Overview of Artificial Intelligence

What is AI ?

Artificial Intelligence (AI) is a branch of computer science which deals with helping machines finds solutions to complex problems in a more human-like fashion. Artificial intelligence is based on the principle that human intelligence can be defined in a way that a machine can easily mimic it and execute tasks, from the most simple to those that are even more complex. The goals of artificial intelligence include mimicking human cognitive activity. Researchers and developers in the field are making surprisingly rapid strides in mimicking activities such as learning, reasoning, and perception, to the extent that these can be concretely defined. Some believe that innovators may soon be able to develop systems that exceed the capacity of humans to learn or reason out any subject. But others remain skeptical because all cognitive activity is laced with value judgments that are subject to human experience.

Artificial Intelligence (AI), a term coined by emeritus Stanford Professor *John McCarthy in 1955,* was defined by him as "the science and engineering of making intelligent machines". Much research has human's program machines to behave in a clever way, like playing chess.

"Artificial intelligence is a computerized system that exhibits behavior that is commonly thought of as requiring intelligence."

"Artificial Intelligence is the science of making machines do things that would require intelligence if done by man."

"AI is the science and engineering of making intelligent machines, especially intelligent computer programs."

Artificial intelligence can be viewed from a variety of perspectives.

1. From the perspective of intelligence artificial intelligence is making machines "intelligent" -- acting as we would expect people to act. The inability to distinguish computer responses from human responses is called the Turing test. Intelligence requires knowledge. Expert problem solving - restricting domain to allow including significant relevant knowledge.
2. From a business perspective AI is a set of very powerful tools, and methodologies for using those tools to solve business problems.
3. From a programming perspective, AI includes the study of symbolic programming, problem solving, and search. Typically AI programs focus on symbols rather than numeric processing, Problem solving - achieve goals and search - seldom access a solution directly.

AI language programming

1. Python

Python tends to top the list of best AI programming languages, When it comes to artificial intelligence, Python comes out strong thanks to its wide variety of pre-designed libraries that are particularly useful in artificial intelligence development.

1. Java

Java is exceedingly easy to implement on a variety of platforms. This means that once you AI application is written and compiled on one platform, you can run it on other platforms easily with the write once run anywhere methodology.

2. R

A number of AI applications involve big data and crunching of big numbers. Did you know that a special language was developed just for the purpose of statistical computing? That's right, R was created by statisticians just for performing computations and crunch massive data sets with ease in a matter of seconds. Today, R is a powerful language used for machine learning programming applications, and any artificial intelligence applications that involve extensive computation or data analysis.

3. C++

C++ rapid processing speed makes it of particular interest to complex machine learning models as it allows them to run with high efficiency. C++ boasts some extremely useful attributes

4. Julia

Julia is a relatively new AI programming language designed to effectively handle expansive numerical analysis and handle large data sets with ease. The engineers at MIT designed Julia keeping in mind all the requirements of modern AI development. It possesses remarkable speed, powerful computational capacity, easy script like syntax and much more, helping developers make the best AI programming.

5. Haskell

Haskell's winning attribute is safety and speed. Haskell is a purely functional, modern AI programming language with far reaching advantages in Artificial intelligence programming. It has advanced features such as type classes that enable type-safe operator overloading.

6. Prolog

It is a logical, declarative programming language developed for natural language processing. How good it is at that job can be understood by the fact that IBM Watson uses Prolog in parsing natural language in fielding human-generated questions.

Some of the winning attributes that make Prolog a top AI programming language include its powerful pattern matching, meta level reasoning, and tree-based data structuring. The pattern

matching features has significant importance in natural language processing, computer vision, and intelligent database search.

7. LISP

LISP is probably the oldest AI programming language. In fact, the very term Artificial Intelligence was coined by John McCarthy, the inventor of LISP. It is one of the most flexible programming languages with automatic garbage collection, quick prototyping abilities, dynamic object creation, and support for symbolic expressions. LISP was used to express the earliest AI programs such as ELIZA.

8. JAVASCRIPT

Just like Java, JavaScript is also an ideal match for AI development. However, it is used to develop more secure and dynamic websites. While Python is suitable for developers who don't like coding, JavaScript is for those who don't mind it.

