Artificial Intelligence

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What is Artificial Intelligence ?

What is Artificial Intelligence ?

To make the computers

do things which, at the moment, people do better.

What is Artificial Intelligence ?

To make the machine

think and act/behave intelligently.

What is AI ?

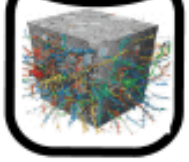
- **A**rtificial Intelligence (AI) is a branch of *Science* which deals with helping machines, find solutions to complex problems in a more human-like fashion

- This generally involves borrowing characteristics from human intelligence and applying them as algorithms in a computer friendly way

- A more or less flexible or efficient approach can be taken depending on the requirements established

History of AI

1943



Evolution of Artificial neurons

1950

Turing Machine

1956

Birth of AI: Dartmouth Conference

1966

First Chatboat : ELIZA

1972

First Intellgence Robot : WABOT -1

1974-1980

First AI winer

1980

Expert Ststem

1987-1993

Second AI Winer

1997

IBM Deep blue : first computer to beat a world chess champion

2002

AI in Home: Roomba

2011

IBM s Watson : Wins a quiz show

2012

Google now

2014

Chatbot Eugene Goostman:Wines a "Turing test

2015

Amazon Echo

Maturation of Artificial Intelligence (1943-1952)

•**Year 1943:** The first work which is now recognized as AI was done by Warren McCulloch and Walter pits in 1943. They proposed a model of **artificial neurons**.

•**Year 1949:** Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called **Hebbian learning**.

•**Year 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 behavior equivalent to human intelligence, called a **Turing test**.

The birth of Artificial Intelligence (1952-1959)

•**Year 1955:** An Allen Newell and Herbert A. Simon created the "first artificial intelligence program "Which was named as **"Logic Theorist"**. This program had proved 38 of 52 Mathematics theorems, and find new and more elegant proofs for some theorems.

• **Year 1955:** John McCarthy and a team of men created a proposal for a workshop on “artificial intelligence.” In 1956 when the workshop took place, the official birth of the word was attributed to McCarthy.

The birth of Artificial Intelligence (1952-1959)

•**Year 1958:** McCarthy developed Lisp, the most popular and still favored programming language for artificial intelligence research.

•**Year 1959:** Samuel coined the term "machine learning" when speaking about programming a computer to play a game of chess better than the human who wrote its program.

The golden years-Early enthusiasm (1960-1974)

•**Year 1966:** The researchers emphasized developing algorithms which can solve mathematical problems. Joseph Weizenbaum created the first **chatbot** in 1966, which was named as **ELIZA**.

• **Year 1966:** Shakey the Robot, developed by Charles Rosen with the help of 11 others, was the first general-purpose mobile robot, also known as the "first electronic person."

•**Year 1972:** The first intelligent humanoid robot was built in Japan which was named as WABOT-1.

The first AI winter (1974-1980)

•The duration between years 1974 to 1980 was 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.

•During AI winters, an interest of publicity on artificial intelligence was decreased.

A boom of AI (1980-1987)

•**Year 1980:** After AI winter duration, AI came back with "Expert System". Expert systems were programmed that emulate 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**.

• **1980:** WABOT-2 was built at Waseda University. This inception of the WABOT allowed the humanoid to communicate with people as well as read musical scores and play music on an electronic organ.

A boom of AI (1980-1987)

• **1986:** Mercedes-Benz built and released a driverless van equipped with cameras and sensors under the direction of Ernst Dickmanns. It was able to drive up to 55 mph on a road with no other obstacles nor human drivers.

The second AI winter (1987-1993)

•The duration between the years 1987 to 1993 was the second AI Winter duration.

•Again Investors and government stopped in funding for AI research as due to high cost but not efficient result. The expert system such as XCON was very cost effective

The emergence of intelligent agents (1993-2011)

- **Year 1997:** In the year 1997, IBM Deep Blue beats world chess champion, Gary Kasparov, and became the first computer to beat a world chess champion.
- **Year 2002:** for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- **Year 2006:** AI came in the Business world till the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

The emergence of intelligent agents (1993-2011)

2007: Computer science professor Fei Fei Li and colleagues assembled ImageNet, a database of annotated images whose purpose is to aid in object recognition software research.

