



## STUDY ON LOGIC AND ARTIFICIAL INTELLIGENCE SUBSETS OF ARTIFICIAL INTELLIGENCE

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**ABSTRACT:** *The field of computer science known as artificial intelligence (AI) encompasses a wide range of subfields. The purpose of artificial intelligence (AI) is to enable intelligent and autonomous operation of a system. AI gives machines the ability to think for themselves and make their own decisions. Machine Learning is a subset of Artificial Intelligence, while Deep Learning is another subset of Machine Learning. Together, these two types of learning make up AI as a whole. The capacity of a computer programme to study its environment, learn from its experiences, and then respond appropriately by making judgements or carrying out predetermined actions is an example of artificial intelligence. The field of Artificial Intelligence, of which Machine Learning is a part, includes a significant number of already-developed algorithms that may be applied to datasets in order to get relevant insights into the data, etc. These methods have been improved over time to ensure that they are functional when applied to a wide range of datasets, among other things.*

*Keywords: Artificial Intelligence, Artificial Intelligence Framework, Dynamic Investigation Problem, etc.*

### ARTIFICIAL INTELLIGENCE (AI)

AI is a branch of computer science and engineering. Artificial intelligence incorporates a few particular regions of research each with its very own particular advantages, investigate techniques and wording. These sub-regions include inquiry advances, information portrayal, common language preparing, apply autonomy, machine learning & others.

A large group of thoughts and techniques from AI can possibly affect the act of scientific modeling. Specifically, information based frameworks and situations can give portrayals and related problem-solving methods that can be utilized to encode domain information and domain-explicit techniques for an assortment of poorly organized problems in model age and result understanding. Propelled AI programming languages and methodologies can give significant level systems to actualizing numerical models and solutions, bringing about cleaner, simpler to compose and increasingly versatile computational mechanics codes. An assortment of calculations for heuristic pursuit, arranging and geometric reasoning can give viable and thorough components to tending to problems for example, shape portrayal and transformation and constraint-based model portrayal. Before talking about the uses of AI in scientific modeling, we quickly survey information based master frameworks and problem-solving techniques.

Artificial intelligence is the combination of methodologies that were intended to model and empower solutions to real world problems, which are not modeled or too hard to even consider modeling numerically. These problems are normally connected with fluffy, unpredictable and dynamical frameworks, with questionable parameters. These frameworks are the ones that model the real world and are of most enthusiasm to modern science. Artificial intelligence techniques have been perceived as alluring options in contrast to the standard, entrenched "hard processing" ideal models. Conventional hard figuring methods are regularly unreasonably lumbering for the present problems. They generally require a definitely expressed systematic model and frequently a great deal of computational time.



Artificial intelligence techniques, which accentuate gains in understanding framework conduct in return for pointless accuracy, have demonstrated to be significant down to earth tools for some contemporary problems. Neural Networks and Fuzzy Systems are general approximations of any multivariate capacity since they can be utilized for modeling exceptionally nonlinear, obscure or halfway known complex frameworks, plants or procedures. Hereditary Algorithm and Particle Swarm Optimization Techniques have developed as potential and vigorous improvement tools lately.

A few segments of artificial intelligence incorporate:

- Fuzzy logic (FL)
- Neural networks (NN)
- Support Vector Machines (SVM)
- Adaptive Neuro Fuzzy Inference System (ANFIS)
- Evolutionary computation (EC), including
- Evolutionary algorithms  $f$
- Genetic algorithms  $f$
- Differential evolution
- Metaheuristic and Swarm Intelligence  $f$
- Ant colony optimization  $f$
- Particle swarm optimization

### Logic and Artificial Intelligence

Artificial Intelligence (alluded "simulated intelligence") is the sub-branch of Computer Science (CS) gave to creating programs that empower PCs to show conduct that can extensively be portrayed as meaningful insight. For example, arranging or discourse to-discourse translation in constrained, all around characterized task domains. Be that as it may, significant intrigue stays in the long-run objective of building commonly shrewd, self-sufficient specialists regardless of whether the objective of completely human-like intelligence is slippery and is only from time to time sought after expressly and all things considered.

