



PART **B**

- **UNIT 1**—Introduction to AI
- **UNIT 2**—AI Project Cycle
- **UNIT 3**—Neural Network
- **UNIT 4**—Introduction to Python

Unit 1



Introduction to AI

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1.1 INTRODUCTION

In the current scenario, Artificial Intelligence (AI) is a new term that covers a broad range of domains and applications these days and is expected to impact every field in the future. Artificial intelligence is gaining the spotlight across applications in our personal and professional lives. We need to take charge of preparing ourselves and our students for the future where devices will be inbuilt with the capabilities of a human mind.

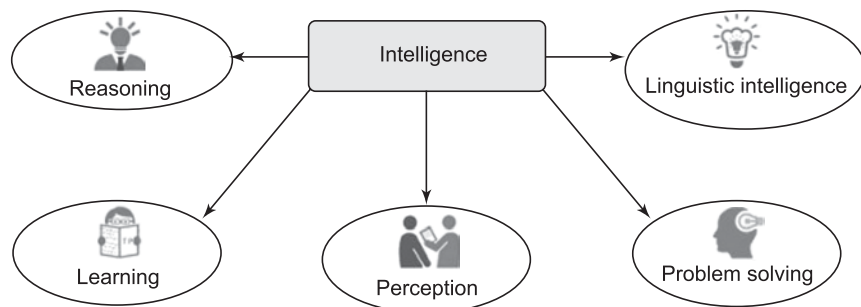
1.2 WHAT IS INTELLIGENCE?

Intelligence is the ability to think, calculate, reason and learn from experience, to solve problems and to adapt to new situations. Intelligence can also perceive relationships, learn from past experience, store and retrieve information from memory, solve problems, evaluate complex ideas, use natural language, categorize, simplify, and adjust new situations.

1.3 WHAT IS INTELLIGENCE MADE OF?

The intelligence is difficult to define and measure. Intelligence is intangible so it varies from person to person. Intelligence is different for different person and different situations. Intelligence cannot be directly observed, touched, or measured in physical terms. However, we can still say that it is composed of:

- Reasoning
- Learning
- Problem solving
- Perception
- Linguistic intelligence



Let us go through all the components briefly:

- **Reasoning**—It is the set of processes that help us in providing a base for judging, making decisions, and predicting behaviour.
- **Learning**—It is the act of gaining knowledge or skill by either studying the mechanism or by practicing a skill or being taught a concept or experiencing something around. Learning increases the awareness of the subjects to be studied.

The ability of learning is possessed by humans, some animals, and AI-enabled systems. Learning is of various types like **Auditory Learning** (through listening and hearing), **Episodic Learning** (through some sequences of events), **Motor Learning** (through movement of muscles), **Observational Learning** (through watching others), **Perceptual Learning** (through sensory experience), **Relational Learning** (through relationship or relational properties), **Spatial Learning** (through visual stimuli) and **Stimulus-Response Learning** (through a particular behaviour).

- **Problem Solving**—It is the process in which one perceives and tries to find a solution of a current situation by following some path. Problem solving also involves **decision-making**, where in one finds the best solution of a given problem among the various alternatives available.

- **Perception**—It is the process of acquiring, analysing, interpreting, selecting, and organizing sensory information. Perception presumes **sensing**. In humans, perception is derived from sensory organs. In terms of artificial intelligent, perception mechanism puts the data derived from sensory organs in an organized manner.
- **Linguistic Intelligence**—It is one's ability to use, understand, evaluate, speak, and write the verbal and written language. It is an important part of communication.

1.4 TYPES OF INTELLIGENCE

Intelligence is of many kinds depending upon the proficiency a person has. Howard Gardner, an American developmental psychologist describe '**Intelligence**' in multifold as:

1. **Linguistic intelligence**—The ability to speak, recognize, and use mechanisms of phonology (speech sounds), syntax (grammar), and semantics (meaning). Examples of Linguistic intelligence are: **Narrators, Orators**.
2. **Musical intelligence**—The ability to create, communicate with, and understand meanings made of sound, understanding of pitch, rhythm. Example of Musical intelligence are: **Musicians, Singers, Composers**.
3. **Logical-mathematical intelligence**—The ability of use and understand complex, abstract ideas and relationships in the absence of action or objects. Example of Logical-mathematical intelligence are: **Mathematicians, Scientists**.
4. **Spatial intelligence**—The ability to perceive visual or spatial information, change it, and re-create visual images, construct 3D images, and to move and rotate images. Examples of Spatial intelligence are: **Map readers, Astronauts, Physicists**.
5. **Bodily-kinesthetic intelligence**—The ability to use complete or part of the body to solve problems and control the fine and coarse motor skills. Example of Bodily-kinesthetic intelligence are: **Players, Dancers**.
6. **Intra-personal intelligence**—The ability to distinguish among one's own emotions, intentions, and motivations. Examples of Intra-personal intelligence are: the people like **Gautam Buddha**.
7. **Interpersonal intelligence**—The ability to recognize and make distinctions among other people's feelings, beliefs, and intentions. Examples of Interpersonal intelligence are: **Mass Communicators, Interviewers**.

A machine is said to be artificially intelligent, if it has any of the intelligence discussed above. To understand this, we need to find the difference between natural/human and artificial/machine intelligence.

1.5 DIFFERENCE BETWEEN HUMAN AND MACHINE INTELLIGENCE

Human Intelligence	Machine Intelligence
1. Humans perceive by patterns	The machines perceive by set of rules and data.
2. Humans store and recall information by patterns. For example, the number 40404040 is easy to remember, store, and recall as its pattern is simple.	Machines has memory that can store and recall the information by searching algorithms.
3. Humans can figure out the complete object even if some part of it is missing or distorted.	The machines finds it difficult to complete or figure out the missing part of an object and cannot do it correctly.

Important Term Related to AI

Reasoning—It is the set of processes that enables us to provide basis for judgement, making decisions, and prediction. They are broadly of two types:

Inductive reasoning	Deductive reasoning
It conducts specific observations to make broad general statements. Example: “Ram is a teacher. Ram is studious. Therefore, All teachers are studious.”	It starts with a general statement and examines the possibilities to reach a specific and logical conclusion. Example: “All women of age above 60 years are grandmothers. Sita is 65 years. Therefore, Sita is a grandmother.”

1.6 ARTIFICIAL INTELLIGENCE (AI)

In today’s world, technology is growing very fast and we are heading towards one of the booming technologies of computer science which is identified as ‘**Artificial Intelligence**’. Artificial Intelligence is nothing but making a machine that is as intelligent as a human being. The Artificial Intelligence these days is growing around us at a very fast pace. It is currently working in many areas, ranging from general to specific, such as displaying our shopping habits, self-driving cars, playing chess, proving theorems, playing music, Painting, etc.

Our future lies in AI that can make a machine to work as a human. When a machine displays attributes like learning, reasoning and solving problems based on the situation or the environment around, the machine is based on Artificial intelligence.

1.7 WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial Intelligence is made up of two words **Artificial** and **Intelligence**, where Artificial means “*man-made*,” and intelligence means “*ability to understand and think*”, hence AI means “*a man-made ability to understand and think*.”

So, we can define AI as:

“It is a branch of computer science by which we can create intelligent machines which can act like a human, think and reason like humans, and able to make decisions like humans.”

Artificial Intelligence exists when a machine can respond like a human displaying the skill of learning, reasoning, and solving problems. Artificial Intelligence is creating a machine with programmed algorithms which can work with own intelligence and that is what makes AI unique in itself.