2009: Google secretly developed a driverless car. By 2014, it passed Nevada's self-driving test.

AI 2010 to present day

2010: Microsoft launched Kinect for **Xbox 360**, the first gaming device that tracked human body movement using a 3D camera and infrared detection.

2011: **Watson**, a natural language question answering computer created by IBM, defeated two former Jeopardy! champions, Ken Jennings and Brad Rutter, in a televised game.

AI 2010 to present day

2011: Apple released Siri, a virtual assistant on Apple iOS operating systems. Siri uses a natural-language user interface to infer, observe, answer, and recommend things to its human user. It adapts to voice commands and projects an “individualized experience” per user.

2012: Google has launched an Android app feature "Google now", which was able to provide information to the user as a prediction.

AI 2010 to present day

2014: Microsoft released **Cortana**, their version of a virtual assistant similar to Siri on iOS.

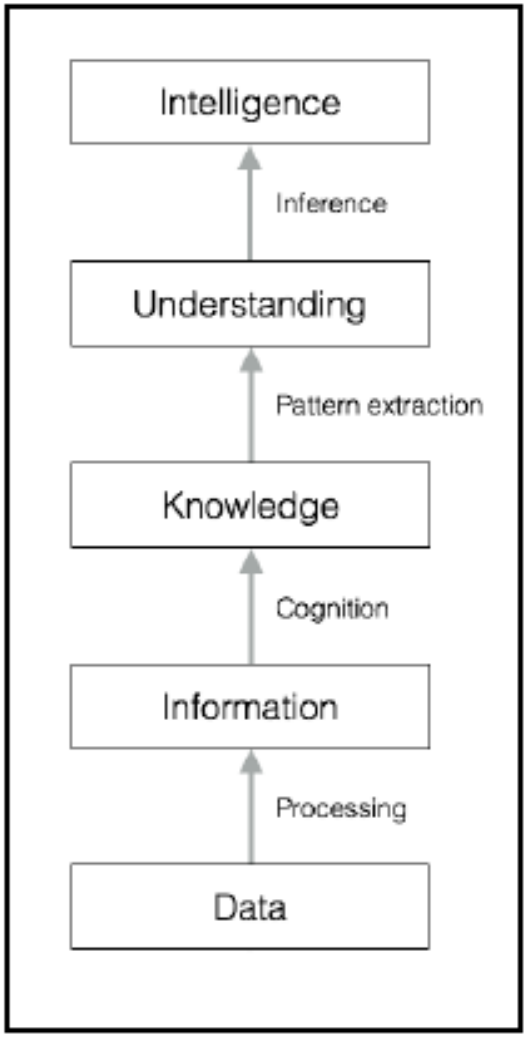
2014: Amazon created **Amazon Alexa**, a home assistant that developed into smart speakers that function as personal assistants.

2016: A **humanoid robot named Sophia** is created by Hanson Robotics. She is known as the first "robot citizen." What distinguishes Sophia from previous humanoids is her likeness to an actual human being, with her ability to see (**image recognition**), make facial expressions, and communicate through AI.