Throughout history, AI has been vigorously affected by logical thoughts. Computer based intelligence has drawn on many research methodologies: the worth and relative significance of logical formalisms is addressed by some driving specialists.

This is very much difficult to find a significant glance of philosophical topic and that doesn't get trapped with issues like reasoning. For example, we need to compare the deductions that can be done by an objective mediator. Whatever the causality is, it is ought to be not comparable with the ordinary common sense situations. Anyhow the conviction is discerning specialists should be able to make conceivable deductions about the convictions of different operators. "The objectives and standing constraints that advise a balanced operator's conduct must allow the formation of sensible plans".

In everycase, similarity with a worthy record of the applicable reasoning is basic for an effective philosophical hypothesis. In any case, methods are too unrefined in contemporary philosophical stocks are unrefined even if think about providing anything like a satisfactory record of reasoning that is very much complex and this ensnared in worldwide information's.

Using a variety of conceptual tools to address the challenge of admired reasoning in genuine contexts, as well as PCs to model and test the speculations. The study of reasoning, particularly functional, common sense reasoning, has altered as a result of advances in AI.

The new bits of knowledge and hypotheses that have risen up out of AI are of incredible potential incentive in advising and compelling numerous territories of philosophical request. In spite of the fact that logic in AI became out of philosophical logic, in its new setting it has created new speculations.



### Subsets of Artificial Intelligence

7 subsets of AI's are listed below:

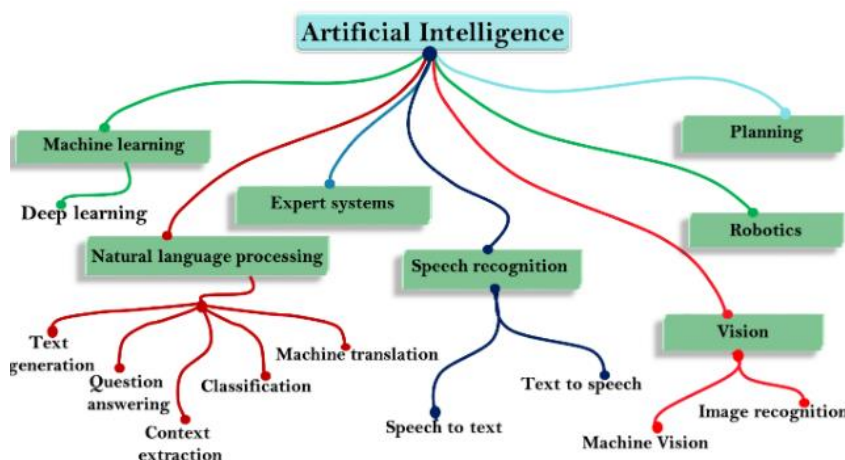


Figure 1.1: Artificial Intelligence

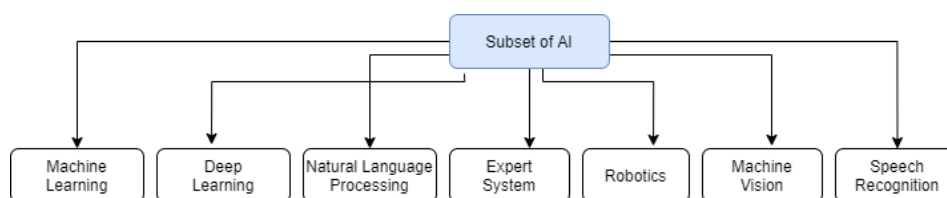


Figure 1.1 (a): 7 Subset of AI

#### 1. Machine Learning

“Machine learning is the sub-field of AI which furnishes intelligence to machines with the capacity to naturally learn with encounters without being explicitly programmed. It is principally worried about the structure and advancement of calculations that enable the framework to gain from authentic data. Machine Learning depends on the possibility that machines can gain from past data, distinguish examples and settle on choices utilizing calculations” [4]. Data can be unprocessed facts, value, text, sound or picture that is not being interpreted and analyzed. Machine learning calculations are planned so that they can learn and improve their presentation naturally.