1.8 WHY WE NEED ARTIFICIAL INTELLIGENCE?

Human Beings were responsible for giving every direction to machines in the past. Artificial Intelligence means equipping machines with the power to make its own decision like human beings. How to give them power? We can do that with the help of machine learning.

Just like human beings store the information in their brain and learn from its patterns, the scientists have also been able to use the stored machine information to make machines learn from them.

For instance, human beings know that fishes swim on the water by storing “**fish**” in their brain and watching them float on the water over and over again. Likewise, machines can also do the

same by analysing the patterns from their stored information (Machine Learning) and coming out with the conclusion to make decisions like human beings (Artificial Intelligence).

Artificial Intelligence is an approach or skill that can make a computer, a robot, or a product to think how similarly like a human. AI is a study of how human brain think, learn, decide and work, while trying to solve a problems. And later this study gives outputs as intelligent software systems. The aim of AI is to improve computer functions which are related to the knowledge of humans, for example, reasoning, learning, and problem-solving.

The long-term goals of the general intelligence sector are to do research in the field of AI related to reasoning, knowledge representation, planning, learning, natural language processing, realization, and ability to move and manipulate objects.

Before Learning about Artificial Intelligence, we should know that what is the importance of AI and why should we learn it. Let us understand some main reasons that shows the importance of AI:

- With the help of AI, we can create such software or devices which can solve real-world problems easily and with utmost accuracy such as health issues, marketing, traffic issues, etc.
- With the help of AI, we can create your personal virtual Assistant, such as Cortana, Google Assistant, Siri, etc.
- With the help of AI, we can build such Robots which can work in an environment where survival of humans can be at risk like freezing zones, political boundaries, risky terrain, etc.

Thus we can say that AI opens a new path for other new technologies, new devices, and new Opportunities for human being.

ACTIVITY-1	
Title: Excite	Approach: Guess and Win
<p>Demonstration: Students will play a games that involve the logic behind AI technology. One student who is the head will think of any real life object and will ask the other students to guess its name based on the features which he/she will ask. The students will guess the name of the real life object based on the features. For example :</p> <p>Group 1 : Head : This real life object is a fruit which is citrus in nature. Student 1 : Is it Orange ? Head : NO, It is not round. The second clue is that it has seeds Student 2: Is it pomegranate ? In this way the students become aware of how a machine will identify a real life object?</p>	
<p>Objectives</p> <ol style="list-style-type: none"> 1. Students get their first experience of Artificial Intelligence. How AI devices can identify the real life objects and portray them through its features. 2. Gain the habit of solving problems by practicing critical thinking and self-directed learning. 3. To discover more about themselves and the real world around. 	
<p>Learning Outcomes</p> <ol style="list-style-type: none"> 1. Describe application of AI in their daily lives especially in the field of identification. 2. Identify the use of identifying face through pictures. 	

Pre-requisites: Basic computer literacy

Key-concepts: Interpreting Face through pictures

Watch Videos

1. <https://youtu.be/Cgxsv1riJhI>
2. <https://youtu.be/tlC2O9T9jks>

1.8.1 Goals of Artificial Intelligence

Following are the main goals of Artificial Intelligence:

1. Imitate human intelligence
2. Solve tasks based on knowledge
3. An intelligent connection of observation and action
4. Building a machine or a device which can perform tasks that requires human intelligence such as:
 - Proving a theorem
 - Playing chess
 - Plan some surgical operation
 - Driving a car in traffic
 - Interpreting your language
5. Creating some system which can demonstrate intelligent behaviour, learn new things by itself, show, explain, and can advise to its user.

1.9

WHAT COMPRISES TO ARTIFICIAL INTELLIGENCE?

Though Artificial Intelligence is a part of computer sciences but it is very vast and requires many other factors including the environment and its agent. To induce AI, we first need to know that what factors or things build intelligence in a human being. Intelligence is an intangible part of our brain which is a combination of **Reasoning, learning, problem-solving observation, language understanding, etc.**

To incorporate the above factors in a machine, Artificial Intelligence requires the following discipline:

- Mathematics
- Biology
- Psychology
- Sociology
- Computer Science
- Neurons Study
- Statistics

1.10

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

Some of the advantages of Artificial Intelligence are as follows:

- **AI machines have high accuracy with less errors:** AI machines or systems have high accuracy since it takes decisions as per pre-experience or information. This is why such systems or machine gives output with less errors.
- **AI machines have high-speed:** AI systems have high-speed and makes fast-decision. An example of this can be seen through the machine that was able to beat a chess champion in the Chess game.

- **AI machines has high reliability:** AI machines are highly reliable and can perform the same action multiple times with accuracy.
- **AI machines are best suited for risky areas:** AI machines can be helpful in situations where employing humans can be risky such as defusing a bomb, exploring the ocean floor, keeping an eye on the international border of a country, etc.
- **AI machines can give digital assistant:** AI machines can give digital assistant to the users like it is doing in the field of E-commerce websites for showing the products as per customer requirement.
- **AI machines can be useful as a public utility:** AI machines can be very useful as public utilities such as a self-driving car for making our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.

1.11 DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

Every new technology emerges because of some advantages but at the same time it can have some disadvantages too. Artificial Intelligence has following disadvantages:

- **AI machines are high in cost:** The hardware and software requirement of AI machines is quite high. The high cost also includes the maintenance cost of the AI machines.
- **AI machines can't think out of the box:** With the emergence of AI Technology, the machines can do the task as per the instruction and algorithm given but still they cannot think or work out of the box e.g., a robot will only do that work for which they are trained, or programmed.
- **AI machines have no feelings and emotions:** AI machines can only work on the instructions and algorithm given. These machines cannot feel or react so it cannot make any kind of emotional attachment with human, and may even harm the users if proper care is not taken.
- **AI machines increase human dependency on machines:** AI is a new technology but it has made humans more dependent on the machines or devices and as a result humans are losing their mental capabilities.
- **AI machines does not have original creativity:** God has blessed humans with intelligence and creativity so humans created the AI machines but on the contrary the AI machines does not have their own intelligence and so they cannot beat the power of human intelligence and cannot be creative and imaginative.

Important Term Related to AI *Speech and Voice Recognition*

Speech and Voice Recognition are common terms in robotics, expert systems and natural language processing. Though these terms are used interchangeably, their objectives are different.

Speech Recognition	Voice Recognition
1. The speech recognition aims at understanding and grasp 'WHAT' was spoken.	The objective of voice recognition is to recognize 'WHO' is speaking.
2. It is used in hand-free computing, map, or menu navigation.	It is used to identify a person by analyzing its tone, voice pitch, and accent, etc.
3. Machine does not need training for speech recognition as it is not speaker dependent.	Voice recognition system needs training as it is person oriented.

1.12 REAL LIFE APPLICATIONS OF RESEARCH AREAS

The domain of artificial intelligence is large and widespread. The broadly common and prospering research areas in the domain of AI are as follows:

Sr.No.	Research Areas
1.	Expert Systems : Related to those devices that can be trained for working as humans. Examples: Flight-tracking systems, Clinical systems.
2.	Natural Language Processing: Related to those devices that use human language for operating. Examples: Google Now feature, speech recognition, Automatic voice output.
3.	Neural Networks: Related to those devices that work the way human brain neurons work. Examples: Pattern recognition systems such as face recognition, character recognition, handwriting recognition.
4.	Robotics: Related to those devices that are programmed to do a task in a factory or industry. Examples: Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving, etc.
5.	Fuzzy Logic Systems: Related to those devices that are based on human reasoning. Examples: Consumer electronics, automobiles, etc.

