MEANING OF ARTIFICIAL INTELLIGENCE

The term artificial intelligence is not easy to define. Scientists over the years have added different meanings to the word. The issue has further become complicated due to the presence of a number of related terms and technologies which are often used interchangeably with AI when they are in fact not the same.

DEFINITION

In simple words, artificial intelligence can be defined as the ability of computer systems, i.e. hardware and software, to do tasks that normally require human beings to use intelligence.

This definition describes the commonly accepted definition of Artificial Intelligence. Almost all of the AI scientists will agree with it. But this definition leaves out the definition of the term intelligence, which causes a difference of opinion in the field. For understanding this we have to understand the usage and meaning of the term human intelligence.

Term intelligence, when used in connection to human beings, refer to one or more of the following behaviours:

- Planning
- Problem solving
- Social intelligence
- Learning
- Motion
- Reasoning
- Manipulation
- Perception
- Knowledge representation

Language recognition systems, smart navigation systems, etc. all fall under the term intelligent systems or artificial intelligence. If a human is capable of learning from experience, then he is known as intelligent. In this sense, we have systems that are capable of learning from the data fed into them will fall under artificial intelligence.

FIELDS CLOSELY RELATED TO ARTIFICIAL INTELLIGENCE

There are many fields, technologies, methodologies, techniques, etc., that are closely related to artificial intelligence. These fields are often confused with Artificial Intelligence, and the problem is magnified when experts use many of these terms interchangeably with Artificial Intelligence. Some of these terms are:

Machine Learning: Machine-learning refers to the capability of the artificially created system to learn from experience, i.e. by processing data. For example, the process by which a natural language translation program improves itself where used more and more. This is one of the subfields of Artificial Intelligence.

Neural Networks: These are one of the techniques or methods of modelling data within the discipline of Artificial Intelligence. This method tries to mimic or stimulate the working of the human brain. The networks created by this method are capable of machine learning, i.e. they improve with the usage. We will learn more about these networks in Chapter 3.

Data Science: A disciplines related to collecting, managing, and analysing data. Where all Artificial Intelligence systems are dependent on data. These are number of areas in artificial Intelligence in which data science contributes and these includes:
Robots are computing machines that have both hardware and software components and robotics is the field which deals with construction and programming of robots. Artificial intelligence contributes towards the software components of robots which can behave and work like a human being. For example, computer vision helps robots to identify their surroundings. Natural language processing helps them to communicate more effectively. Neural networks allow them to mimic emotions. Machine learning helps them to learn.

IMPORTANT PHASES IN DEVELOPMENT OF ARTIFICIAL INTELLIGENCE

As we have learned, the shifting of the artificial intelligence from science fiction to real science started in 1940s, and the term artificial intelligence was not developed until 1956. Thereafter, the pace of the development of the AI field was not spontaneous. Instead, it took its time and happened in bouts. The phases in the development of Artificial intelligence was divided into four distinct wave:

FIRST WAVE AND SECOND WAVE

The first serious boost to the development of the artificial intelligence happened with the growth of the internet. This development boosted the generation and use of data at a rate that was never seen in the history of the world previously. This is known as the first wave of artificial intelligence.

The second substantial boost to the development of artificial intelligence happened with the advancement of mobile internet. This development shifted the focus from static (and often outdated) data to the real-time data. This brought a fundamental change in the manner in which AI systems were developed and operated. This is known as the second wave of AI.

THIRD WAVE

The third serious boost to the development of Artificial Intelligence happened with the evolution of the 'Internet of Things'. Internet of Things calls for all the appliances and sensors in the world to become
smarter; i.e. to be capable of communication. These interconnected and communicating devices increased the number of internet-connected users or devices from 10 billion in the second wave to 50 billion. This fivefold increase led to unprecedented jump in the availability of data due to the multiplier effect. This change in the working and functioning of artificial systems is known as the third wave.

FOURTH WAVE

Many scientists and philosophers consider this as the next coming wave. In this wave, true artificial intelligence will emerge. This artificial intelligence will be surpass what human beings are capable of doing today.

**WORKSHEET 1: AI-related fields**

In the following quiz, try to determine which AI-related fields are involved in them. You have to select all that apply, e.g., ML involves some kind of statistics. (First one is done for you as a sample).

- Driverless cars ➔ **STATISTICS**
- Maneuvering of a rocket in its orbit in the space ➔ **ROBOTICS**
- Optimisation mechanism for online advertisement optimisation ➔ **MACHINE LEARNING**
- Chat-bots on the website for customer service

Consider the following smart products. Find out what they do and which company produced them.

<table>
<thead>
<tr>
<th>Product</th>
<th>What it does</th>
<th>Company</th>
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<tbody>
<tr>
<td>Chromecast</td>
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<td>Echo Dot</td>
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<td>Nest Hub</td>
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<td>Smart Things</td>
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TYPES OF ARTIFICIAL INTELLIGENCE

At a broad level, there are two types of Artificial Intelligence:

ARTIFICIAL NARROW INTELLIGENCE (ANI)

An existing type of AI which is capable of performing simple tasks requiring basic intelligence. The intelligence of these systems is narrow in the sense that they are only capable of performing one task, but in many cases, they can perform this one task better than human beings.

For example, Google Now and Alexa can recognise and speak multiple languages. The number of languages spoken and understood by these systems are more than what humans can speak and understand. However, Google Now and Alexa cannot drive vehicles, but in the future they might be able to communicate with the AI, which is capable of driving vehicles.

WHAT CAN ARTIFICIAL NARROW INTELLIGENCE DO?