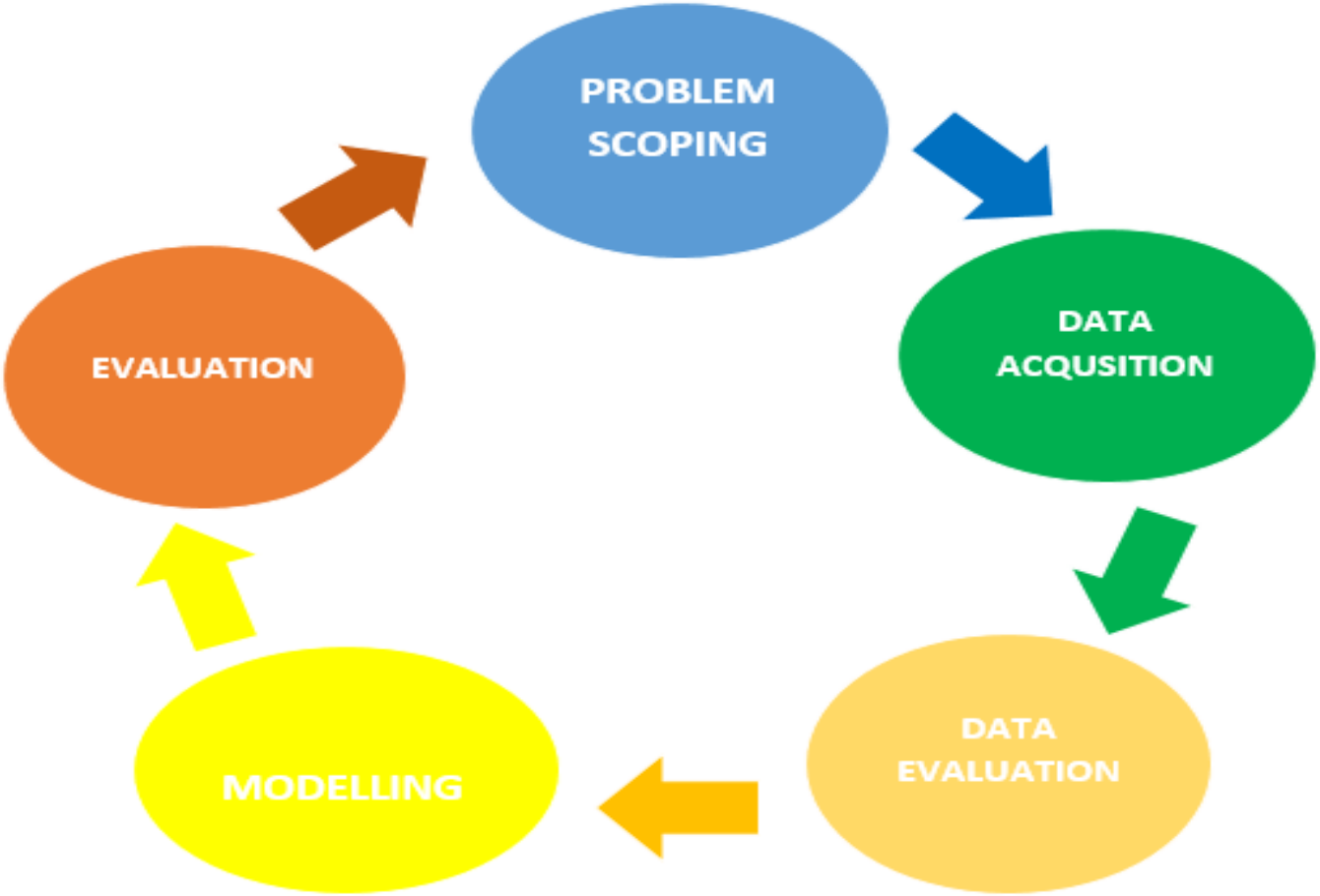
AI 2010 to present day

2017: The Facebook Artificial Intelligence Research lab trained two "dialog agents" (chatbots) to communicate with each other in order to learn how to negotiate. However, as the chatbots conversed, they diverged from human language (programmed in English) and invented their own language to communicate with one another – exhibiting artificial intelligence to a great degree.