1.13 APPLICATION OF AI

AI or Artificial Intelligence can be understood as simulating human intelligence processes by machines, especially computer systems. These processes include learning, reasoning and self-correction.

AI was coined by **John McCarthy**, an American computer scientist, in 1956 at ‘**the Dartmouth Conference**’. This term that explains everything from robotic process automation to actual robotics. AI can perform tasks like identifying patterns using data more effectively than the humans, enabling deeper view of business prospects, analyzing large data for mapping poverty and climate change, automate agricultural practices and irrigation, individualize healthcare and learning, predict consumption patterns, evaluate energy-usage and waste-management.

AI is making our daily life more comfortable and easy and that is why Artificial Intelligence has various applications in today’s world like solving complex problems in an efficient way in many industries, such as Healthcare, entertainment, finance, education, etc. Following are some sectors which have the application of Artificial Intelligence:

1. Astronomy

Artificial Intelligence can be very useful to solve complex universe problems. AI technology can be useful in understanding our entire universe and how it works. This implementation could better explain the mankind about the origin of our galaxies and other milky way.

2. Healthcare

Healthcare Industries are applying AI to make a better and faster medical diagnosis than humans. AI can help doctors with diagnoses and can inform when the condition of patients are deteriorating

so that medical help can reach to the patient before hospitalization. The AI-based applications are useful in understanding medical data and drawing conclusion about the medical health of humans. These applications are applied in diagnosis and treatment, drug development, prescribing medicine, and patient monitoring and care.

3. Gaming

The AI machines can play strategic games like chess, where the machine needs to think of a large number of possible places. Many 3D and online games based on AI are also being played which has made games, an industry, these days.

4. Finance

The finance industry is implementing automation, ChatBot, adaptive intelligence, algorithm trading, and machine learning into financial processes. Many major banks across the world have implemented these emerging technologies for automation and as powerful tools for their effective operations. The implementation of the AI in the banking helped in the payment efforts and reduced complex process through simple ChatBots conversation to continue the operations without any hassles. Some banks are also using AI technology in the field of an intelligent virtual assistant to improve their customer services where as some of them are using this to prevent fraud and monitor potential threats to customers in commerce.

5. Data Security

The security of data is very important for every company especially since cyber-attacks are growing very rapidly in the digital world. AI can be used to make the data more safe and secure. Some examples of AI technology are shown in the field of security by AEG bot, AI2 Platform which can determine software bug and cyber-attacks in a better way.

6. Social Media

Social Media sites such as Facebook, Twitter, and SnapChat contain billions of user profiles, which are stored and managed in a very efficient way through the AI Technique. AI can organize, evaluate and manage massive amounts of data to identify the latest trends, hashtag and requirement of different users.

7. Travel and Transport

AI is capable of doing various travel related works such as from making travel arrangement to suggesting the hotels, flights, and best routes to the customers. Travel industries are using AI-enabled ChatBots which can make human-like interaction with customers for better and fast response.

8. Automotive Industry

Some Automotive industries are using AI to provide virtual assistant to their customers for better performance. One of the famous examples of AI in automation industry is TeslaBot, an intelligent virtual assistant introduced by Tesla. Various Automotive Industries are also currently working on developing self-driven cars which can make your journey more safe and secure.

9. Robotics

Artificial Intelligence has a major role in Robotics. Usually, general robots are programmed such that they can perform some repetitive task, but with the help of AI, we can create intelligent robots which can perform tasks with their own experiences without pre-programmed. Humanoid Robots are best examples for AI in robotics. Recently, the intelligent Humanoid robot named as Erica and Sophia has been developed which can talk and behave like humans.

10. Entertainment

In the field of entertainment, we are currently using some AI based applications in our daily life such as Netflix or Amazon Prime. With the help of machine learning algorithms, these services show the recommendations for programs or shows depending on your search history.

11. Agriculture

Agriculture is now becoming digital, and AI is emerging in this field. Agriculture is applying AI as agriculture robotics, solid and crop monitoring, predictive analysis. AI in agriculture can be very helpful for farmers. Agriculture is one of the core sectors and we have been modifying the cultivation process to yield more from it. The technologies like AI and IoT (Internet of Things) will be very useful in understanding a timely planting, getting predictions, using fertilizers, harvesting and the climate.

12. E-commerce

AI is helping shoppers to find related products with recommended size, colour, or brand. Major e-commerce companies have been using advanced technologies like AI or machine learning by using the AI as ChatBots, AI assistants, smart logistics, using algorithms to predict and analyze customers' behaviours. The ultimate aim is to reduce shipping costs. Machine learning helps companies in demand forecasting, product search ranking, product and deals recommendations, merchandising placements, fraud detection, translations and many more.

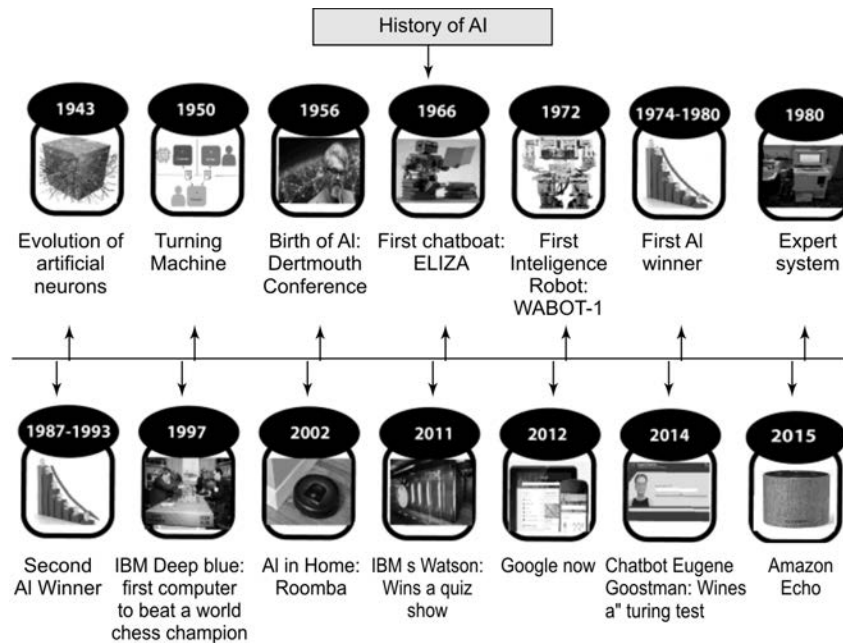
13. Education

AI can automate grading so that the teacher can have more time to teach. AI chatbot can communicate with students as a teaching assistant. AI in the future can act as a personal virtual tutor for students, who will be accessible easily at any time and any place. AI or machine learning is making our education system smarter. AI and collaborative virtual networks are used to make a perfect learning environment for students as well as teachers also.