10. Matlab

Application of Artificial intelligence

- Gaming

Artificial intelligence (AI) in computer games covers the behavior and decision-making process of game-playing opponents. Computer games are also often multiagents, making teamwork, competition, and modelling key elements to success. In commercial games, such as action games, role-playing games, and strategy games, the behavior of model is usually implemented as a variation of simple rule-based systems.

- Speech Recognition

Speech recognition, also known as automatic speech recognition (ASR), computer speech recognition, or speech-to-text, is a capability which enables a program to process human speech into a written format. While it's commonly confused with voice recognition, speech recognition focuses on the translation of speech from a verbal format to a text one whereas voice recognition just seeks to identify an individual user's voice.

- Natural Language processing

Natural language processing (NLP) refers to the branch of artificial intelligence concerned with giving computers the ability to understand text and spoken words in much the same way human beings can NLP drives computer programs that translate text from one language to another, respond to spoken commands, and summarize large volumes of text rapidly even in real time. There's a good chance

you've interacted with NLP in the form of voice-operated systems, digital assistants, speech-to-text dictation software, customer service chat bots.

- Computer Vision

Computer vision is a field of artificial intelligence (AI) that enables computers and systems to derive meaningful information from digital images, videos and other visual inputs and take actions or make recommendations based on that information and works much the same as human vision, computer vision trains machines to perform these functions, but it has to do it in much less time with cameras, data and algorithms rather than retinas, optic nerves and a visual cortex. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

- **Expert Systems**

An expert system is a computer program that uses artificial intelligence (AI) technologies to simulate the judgment and behavior of a human or an organization that has expert knowledge and experience in a particular field. Typically, an expert system incorporates a knowledge base containing accumulated experience and an inference or rules engine -- a set of rules for applying the knowledge base to each particular situation that is described to the program. That allows them to improve their performance based on experience, just as humans do. Expert systems have played a large role in many industries including in financial services, telecommunications, healthcare, customer service like MYCIN in 1974v, which helped to identify bacteria such as bacteremia and meningitis, and to recommend antibiotics and dosages.

- **Robotics**

Robotics is another field where artificial intelligence applications are commonly used. Robots powered by AI use real-time updates to sense obstacles in its path and pre-plan its journey instantly. It can be used for -

Carrying goods in hospitals, factories, and warehouses

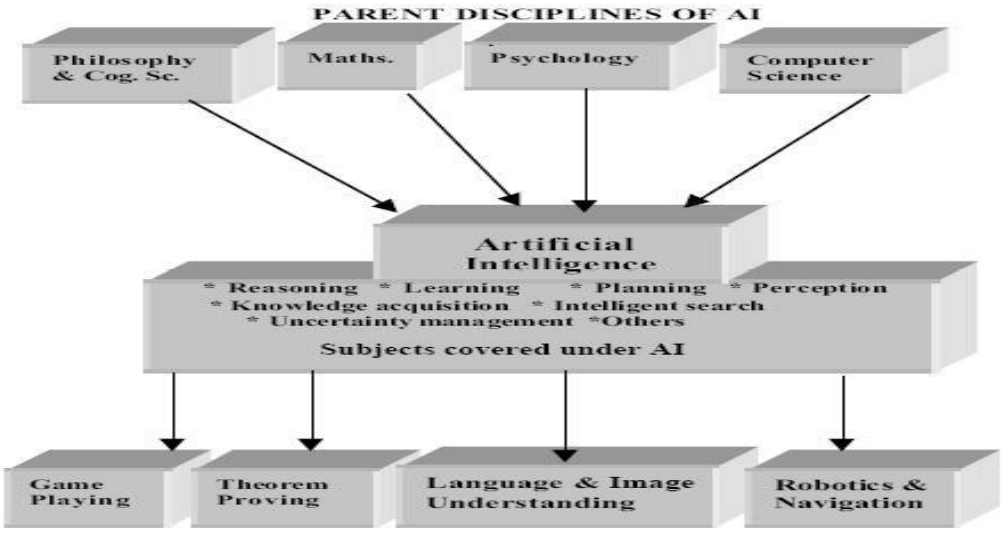
Cleaning offices and large equipment

Inventory management

Heuristic Classification

Heuristic classification is suitable for classification problems in which it is known from experience which observations - or combinations of observations – indicate intermediate or final solutions, and

with what degree of certainty. Thus the basic object types are observations, solutions and rules of the form "observation indicates solution" (0 →*S,* with certainty *x).* That solution is selected which has the highest total score on the basis of the observations.