The similarity between Human and AI based machine are


Intelligence
Inference
Understanding
Pattern extraction
Knowledge
Cognition
Information
Processing
Data

AI Project Cycle



Let see these components of project cycle

- Checking different **factors** and **understanding** the project – **Problem scoping**

- **Acquiring** or **collecting** the data from different data sources for our project – **Data acquisition**

Difference between Data and Information

Data

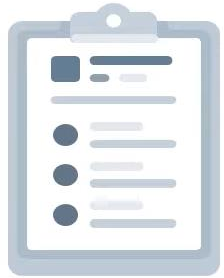
It is raw facts

Information

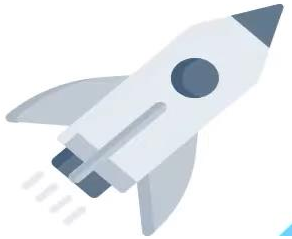
It is an organized form of data

- Arranging the gathered in a meaningful format to analyze the data– **Data exploration**

- Now is creating a model from the gathered data like creating a greeting card from the data collected – **Modelling**



- After the model is created it need to be **tested** or to **evaluate** it and understand the reliability – **Evaluation**



Applications of Artificial Intelligence

Artificial Intelligence in E-Commerce

Personalized Shopping

- Recommendation engines can enable you to engage with your customers, by taking into consideration their usage history, preferences and interests
- This can lead to improved brand loyalty and an increase in the number of conversions

Artificial Intelligence in E-Commerce

AI Powered Assistants

- AI powered assistants like virtual shopping assistants and chatbots help improve user experience while shopping online
- Using techniques like Natural Language Processing (NLP), conversations with users can seem personal to users and tailored to their interests

Artificial Intelligence in E-Commerce

Fraud prevention

- AI can identify credit card usage patterns and reduce the possibility of credit card fraud taking place
- AI can also help identify and handle fake reviews, in the process improving customers' trust in your brand and products

Artificial Intelligence in Robotics

Mobility

AI enabled robots will be able to maneuver through its path of travel with real-time updates. It uses this path to sense obstacles and pre-plan its path

Artificial Intelligence in Healthcare

Medical Imaging and Diagnostics

- AI can help analyze chronic conditions with the help of lab and other medical data to ensure early diagnosis
- AI can also be used with advanced medical imaging to analyze and transform images

Artificial Intelligence in Healthcare

Research and Development

- AI can be used for discovering new drugs based on previous data and medical intelligence
- It can be used to understand the human gene and its components

Artificial Intelligence in Agriculture

Monitoring Crop and Soil Health

Artificial Intelligence can be used to identify defects and nutrient deficiencies in the soil

Artificial Intelligence in Agriculture

Decreased Pesticide Usage

With the help of computer vision, robotics and machine learning, AI can be used to analyze where weeds are growing

Artificial Intelligence in Gaming

- AI can be used to saving labor costs. It can be used to generate levels, maps, textures, weapons, characters, etc.
- AI can be used to develop smart, human-like NPCs to interact with gamers
- It can predict player behavior to improve game testing and design

Artificial Intelligence in Automobiles

Driverless Automobiles

AI can be used to along with the vehicle's camera, radar, cloud services, GPS and control signals to operate the vehicle

Artificial Intelligence in Automobiles

Driver Assistant

AI can be used to improve the in-vehicle experience. AI can be used to provide additional systems like emergency braking, blind spot monitoring, driver-assist steering

Artificial Intelligence in Social Media

Facebook

- AI is being used for **Picture Analyzing** to recognize people in photos
- AI is also used along with a tool called **DeepText**. With this tool, Facebook can better understand conversations.

Artificial Intelligence in Social Media

Facebook

- **DeepText** can also be used to prevent suicide, by identifying posts that represent suicidal thoughts
- AI is also used to automatically translate posts from different languages

Artificial Intelligence in Social Media

Instagram

- AI is used to show what posts you get to see on the Explore feature based on the likes and accounts you follow
- AI can recognize and remove spam messages from user accounts using Facebook's DeepText tool

Artificial Intelligence in Social Media

Twitter

- AI is being used by Twitter for fraud detection, removing propaganda and hateful content
- Twitter also uses AI to recommend tweets users might enjoy, based on what type of tweets you engage with

Pros Of Artificial Intelligence

- Chances of error are almost nil and greater precision and accuracy is achieved.
- Robots can do certain laborious tasks.
- Fraud detection in smart card-based systems is possible with the use of AI.
- Machines do not require sleep or breaks, and are able to function without stopping.