Artificial Narrow Intelligence is capable of undertaking a number of actions which include the following:

- Processing videos for understanding them. For example, recognising when an intruder enters a house or when small children are in danger in the house.
- Performing routine of everyday tasks which might require some limited decision making. For example, ordering milk, switching off the power in empty rooms, switching on Air Conditioners when needed.
- Performing simple tasks done by secretaries. For example, taking dictations, scheduling appointments, taking minutes of meetings, reading emails, etc.
- Performing tasks that require processing data. For example, assisting doctors in diagnosing diseases based on symptoms.

ARTIFICIAL GENERAL INTELLIGENCE (AGI)

Artificial General Intelligence refers to the science fiction idea of artificial intelligence, i.e. the computer systems, which are at least as intelligent as human beings, if not more. These systems will be capable of learning and developing themselves. They will not be limited by the tasks which they can perform. These systems are in the research stage, and much breakthrough has not been made regarding them.

WEAK VERSUS STRONG ARTIFICIAL INTELLIGENCE

Artificial intelligence systems can also be classified into strong AI and weak AI systems:

Weak AI: It is the intelligence that mimics intelligence but does not process it or in other words, acts intelligently without having any intelligence. All of the AI systems in existence today fall under this category. For example, a self-driving car might recognise that it is raining, but it will not understand what rain is. A smart home security system can recognise intruders without understanding what intruder is.

Strong AI: Strong AI systems are theoretical systems that actually process intelligence. These systems currently are in the research stage.

DISCIPLINE OF ARTIFICIAL INTELLIGENCE

As we have seen, the discipline or field of Artificial Intelligence is a relatively new development as such this field has borrowed heavily from the existing disciplines and fields.
REAL LIFE USAGE OF ARTIFICIAL INTELLIGENCE

The Weak AI systems in existence today are being used in a number of fields and areas. Some of these are:

- **Gaming**: AI systems help make the games more interesting by not limiting it to pre-programmed interactions. AI systems learn from their experience and in turn, provide better gaming experience to the players.

- **Natural Language Processing**: The development in AI technology helps in advancing the natural language processing (NLP) capabilities of computer systems, i.e. their ability to understand the natural languages spoken by human beings.

- **Decision Making**: The capability of AI systems to predict or make forecasts relating to the future is helping the organisations in making better decision making, for example, diagnosing patients.

- **Vision Systems**: AI systems are helping in many real situations by interpreting and understanding visual data. For example, identifying intrusions in restricted areas, identifying fugitives, smart nannies for protecting children, etc.

- **Speech Recognition**: In this area, the AI systems are allowing computers and robots to communicate in a natural language without using heavy syntax.

- **Handwriting Recognition**: The AI helps in converting the handwritten text into computer editable text. This has dramatically helped in preserving and restoration of ancient text and documents. This has
also allowed users to interact with their systems by using handwritten commands/interactions with the help of a stylus.

- **Intelligent Robots:** AI systems are making robots more intelligent and providing them with the ability to learn and adapt.

- **Commercial Establishments:** Commercial establishments and big businesses, along with the government, are the drivers for artificial intelligence development. Adopting AI-based solutions allows businesses to cut both cost, time, and provide better services and products to the customers. Leading companies in every field are using AI solutions to stay ahead of the competition.

- **Life-Saving AI:** The healthcare industry is using AI to improve the quality of life and save it. The developments in this field include personalised drug treatments based on 24×7 monitoring using various sensors. Robot-assisted surgeries improve diagnosis. In the field of disaster management, these techniques are helping in both reducing the impact of disasters and managing the post-disaster rescue.

- **Entertaining AI:** The entertainment industry is experimenting with AI to produce original music, books, recipes, etc. Companies like Netflix and Spotify use AI to predict what the users would like to watch or listen.

## LIMITATION OF WEAK AI

The development in the field of artificial intelligence have been truly tremendous. Today, artificial intelligence has made it possible for humans to do things that were unimaginable a decade ago. Yet till date, we have been unable to create AI systems to function in the open-ended world. All of our existing AI systems are narrow or weak AIs, which are more or less closed systems, i.e. these are capable of only limited interactions with the world. The following infographic will help us in better understanding these limitations:

![Infographic](image-url)
WORKSHEET 2: AI or not

Which of the following are AI and which are not? Choose Yes (if it is AI); No (if it is not AI); or, May be (where it both can be or not, depending on the viewpoint).

Q1. A web application that accesses a Microsoft Access Database for finding information pertaining to the queries asked by the users.

Q2. A stock price forecasting system that looks for patterns in the past data for predicting the stock prices in the future.

Q3. A smart attendance system uses a fingerprint sensor in the classroom for recording attendance, and provides up to date records to parents, teachers, and school authorities on request.

Q4. A smart recommendation system that analyses user data to provide the purchase recommendations to its customers. Its recommendations are based on customer’s past purchases.

Q5. A smart online video storage system which stores user videos, generates automatic tags, and categorises them based on some standard parameters.

Q6. A smart security system that can identify the authorised persons based on their face, voice, behaviour, etc.

SOLUTION:

THREE DOMAINS OF ARTIFICIAL INTELLIGENCE

Artificial intelligence is generally divided into three separate domains:

- Data
- Computer Vision (CV)
- Natural Language Processing (NLP)

DATA

Every Artificial Intelligence System — irrespective of its function, nature, or capability — is heavily dependent on data for its functioning or in other words data is at the core of every AI system. Both of the other AI domains also need data for their functioning. Data is also at the core of the General AI systems, as these systems will have the capability of processing data for learning and growing.

Data for Artificial Intelligent System mean data that is relevant for the AI system in question. For example, an AI-based automatic student attendance system for school will not be helped by the data of images