis,

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## 2. Business and manufacturing

- Latest generation of robots are equipped well with the performance advance, growing integration of vision and an enlarging capability to transform manufacturing.

## 3. Entertainment

- many movies, games, robots are designed to play as a character. In games they can play as an opponent when human player is not available or not desirable.

## 4. Voice Technology

- Voice recognition is improved a lot with AI.

## 5. Social Media

e.g. Facebook, Twitter &

## 6. NLP

- Machine can understand human language

## 7. Finance

- Adaptive Intelligence, algorithm trading, (ML, AI).

## 8. Data security

It helps in making data/apps more secure.

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\*\* Current trends in AI -

2. Deep Learning

Tip  $\rightarrow$  Feature extraction  $\rightarrow$  CNN Not CNN  
+ classification O/P

- Is a type of machine learning

- works on Unstructured data

- Inspired by the structure of human brains

- In terms of Deep Learning, it is called Artificial Neural NW.

- Used to handle huge amount of data, complex problems and Features Extraction.

- Deep Learning Neural NW, or Artificial Neural Networks, attempts to mimic the human brain.

- Consist of multiple layers of interconnected nodes, each building upon the previous layer to refine and optimize the prediction or categorization.

- These elements work together to accurately recognize, classify and describe objects within the data.

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### 3. Machine Learning

- A branch of artificial intelligence (AI) and computer science which focuses on the use of data and algo. to imitate the way that humans learn.

- Give computers the capability to learn without explicitly programmed.

- Provide statistical tools to explore and analyse the data.

### 3. Internet of Things (IoT)

- The concepts of smart homes, smart cars and smart world is evolving rapidly with the invention of IoT.

- The future is not far when each and every objects will be wirelessly connected to something in order to perform some smart actions without any human instructions or interference.

### 4. AI Replacing workers

### 5. Emotional AI

### 6. AI in shopping and customer service

### 7. Ethical AI