Cons Of Artificial Intelligence

- Machines lack a creative mind.
- Lack the human touch.
- If robots begin to replace humans in every field, it will eventually lead to unemployment
- Multitasking abilities of humans may diminish.
- If the control of machines goes in the wrong hands, it may cause destruction.

What is AI?

Thinking humanly	Thinking rationally
Acting humanly	Acting rationally

Thinking Humanly: Cognitive Modelling

- If we are going to say that a given program thinks like a human, we must have some way of determining how humans think.
- We need to get *inside* the actual workings of human minds.
- There are two ways to do this:
    - through introspection
    - through psychological experiments
- cognitive science brings together computer models from AI and experimental techniques from psychology to try to construct precise and testable theories of the workings of the human mind.

Thinking Humanly

- Cognitive Science
  - Very hard to understand how humans think
    - Post-facto rationalizations, irrationality of human thinking
- Do we want a machine that beats humans in chess or a machine that *thinks like humans* while beating humans in chess?
  - Deep Blue supposedly DOESN'T think like humans..
- Thinking like humans important in Cognitive Science applications
  - Intelligent tutoring
  - Expressing emotions in interfaces... HCI

Thinking Rationally: Laws of Thought

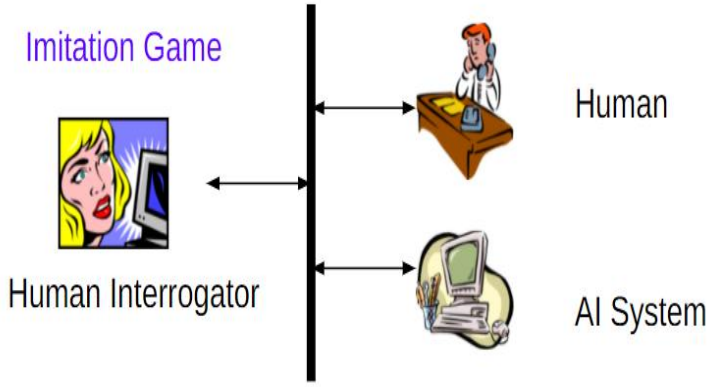
- Aristotle was one of the first to attempt to codify ``right thinking,'' that is, irrefutable reasoning processes.
- Formal Logic provides a precise notation and rules for representing and reasoning with all kinds of things in the world.
- Limitation:
    - Informal knowledge representation.
    - Computational complexity and resources.

Thinking Rationally: laws of thought

- Aristotle: what are correct arguments/thought processes?
  - Logic
- Problems
  - Not all intelligent behavior is mediated by logical deliberation (reflexes)
  - What is the purpose of thinking?

Acting Humanly: The Turing Test

- Alan Turing (1950)
- designed to provide a satisfactory operational definition of intelligence
- Turing defined intelligent behavior as the ability to achieve human-level performance in all cognitive tasks, sufficient to fool an interrogator.
- The computer would need to possess
  - natural language processing
  - knowledge representation
  - automated reasoning
  - machine learning



Acting Humanly

- Loebner Prize
  - Every year in Boston
  - Expertise-dependent tests: limited conversation
- What if people call a human a machine?
  - Shakespeare expert
  - Make human-like errors
- Problems
  - Not reproducible, constructive or mathematically analyzable