ACTIVITY-2	
Title: Excite	Approach: Emoji Scavenger Hunt
Demonstration: Emoji Scavenger Hunt is a browser-based game built with machine learning that uses your phone's camera and a neural network (brain network) to try and guess what it's viewing.	
Objectives <ol style="list-style-type: none"> 1. Students will understand the logic behind the Artificial Intelligence application and will become excited about learning the technology behind it. 2. Gain the knowledge emoticons in real life. 3. To discover more about themselves and their knowledge about identifying emoticons. 	
Learning Outcomes <ol style="list-style-type: none"> 1. Describe application and uses of AI in daily life. 2. Identify the use of AI in facial expression. 	
Pre-requisites: Basic computer literacy	Key-concepts: Interpreting Facial expression.
Watch videos <ol style="list-style-type: none"> 1. https://youtu.be/jr3q_9pJBr8 2. https://youtu.be/pNm5OgeT7K8 	

1.14 HISTORY OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence is not a new word nor a new technology for researchers. This technology is much older than you would imagine. There are many myths of Mechanical men in Ancient Greek and Egyptian Myths. Following are the milestones in the history of AI which defines the journey from the AI generation to till date development.



1.14.1 Evolution of the Artificial Intelligence Concept (1943-1952)

In 1923, Karel Capek play named **“Rossum’s Universal Robots”** (RUR) which was shown in London. The word “robot” was first used in English, but the evolution started from 1943 onwards.

Year	Development
1943	The first development in the field of AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of artificial neurons similar to human brain neurons.
1949	Donald Hebb demonstrated Hebbian learning , an updating rule for modifying the connection strength between neurons.
1950	Alan Turing publishes “Computing Machinery and Intelligence” in which he proposed a test. The test can check the machine’s ability to exhibit intelligent behaviour equivalent to human intelligence, called a Turing test .

1.14.2 Birth of Artificial Intelligence (1952-1956)

Year	Development
1955	An Allen Newell and Herbert A. Simon created the “first artificial intelligence program” which was named as “Logic Theorist” . This program proved 38 of 52 Mathematics theorems.
1956	The word “Artificial Intelligence” was first coined by American Computer scientist John McCarthy at the Dartmouth Conference.

1.14.3 Early Years of AI (1956-1974)

Year	Development
1966	The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA.
1972	The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

The duration between years 1974 to 1980 was known as the first AI winter duration. AI winter refers to the time period where computer scientist dealt with a severe shortage of funding from government for AI researches.

1.14.4 Pre-development Stage of AI (1980-1987)

Year	Development
1980	AI came back with “ Expert System ” after the AI winter duration. Expert systems were programmed that displayed the decision-making ability of a human expert. In the Year 1980, the first national conference of the American Association of Artificial Intelligence was held at Stanford University .

The duration between the years 1987 to 1993 was the second AI Winter duration. This time also Investors and government stopped funding for AI research due to high cost.

1.14.5 Arrival of Intelligent Agents (1993-2011)

Year	Development
1997	In the year 1997, IBM machine Deep Blue beats world chess champion, Gary Kasparov.
2002	AI became a part of home in the form of Roomba, a vacuum cleaner.
2006	AI became a part of business and social networking sites like Facebook, Twitter and Netflix.

1.14.6 Arrival of Deep Learning in AI (till now)

Year	Development
2011	In the year 2011, IBM’s Watson won ‘ jeopardy ’, a quiz show, which had the complex questions and riddles. IBM Watson proved that it can understand natural language and can solve complex problems.
2012	Google launched an Android app feature “ Google now ”, which could provide the information to the user as a prediction.
2014	In the year 2014, Chatbot “ Eugene Goostman ” won a competition in the infamous “ Turing test ”.
2018	The “Project Debater” from IBM debated on complex topics with two master debaters and performed well.

Google has demonstrated an AI program “**Duplex**” which was a virtual assistant and which had taken hair-dresser appointment on call, and lady on other side didn’t notice that she was talking with the machine.

AI has made development to a remarkable level. The concept of Deep learning, big data, and data science are now latest trends in AI like a boom. Nowadays companies like Google, Facebook, IBM, and Amazon are working with AI and creating new devices. The future of Artificial Intelligence is quite promising and we see a very bright future ahead.

1.15 THREE DOMAINS OF AI

In AI, we use computer but in a different sense. Normally when we use computer, we give input and then process it and then we get the output but in AI, we feed data into the computer then analyse that data and gives out the prediction. For performing this mechanism of AI, we need to discuss the domains of AI. The three domains of artificial intelligence are:

1. Data
2. Computer Vision
3. Natural Language Processing.

Data can be in any form. It can be in the form of numerical facts or in the form of images or audio, voice or music. If the data is in the visual form like images or video, then it is related to computer vision. If the data is in the form of voice or audio or music, it is related to natural language processing.

Computer Vision is when we process graphics and video to recognize some pattern or trend. For example, when we watch a CCTV footage and try to match the criminal face for finding the culprit then it is AI using computer vision.

Natural Language Processing is when we try to understand the language spoken by the user for communication purpose then it is AI using natural language.

AI needs only data. The more the data, the better will be the analysis done and more accurate will be the predictions. Thus AI require large amount of data for predicting the output. Here output does not mean traditional computer output rather data is analyzed to find the latest trends and patterns using the data.

1.16 SOFTWARE RELATED TO AI

1.16.1 Apps to Understand AI and Machine Learning

There are some of the apps to help your children get an in-depth understanding of AI and machine learning. These are as follows:

- **Pika:** Pika is an entertaining camera app for kids. It allows kids to photograph colours and make robots learn about the colours.
- **Machine Learning for Kids:** This app provides parents with scratch and spreadsheets. The parents can track the progress of their kids via this app. The kids can also train machines via image selection or by using scratch.
- **Dalton Learning Lab:** This application offers numerous tools to help parents with AI and machine learning. The Scratch option is free for parents, and there is no need to either register or make an account on this website.

- **Kano Computing:** Kano Computing enables kids to develop their version of computers. Then, they need to program that computer for the completion of tasks. The guide is available for helping kids with the learning process.
- **VIPER:** Wonderville introduced a game, Viper, to make machine learning interesting for kids. In this game, the kids program a robot for exploring Europe.
- **Azure Machine Learning:** This cloud-based service provides tools for organizing predictive models as analytic solutions. It can also be used to test machine learning models, run algorithms, and create recommender systems.
- **Caffe:** It is an open-source framework for deep learning that supports various types of software architectures that were designed with image segmentation and image classification in mind.
- **CNTK:** CNTK (Computational Network Toolkit) is a deep learning toolkit developed by Microsoft that “**describes neural networks as a series of computational steps via a directed graph.**”
- **IBM Watson:** IBM Watson is called a “question answering machine.” It uses analytical powers and artificial intelligence to replicate human-like abilities to respond to questions.
- **Pybrain:** PyBrain is an open-source, modular machine learning library. A completely Python-based framework, PyBrain aims to be a tool that can be used by developers ranging from students who are just beginning to explore the world of Python, as well as computer science researchers in the world of deep learning and neural networks.
- **Scikit-Learn:** Scikit-learn is an open-source machine learning framework for Python that is useful for data mining, data analysis, and data visualization.
- **Swift AI:** Swift AI is a deep learning and neural network library for Swift, with support for Mac machines. This library is made up of various tools that allow developers to create neural networks, create deep learning algorithms, and work with signal processing.
- **Tensorflow:** It is originally developed by members of Google’s Machine Intelligence research division to conduct deep learning neural networks and machine learning research along with numerical computing.

About AI

Machine learning is an artificial intelligence technique, that is newly developed by creating new algorithms which imitate or support human behaviour or decision-making capabilities like Apple’s Siri, or the email servers which eliminate junk or spam emails. Before talking about the facts of AI, Let us watch some videos to understand ‘What is Artificial intelligence?’