Step Problem Solving Process

Six step guide to help you solve problems:

1. Defining The Problem: The definition of the problem must be included precisely. It should contain the possible initial as well as final situations which should result in acceptable solution.
2. Identification of Solutions: List all the possible solutions; don't worry about the quality of the solutions at this stage.
3. Evaluate alternatives: The next step is to go through and eliminate less desirable or unreasonable solutions. Evaluate the remaining solutions in terms of their advantages and disadvantages.
4. Decide on a solution : Specify who will take action.
5. Choosing a Solution: From all the identified solutions, the best solution is chosen basis on the results produced by respective solutions.
6. Implementation: After choosing the best solution, its implementation is done**.**

All this steps not available to find the solution in artificial intelligence problems , Since the choice is made by heuristic, it must be searched using one of the research methods, that is, finding by inference methods.

Inference

It is one of the logical deductions from facts and rules using heuristic. In artificial intelligence, we need intelligent computers which can create new logic from old logic or by evidence**,** so generating the conclusions from evidence and facts is termed as Inference**.**

Inference rules

Inference rules are the templates for generating valid arguments. Inference rules are applied to derive proofs in artificial intelligence, and the proof is a sequence of the conclusion that leads to the desired goal.

In inference rules, the implication among all the connectives plays an important role. Following are some terminologies related to inference rules:

- **Implication:** It is one of the logical connectives which can be represented as P → Q. It is a Boolean expression.
- **Converse:** The converse of implication, which means the right-hand side proposition, goes to the left-hand side and vice-versa. It can be written as Q → P and P → Q
- **Contrapositive:** The negation of converse is termed as contrapositive, and it can be represented as is Q→P is ¬ Q ¬ P.
- **Inverse:** The negation of implication is called inverse. It can be represented as

  ¬ P → ¬ Q is Q→P

From the above term some of the compound statements are equivalent to each other, which we can prove using truth table:

- **Conjunction:** The proposition "p and q" denoted by p ∧ q, is true when both p and q are true and is false otherwise. The proposition p ∧ q is called the conjunction of p and q

Definitions

-**Implicit functional association:** if the definition of function *cannot be* expressed briefly and clearly, the only way to specify the function is by listening all types that satisfy it.

* Clinic (date, time, doctor, patient);

For example: Clinic (1/1/2022, 4PM, Ali, samir);

-**Explicit functional association:** if the definition of function *can b*e expressed briefly and clearly.

Examples: f(x)=(x-32)/1.8

-**Data:** is the fundamental, indivisible object in the application.

-**Information**: is implicit functional association between data in the application.

- **Knowledge:** is the explicit functional association between item of information and/or data in the application.

How human solve problem

To solve problem in AI systems try to simulate humans from science of knowledge or cognitive, which includes the following points:

1. How is knowledge store in human brain?
2. How is knowledge obtained back from brain for process and usage?
3. How is knowledge gained (the mechanism used in gaining knowledge)
4. Problem solving or decision making is process information using the method of qualitative description or logical deduction.

Conventional programming and intelligence programming

Conventional programming could be assembly language or a high-level language such as C, C++, Java, JavaScript, Python, etc. Conventional programming is a manual process, which means the programmer creates the logic of the program. The program processes dependence for data or information.

Intelligence programming is the simulation of human intelligence processes by machines, especially computer systems. Specific applications of AI include expert systems, natural language processing, and speech recognition and machine vision. The program processes dependence for knowledge

	Knowledge process	Data process
	Represent and used knowledge	Represent and used data and information
	It used heuristic processing	It used algorithmic processing
	Inferential process	Repetitive processing

. **The problem formulation is as follows:**

- **States:** It describes the location of each numbered tiles and the blank tile.
- **Initial State:** We can start from any state as the initial state.
- **Actions:** Here, actions of the blank space is defined, i.e., either **left, right, up or down**
- **Transition Model:** It returns the resulting state as per the given state and actions.
- **Goal test:** It identifies whether we have reached the correct goal-state.
- **Path cost:** The path cost is number of steps in the path where the cost of each step is 1.