Acting Rationally

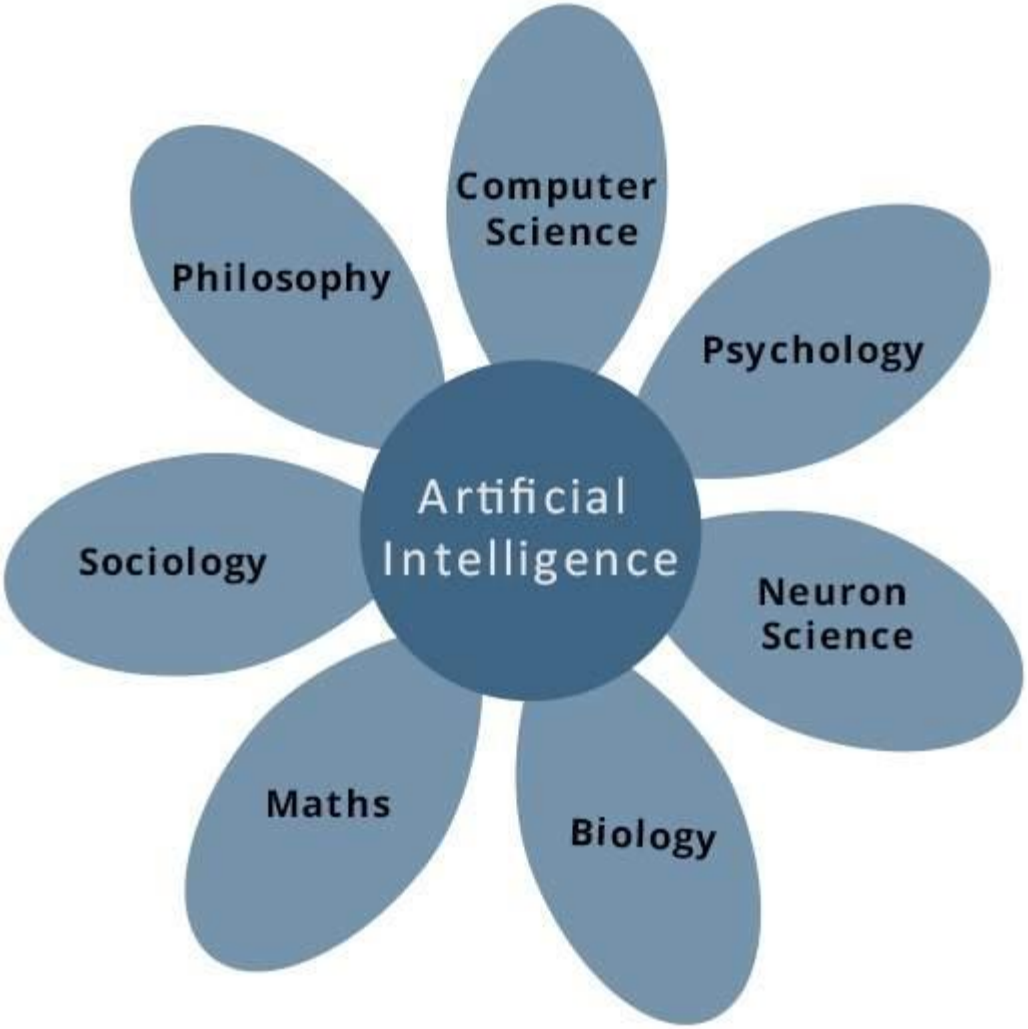
- Acting rationally means acting so as to achieve one's goals, given one's beliefs.
- An agent is just something that perceives and acts
- In the ``laws of thought'' approach to AI, the whole emphasis was on correct inferences.
- Act rationally is to reason logically to the conclusion that a given action will achieve one's goals, and then to act on that conclusion.

Acting rationally

- Rational behavior: doing the right thing
- Need not always be deliberative
  - Reflexive
- Aristotle (Nicomachean ethics)
  - Every art and every inquiry, and similarly every action and every pursuit is thought to aim at some good.

Foundations of AI

Foundations of AI



1.Philosophy:

- *Can formal rules be used to draw valid conclusions?*
- *How does the mind arise from a physical brain?*
- *Where does knowledge come from?*
- *How does knowledge lead to action?*

Rationalism, Dualism, Materialism, Empiricism, Induction, Logical Positivism, Confirmation Theory.

2. Mathematics

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

The main three fundamental areas are logic, computation and probability.

Algorithm, incompleteness theorem, computable, tractability, NP completeness, Non deterministic polynomial and probability.