Watch Videos

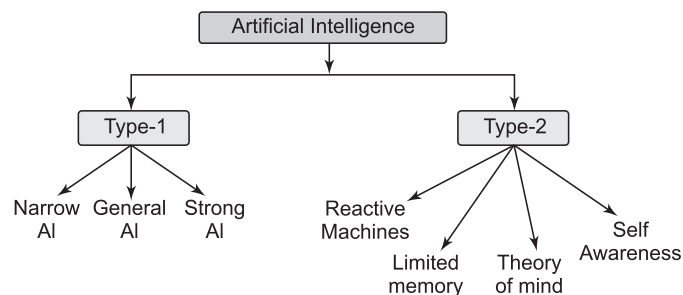
1. <https://youtu.be/kWmX3pd1f10>
2. <https://youtu.be/2ePf9rue1Ao>
3. https://youtu.be/Bg_tJvCA8zw
4. <https://youtu.be/S5t6K9iwc dw>
5. <https://youtu.be/WSbgixdC9g8>

10 Interesting Facts of AI

1. Google's AI-Powered Predictions: Using unknown location data from smartphones, Google Maps (Maps) can analyze the speed of movement of traffic at any given time. And, with its acquisition of crowd sourced traffic app Waze in 2013, Maps can more easily incorporate user-reported traffic incidents like construction and accidents. Check the Waze app on <https://youtu.be/66jehpnKoUA>. (Waze is a community driven GPS navigation app).
2. With Machine learning and language recognition, it is expected that 85% of telephonic customer service jobs will be performed by computers and will not need human interaction in future.
3. It is a fact that with increased intelligence and ability to perform tasks with accuracy, it is predicted that over the next few years around three million workers will be reporting to or will be supervised by **"Robot-bosses"**.
4. Sony created a robotic dog called **Aibo**. It is one of its first toys that could be bought and played with. It could express emotions and could also recognise its owner.
5. IBM has created a supercomputer based on AI, called Watson. Watson could understand questions in most of the common languages and has the ability to attend to the questions in real time.
6. Autonomous vehicles will be in market soon. The **knight rider** can become a reality in the next 2-3 years or less. These cars are based on the artificial intelligence that can recognise the driving conditions and adapt the behaviour. These cars are under testing and make be launched soon.
7. Researchers at the University of Stanford have built a machine learning algorithm that can predict your death with 90% accuracy.
8. Nautilus, a self-learning supercomputer can foretell your future. This is the same robot that located Osama Bin Laden and gained popularity. It can make predictions from the information provided to him.
9. A new methodology has been developed by roboticists that can create an image of your thoughts using an FMRI (Functional Magnetic Resonance Imaging) scanner. The AI is designed to construct an image from your brain and compare it with other pictures, received from volunteers.
10. Sophia, a lifelike humanoid has gained guaranteed citizenship of Saudi Arabia. She was created by Dr. David Hanson, founder of Hanson Robotics. Sophia uses artificial intelligence, visual data processing and facial recognition. Sophia also imitates human gestures, facial expressions, answer certain questions and can make simple conversations on predefined topics.

1.17 TYPES OF ARTIFICIAL INTELLIGENCE

Artificial Intelligence is divided into two categories, out of which one is based on capabilities and other one is based on functionality of AI. We can understand this division using the following flow diagram:



1.17.1 AI Type-1: Based on Capabilities

1. Weak AI or Narrow AI

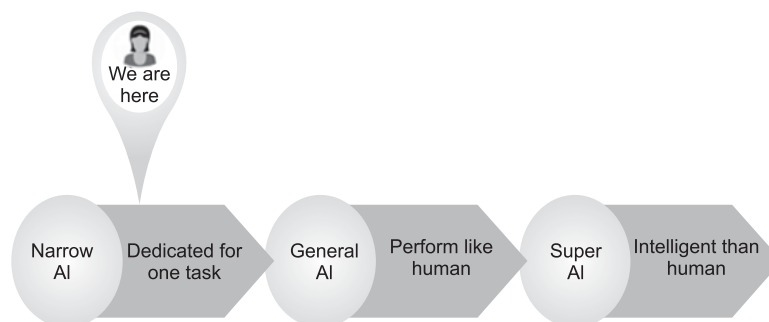
- Narrow AI is a type of AI which is able to perform a particular task with intelligence where limited part of mind is involved. The AI which is common and currently available is the Narrow AI. Narrow AI can only perform within its boundary, as it is only trained for one specific task. This is the reason Narrow AI is also known as Weak AI. Narrow AI is bounded within the limit.
- Apple Siri, Cortana, and Google Assistant are all examples of narrow AI, but they operate within a limited pre-defined range of functions.
- IBM's Watson supercomputer is also an example of Narrow AI as it uses an Expert system approach together with Machine learning and natural language processing.
- Some more examples of Narrow AI are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition where a predefined task is associated with each feature.

2. General AI

- General AI is a type of intelligence which could perform any intelligent task with efficiency like a human.
- The concept behind the general AI is to make such devices or system which can act and think smartly like a human on its own.
- Till now we have no such system which can actually be called an example of general AI and can act or behave like a human. The system with general AI are still going through under research work, and it will take lots of efforts and time to develop such systems as this would be a major step towards AI.

3. Super AI

- Super AI is that type of Intelligence where devices or systems will behave in more intelligent manner than humans or we can say that AI machines will beat human intelligence, and can perform any task better than human with cognitive thinking.
- The characteristics of strong AI will include the ability to think, reason, solve the puzzle, make judgments, plan, learn, and communicate by its own. In other way we can say that a machine having the brain of human but performing better in all the cognitive properties.
- Super AI is still an imaginary concept of Artificial Intelligence as designing such system is much beyond out-of-box task.



1.17.2 Artificial Intelligence Type-2: Based on Functionality

1. Reactive Machines

Reactive machines are the basic types of Artificial Intelligence. These AI systems do not store memories or past experiences for future actions. These machines only focus on present scenarios and react on it as per best possible action available.

IBM's Deep Blue system and Google's AlphaGo is an example of reactive machines.

Reactive machines became famous with Deep Blue that was created to play chess against a human competitor with the perception that it will defeat the competitor. Deep Blue defeated Gary Kasparov (world chess champion). Deep Blue was programmed such that it can identify a chess board and its pieces and the moves each piece can do. Deep Blue was able to make predictions that **“which moves it should make and what moves its opponent might make.”** This prediction helped him select, move and win.

2. Limited Memory

Limited memory is made up of machine learning models that develop knowledge from previously-learned information, stored data, or events. Unlike reactive machines, limited memory learns from the past by observing actions or data fed to them. These machines can store past experiences or some data for a limited period of time only.

Self-driving cars are one of the best examples of Limited Memory systems. These cars can store recent speed of nearby cars, the distance of other cars, speed limit, and other information to navigate the road and travel as per the route, direction and traffic they find currently.

3. Theory of Mind

Theory of Mind AI can make a machine understand the human emotions, people, beliefs, and be able to interact socially like humans. Such type of machines are yet to be developed and so researchers are making lots of efforts and improvement for making such AI machines.

4. Self-Awareness

- Self-awareness AI will be the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, feelings, emotions, and self-awareness. These machines will be ahead of human intelligence. Self-Awareness AI is an concept and does not exist in reality.

ACTIVITY-3	
Title: Relate	Approach: Become a chatbot
<p>Demonstration: Students will play a games that involve AI technology and computer applications. The students will be divided into groups of 5 student each and then one of them will act as a machine like a chatbot. The other students will act as a user and will ask questions.</p> <p>For example:</p> <p>Group 1: User 1 : Hello Chatbot user : hi, how can I help you ? User 2 : I am looking for a flight ticket. Chatbot user : Can You please specify the date and place?</p> <p>The chatbot replies on the basis of interpretation of the keywords. (Like in line no 3 : Looking, flight ticket are keywords)</p>	

Objectives

1. Students get their first taste of what problems Artificial Intelligence can solve and become excited about learning the technology behind it.
2. Gain the habit of solving problems by practicing critical thinking and self-directed learning.
3. To discover more about themselves and their friends.

Learning Outcomes

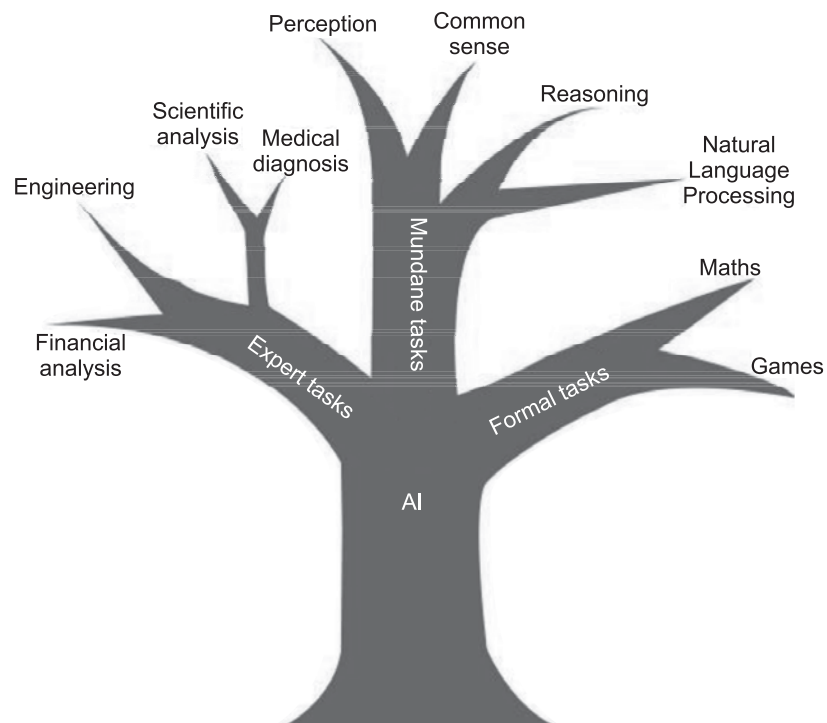
1. Describe application of AI in their daily lives that uses chatbot.
2. Identify the use of natural language processing

Pre-requisites: Basic computer literacy**Key-concepts:** Interpreting Natural language processing**Watch Videos**

1. <https://youtu.be/TL1XjHTBLKI>
2. <https://youtu.be/byXa6tIgyKY>

1.18 TASK CLASSIFICATION OF AI

The domain of AI is classified into **Formal tasks**, **mundane tasks**, and **Expert tasks**.



Task Domains of Artificial Intelligence

Mundane (Ordinary) tasks	Formal tasks	Expert tasks
<ul style="list-style-type: none"> Based on common sense, reasoning and planning <p>Perception</p> <ul style="list-style-type: none"> Computer vision Speech, voice <p>Natural Language Processing</p> <ul style="list-style-type: none"> Understanding Language Generation Language Translation <p>Robotics</p> <ul style="list-style-type: none"> Locomotive 	<ul style="list-style-type: none"> Based on verification and theorem proving <ul style="list-style-type: none"> Mathematics Geometry Logic Integration and differentiation <p>Games</p> <ul style="list-style-type: none"> Go Chess (Deep Blue) Checkers 	<ul style="list-style-type: none"> Based on Financial analysis, Medical diagnosis, Scientific analysis and creativity <ul style="list-style-type: none"> Engineering Fault/ Error finding Manufacturing Monitoring

Humans learn **mundane (ordinary) tasks** since their birth. They learn by perception, speaking, using language, and locomotives. The brain develops with age and so does the cognitive capabilities and this is why the ordinary tasks are normally done through observation. The humans learn Formal Tasks and Expert Tasks later, in that order.

For humans, the mundane tasks are easiest to learn. But since the machine cannot observe, so these ordinary task are not easy for machines. Later, it was concluded that the machine requires more knowledge, complex knowledge representation, and complicated algorithms for handling mundane tasks. This is the reason **why AI work is more successful in the Expert Tasks domain** now, as the expert task domain needs expert knowledge without observation or common sense, which can be easier to represent and handle.

An AI system is composed of an agent and its environment. Here the agent is anything that can perceive its environment through **sensors** and acts upon that environment through **effectors**.
For example :

- A **human agent** has sensory organs such as eyes, ears, nose, tongue and skin parallel to the sensors, and other organs such as hands, legs, mouth, for effectors.
- A **robotic agent** replaces cameras and infrared range finders for the sensors, and various motors and **actuators*** for **effectors****.
- A **software agent** has encoded bit strings as its programs and actions.

The environment on the other hand can sometimes be entirely **artificial that can be** confined to keyboard input, database, computer file systems and character output on a screen.

The most famous **artificial environment** is the **Turing Test environment**, in which one real and other artificial agents are tested on same grounds.

*actuator is the actual mechanism that enables the effector to execute an action like electric motors, pneumatic cylinders.

** effector is any device that affects the environment.

ACTIVITY–4	
Title: Relate	Approach: Story writing
<p>Demonstration: Students will play a games that will relate how a machine can understand the words we speak. The students will be asked to write the synonyms of the words given by the teacher. The teacher will then ask the students to write a story using these synonyms.</p> <p>For example: Teacher : forest Student1: jungle, woods, woodland Teacher : nature Student : environment, scenery</p>	
<p>Objectives</p> <ol style="list-style-type: none"> 1. Students will understand the logic behind the Artificial Intelligence application and will become excited about learning the technology behind it. 2. Gain the knowledge of using vocabulary for creating AI machines. 3. To discover more about themselves and their knowledge of language usage. 	
<p>Learning Outcomes</p> <ol style="list-style-type: none"> 1. Describe application of AI that can help you on story writing. 2. Identify the use of English language for speaking. 	
Pre-requisites: Basic computer literacy	Key-concepts: Interpreting Natural language processing
<p>Watch Videos</p> <ol style="list-style-type: none"> 1. https://youtu.be/Un2p5VUxPEU 2. https://youtu.be/dj3EvdOJXMc 	

1.18.1 Turing Test

Turing test is a measure to find the success of the system built using Artificial Intelligence. In this test, two persons and a machine are used to participate in the test for evaluation. Out of the two persons, one plays the role of the tester. One person and the machine sits in different rooms. The tester is unaware of who is machine and who is a human. He interrogates through the questions by typing and sending them to both and in return it receives typed responses.

This test aims at fooling the tester. If the tester fails to determine machine's response from the human response, then the machine is said to be intelligent. Alan Turing introduced this test in 1950.

1.19 THREATS TO AI

AI is developing at a very fast speed which at times appear more magical. Some of the researchers and developers think that AI can grow so strong that it might become difficult for humans to control it.

Humans developed AI systems by introducing all the possible intelligence they have experienced but this process can make the machine more intelligent than humans and pose a threat to human race. The various threat that we can face are:

1. Threat to Privacy

An AI program that recognizes speech and understands natural language is capable of understanding each conversation on e-mails and telephones. This can create threat to privacy of any individual.