3. Economics

- *How should we make decisions so as to maximize payoff?*
- *How should we do this when others may not go along?*
- *How should we do this when the payoff may be far in the future?*

Utility, Decision Theory, Game Theory, Operations Research.

4. Neuroscience

How do brains process information?

Neuroscience is the study of the nervous system, especially the brain. We are still a long way from understanding how cognitive processes actually work. The truly amazing conclusion is that a collection of simple cells can lead to thought, action, and consciousness or, brains cause minds. The only real alternative theory is mysticism: that minds operate in some mystical realm that is beyond physical science.

5. Psychology

- How do humans and animals think and act?

Behaviourism, Cognitive psychology.

6. Computer engineering

•How can we build an efficient computer?

Operational computer and operational programmable computer

AI has pioneered many ideas that have made their way back to mainstream computer science, including time sharing, interactive interpreters, personal computers with windows and mice, rapid development environments, the linked list data type, automatic storage management, and key concepts of symbolic, functional, declarative, and object-oriented programming.

7. Linguistics

- How does language relate to thought?
- Verbal Behavior — behaviorist approach to language learning

Computational linguistics or natural language processing and knowledge representation.

Branches of Artificial Intelligence

Branches of Artificial Intelligence

1. Expert Systems:

Expert Systems is an Artificial Intelligence (AI-based) system that learns and imitates a human being's decision-making ability.

- Expert Systems does not use conventional programming to solve complex problems but instead uses logical notations to achieve such an aim.
- It is mainly used in the medical field to operate medical facilities and detect virus infections. It is also used in the banking sector for loan and investment analysis.

2. Robotics:

This is a very interesting branch of Artificial Intelligence that focuses on the design and development of robots. Robotics deals with the designing, constructing, and operating of robots by incorporating both science and engineering techniques.

The aim of deploying robots is to help humans with tedious and bulky tasks. These tasks involve the control of computer systems, information transformation and manufacturing of automobiles. It is used by NASA to move heavy objects in space.

Robots also act as artificial intelligence agents that perform tasks in a real-world environment with the aim of actualizing results. This branch of AI is so amazing.

3. Machine Learning:

Machine Learning algorithms and techniques help in training a model with data presented which will then predict and adjust to future outcomes. It is the science of allowing computer systems to learn and translate data for the sake of task execution without programming. Technology discoveries such as web search, speech recognition and automatic vehicles are results of Machine Learning.

Here are three major categories under Machine Learning;

- Supervised Learning
- Unsupervised Learning

4. Neural Network:

Neural Network is a branch of Artificial Intelligence associated with the use of Neurology to incorporate cognitive science in helping computer systems and machines to execute tasks. It is known as "*Deep Learning*" because it involves making use of artificial brain neurons to solve complex problems.

Neural Network helps machines process how the human brain operates. This branch of AI also involves implementing mathematical functions and statistical techniques to solve real-world problems. It is used in fields such as risk analysis, market research, fraud detection, forecasting, and stock exchange prediction.

5. Fuzzy Logic:

This branch of AI is the technique of modifying and representing uncertain information by analyzing the degree to which the hypothesis is true. Fuzzy Logic helps to offer a certain level of reasoning flexibility when faced with uncertainties.

This might sound a bit complex but it is simply a case of using standard logic to determine if a concept exhibits a degree of truth. For instance, standard logic is 1.0 if a concept is TRUE and 0.0 if a concept is FALSE. However, there are cases where a concept can either be partially true or partially false.

6. Natural Language Processing:

Communicating with someone who doesn't understand your language can be very challenging and the same can be said of humans trying to communicate with a computer system. A computer will find it difficult to interpret words because it only understands the language of binary digits. This challenge has led to the development of Natural Language Processing in computer science.

This is simply the process of making computer systems and machines to understand basic human interactions. This process involves a machine receiving human sound from interaction and converting it to text format so that it can be easily read and understood. These texts are then converted to components by the computer system that will make it understand the intention of the human.

Any Question?