2. Threat to Human Dignity

AI systems are now being used in many industries at the place of humans. We should be careful to decide that these machines should not replace people in the sectors where they are holding dignified positions related to the ethics and morals of humans such as nursing, surgeon, judge, police officer, etc.

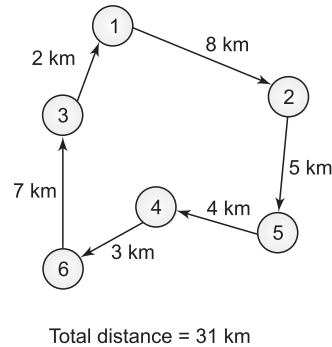
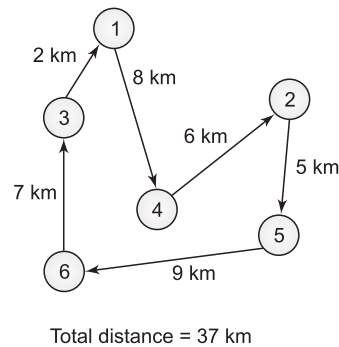
3. Threat to Safety

The self-improving AI systems can be so strong that it could become difficult to stop these machines from achieving their goals, which may lead to safety issues of the humans.

ACTIVITY-5	
Title: Possibilities	Approach: Theme-based research
<p>Demonstration: Students will be allotted a theme around which they need to search for present AI trends and have to visualize the future of AI in and around their respective theme given below:</p> <p>For Example:</p> <ol style="list-style-type: none"> 1. AI will make healthcare more accurate and less costly 2. Improved accuracy and efficiency of neural networks 3. The geopolitical implications of AI 4. IoT (Internet of things—discussed in detail in Unit 2) is all set to become the biggest driver of artificial intelligence in the enterprise. IoT is network of internet connected objects that can collect and exchange data. 	
<p>Objectives</p> <ol style="list-style-type: none"> 1. Students will understand the logic behind the Artificial Intelligence application and will become excited about learning the technology behind it. 2. Gain the knowledge of using AI in latest trends. 3. To discover more about themselves and their knowledge about latest trends in AI. 	
<p>Learning Outcomes</p> <ol style="list-style-type: none"> 1. Discuss the various application areas of AI. 2. Identify the areas where we can use AI. 	
Pre-requisites: Basic computer literacy	Key-concepts: Using AI in all the fields
<p>Watch Videos</p> <ol style="list-style-type: none"> 1. https://youtu.be/tzopvUCTaRM 2. https://youtu.be/3BhkeY974Rg 	

ACTIVITY-6	
Title: Possibilities	Approach: Travelling Salesman Problem
<p>Demonstration: In this algorithm, the objective is to find a low-cost tour that starts from a city, visits all cities en-route exactly once and ends at the same starting city.</p>	
<p>Start</p> <p>Find out all $(n-1)!$ Possible solutions, where n is the total number of cities.</p> <p>Determine the minimum cost by finding out the cost of each of these $(n-1)!$ solutions.</p> <p>Finally, keep the one with the minimum cost.</p>	

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Objectives

1. Students will understand the logic behind the Artificial Intelligence application and will become excited about learning the technology behind it.
2. Gain the knowledge of using AI In latest trends.
3. To discover more about themselves and their knowledge about latest trends in AI.

Learning Outcomes

1. Discuss the various application areas of AI.
2. Identify the areas where we can use AI.

Pre-requisites: Basic computer literacy

Key-concepts: Using AI in all the fields

Watch Videos

1. <https://youtu.be/pglyY0O78Pc>
2. <https://youtu.be/BmsC6AEbkrw>

Some Famous Robots Made Using AI

1. Sophia is a humanoid robot that has the capability of displaying human like expressions. Her behavior is similar to a human and she can interact with other people as a human does. She was made by Hong Kong based company Hanson Robotics. Sophia was activated on February 14, 2016. She is able to display more than 60 facial expressions. On October 25, at the Future Investment Summit in Riyadh, the robot was granted Saudi Arabian citizenship, becoming the first robot ever to have a nationality



2. Manav is India's first humanoid robot which was developed in the laboratory of A-SET Training and Research Institutes by Diwakar Vaish (Head of Robotics and Research, A-SET Training and Research Institutes) in late December 2014. It debuted at the IIT-Bombay Techfest 2014-15 in Mumbai. Manav stands at 2 feet tall and has a weight of 2 kilograms. It is equipped with onboard sound processing and visual processing so it can respond to commands. The Robot was designed in a span of 2 months



3. Ranjit Srivastava developed the world's first Hindi speaking realistic humanoid robot named Rashmi. Rashmi, who can speak Hindi, Bhojpuri and Marathi along with English, embodies linguistic interpretation, artificial intelligence, visual data and facial recognition systems



List of Artificial Intelligent Machines

S.No.	Name of the Robot	URL Link
1.	Hanson robotics sophia	https://www.designboom.com/technology/sophia-robot-citizenship-saudi-arabia-10-26-2017/
2.	Mayfield robotics kuri	https://www.designboom.com/technology/ces-2017-kuri-robot-01-04-2017/

(Contd...)

3.	Sony aibo	https://www.designboom.com/technology/sony-aibo-robot-dog-11-02-2017/
4.	Stanford university snake robot	https://www.designboom.com/technology/stanford-snake-robot-07-20-2017/
5.	Festo octopusgripper	https://www.designboom.com/technology/festo-octopusgripper-03-20-2017/
6.	Honda E2-DR	https://www.designboom.com/technology/honda-e2-dr-robot-iros-disaster-relief-10-04-2017/
7.	Boston dynamics handle	https://www.designboom.com/technology/boston-dynamics-handle-robot-02-28-2017/
8.	Piaggio gita cargo bot	https://www.designboom.com/technology/piaggio-gita-personal-cargo-bot-boston-01-31-2017/
9.	Nasa puffer	https://www.designboom.com/technology/nasa-puffer-robot-03-21-2017/
10.	Honda 3E robotics concept	https://www.designboom.com/technology/honda-3e-robotics-concept-ces-2018-08-12-2017/

Artificial Intelligence Companies – A Brief Introduction

1. Apple Inc. is a multinational technology company headquartered in California that develops and manufactures consumer electronics, online services, and software. Apple has acquired several promising artificial intelligence startups. Some of which founding the basis of FaceID, Apple's facial recognition security system.
2. Amazon, the e-commerce Enterprise that offers cloud computing and AI software and hardware services for both consumers and businesses.
3. Microsoft Corporation develops, manufactures and license computer hardware, software, and consumer electronics, as well as provides various data protection and storage services. Microsoft was founded by Bill Gates and Paul Allen.
4. Google is a multinational technology and internet services company based in California. Google is known for its leading search engine platform, advertising technologies, android software, as well as cloud computing and machine learning.
5. Facebook is a social network and media service company based out of California. Launched in 2004 by Mark Zuckerberg, Facebook continues to operate as one of the world's largest social media platforms along with developing cloud computing, virtual reality, machine learning and other forms of AI software.
6. IBM (International Business Machines) is one of America's oldest technology companies, manufacturing device hardware, middleware, and software since 1911. IBM also provides an array of hosting and consulting services in areas including nanotechnology, mainframe computing, and predictive maintenance.
7. Intel develops software and manufactures hardware for the computing industry and the inventor of the x86 chip series found in most personal computers.

Points to Remember

1. **Intelligence** is the ability to think, calculate, reason and learn from experience, to solve problems and to adapt to new situations.
2. Intelligence cannot be directly observed, touched, or measured in physical terms.
3. **Reasoning** is the set of processes that enables us to provide basis for judgement, making decisions, and prediction.
4. **Artificial Intelligence** exists when a machine can respond like a human displaying the skill of learning, reasoning, and solving problems.
5. The long-term goals of the general intelligence sector are to do research in the field of AI related to reasoning, knowledge representation, planning, learning, natural language processing, realization, and ability to move and manipulate objects.
6. AI machines can be very useful as public utilities such as a self-driving car for making our journey safer and hassle-free, facial recognition for security purpose, Natural language processing to communicate with the human in human-language, etc.
7. AI machines can only work on the instructions and algorithm given. These machines cannot feel or react so it cannot make any kind of emotional attachment with human, and may even harm the users if proper care is not taken.
8. AI was coined by **John McCarthy**, an American computer scientist, in 1956 at The Dartmouth Conference.
9. The first development in the field of AI was done by Warren McCulloch and Walter Pitts in 1943.
10. The first intelligent humanoid robot was built in Japan which was named as WABOT-1.
11. The three domains of artificial intelligence are: Data, Computer Vision and Natural language processing.
12. Narrow AI is a type of AI which is able to perform a particular task with intelligence where limited part of mind is involved.
13. General AI is a type of intelligence which could perform any intelligent task with efficiency like a human.
14. Super AI is a type of Intelligence where devices or systems will behave in more intelligent manner than humans or we can say that AI machines will beat human intelligence, and can perform any task better than human with cognitive thinking.
15. Reactive machines are the basic types of Artificial Intelligence. These AI systems do not store memories or past experiences for future actions.
16. Limited memory is made up of machine learning models that develop knowledge from previously-learned information, stored data, or events.
17. Theory of Mind AI can make a machine understand the human emotions, people, beliefs, and be able to interact socially like humans.
18. Self-awareness AI will be the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, feelings, emotions, and self-awareness.
19. An AI system is composed of an agent and its environment. Here the agent is anything that can perceive its environment through **sensors** and acts upon that environment through **effectors**.
20. Turing test is a measure to find the success of the system built using Artificial intelligence. In this test, two persons and a machine are used to participate in the test for evaluation.

Activity Time

1. Draw your own emoji's expressing a thought or an emotion in your practical file.
2. Watch the various videos given in the chapter and create a brief report on the topic "AI -Boon or Bane for mankind".

Solved Question and Answers

1. What is Artificial Intelligence?
 - (a) Putting your intelligence into computer
 - (b) Programming with your own intelligence
 - (c) Making a machine intelligent
 - (d) Playing a game

Ans. (c) Making a machine intelligent

Explanation: Because AI is to make things work automatically through machine without using human effort. Machine will give the result with just giving input from human. That means the system or machine will act as per the requirement.

2. Strong Artificial Intelligence is _____
 - (a) the embodiment of human intellectual capabilities within a computer
 - (b) a set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans
 - (c) the study of mental faculties through the use of mental models implemented on a computer
 - (d) all of the mentioned

Ans. (a) the embodiment of human intellectual capabilities within a computer.

3. A certain Professor at the Stanford University coined the word 'artificial intelligence' in 1956 at a conference held at Dartmouth college. Can you name the Professor?
 - (a) David Levy
 - (b) John McCarthy
 - (c) Joseph Weizenbaum
 - (d) Hans Berliner

Ans. (b) John McCarthy

4. Who is the "Father" of Artificial Intelligence?
 - (a) Fisher Ada
 - (b) John McCarthy
 - (c) Allen Newell
 - (d) Alan Turning

Ans. (b) John McCarthy

5. What among the following is considered a pivotal event in the history of Artificial Intelligence?
 - (a) 1949, Donald O, The organization of Behaviour
 - (b) 1950, Computing Machinery and Intelligence
 - (c) 1956, Dartmouth University Conference Organized by John McCarthy
 - (d) 1961, Computer and Computer Sense

Ans. (c) 1956, Dartmouth University Conference Organized by John McCarthy.

6. What is Artificial Intelligence? Give an example of where AI is used on a daily basis.

Ans. “Artificial Intelligence (AI) is an area of computer science that deals with the creation of intelligent machines that can behave like human beings. i.e., **“The capability of a machine to imitate the intelligent human behaviour.”**”

Example : Google’s Search Engine is a famous AI Application. If you open up your chrome browser and start typing something, Google immediately provides recommendations for you to choose from. The logic behind the search engine is Artificial Intelligence.

7. What are the different types of AI based on functionality and capabilities ?

Ans. Based On Functionality, there are 4 types of AI:

- **Reactive Machines AI:** Based on present actions, it cannot use previous experiences to form current decisions and simultaneously update their memory.
Example: Deep Blue.
- **Limited Memory AI:** Used in self-driving cars. They detect the movement of vehicles around them constantly and add it to their memory.
- **Theory of Mind AI:** Advanced AI that has the ability to understand emotions, people and other things in the real world.
- **Self Aware AI:** AIs that possess human-like consciousness and reactions. Such machines have the ability to form self-driven actions.

Based On Capabilities, there are 3 types of AI:

- **Narrow Artificial Intelligence :** Also known as Weak AI. The weak AI can perform the expert task like driving a vehicle or talking to a human. It is also used in building virtual assistants like Siri.
- **General Artificial Intelligence :** Also known as General AI. General AI is when a machine performs like a human being with all those emotions and behaviour.
- **Super Artificial Intelligence :** Also known as Super AI. AI that possesses the ability to do everything more smartly than a human and can supersede humans. We are yet to make such a machine.

8. Explain the assessment that is used to test the intelligence of a machine.

Ans. In artificial intelligence (AI), a Turing Test is a method of inquiry for determining whether or not a computer is capable of thinking like a human being.

9. What is Turing test?

Ans. The Turing test is a method to test a machine’s ability to match the human-level intelligence. A machine is used to challenge human intelligence, and when it passes the test it is considered intelligent. Yet a machine could be viewed as intelligent without sufficiently knowing how to mimic a human.

10. What is an expert system? What are the characteristics of an expert system?

Ans. An expert system is an Artificial Intelligence program that has expert-level knowledge about a specific area and how to utilize its information to react appropriately. These systems have the expertise to substitute a human expert. Their characteristics include:

- High performance
- Adequate response time
- Reliability
- Understandability

Unsolved Questions

1. Fill in the blanks:
 - (a) _____ is intangible so it varies from person to person.
 - (b) Problem solving also involves _____, where in one finds the best solution of a given problem among the various alternatives available.
 - (c) Artificial Intelligence is made up of two words **Artificial** and **Intelligence**, where Artificial means “_____,” and _____ means “*ability to understand and think*”.
 - (d) The speech recognition aims at understanding and grasp _____ was spoken.
 - (e) An Allen Newell and Herbert A. Simon created the “first artificial intelligence program” which was named as _____.
2. Write any 4 goals of Artificial Intelligence.
3. What are the 3 domains of Artificial Intelligence ?
4. What is the difference between Weak, General and Super AI ?
5. What are the important threats to AI ?
6. Why AI work is more successful in the Expert Tasks domain ?
7. What are mundane task ?
8. What is turing test ? How do you perform a turing test ?
9. What is the difference between Reactive and limited memory machines ?
10. How did deep blue defeated Gary Kasparov in chess ?