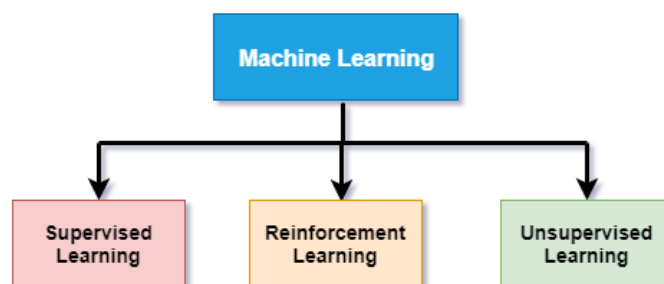


Figure 1.2: Types of machine learning

ML can be divided into 3 types:

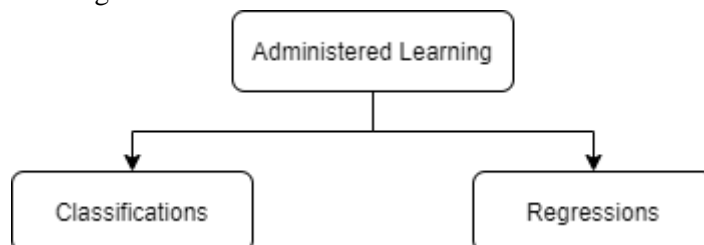
#### 2. Supervised Learning:

There are 3 types of learning and, this is one of them. It happens only in the presence of supervisor or teacher. It is a fast learning mechanism with high accuracy. Output is already known. The machine is fed with lots of input data. The dataset in which both the input and output are given. A model is built to predicate the outcomes. It includes Regression & Classification problems.



Examples – SVM (Support Vector Machine), KNN (K-nearest Neighbor), ANN (Artificial Neural Network) & DT (Decision Tree). The 3 applications are as follows – 1) Predict the weather based on wind speed, pressure value, 2) Forecast the sales for next month or next quarter for different products; and 3) Stock price analysis.

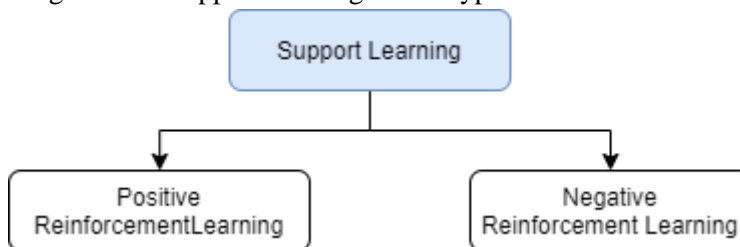
Again, Administered learning divided into 2 classes of calculations:



**Figure 1.3: Classes of Administered Learning**

**3. Reinforcement Learning:**

As the name indicates, it is an area of learning wherein an AI specialist is prepared by giving a few directions and on each activity; an operator gets an award as a criticism. Utilizing these inputs, specialist improves its exhibition. Prize criticism can be certain or negative which means each right step will give positive reward while for wrong step, it gets a negative reward. It will learn from its own experience in the absence of a training dataset. Support learning is of 2 types:

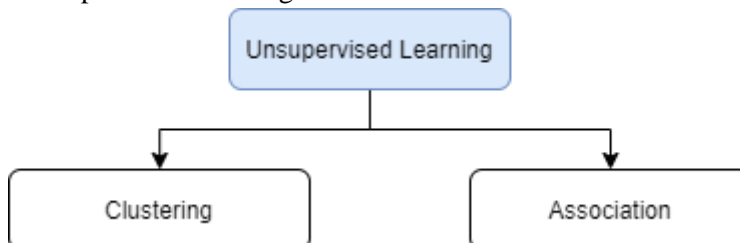


**Figure 1.4: Types of Support Learning**

**4. Unsupervised Learning:**

As the name indicates, it means learning in the absence of supervisor or a teacher, which means that the correct answer is not known. No output is mapping with input and these types of dataset are called unlabelled data set. That’s why it is called the independent learning process. An unsupervised learning agent tries to learn on its own from the patterns without corresponding output values. It is used for finding the hidden patterns of Data sets. Commonly used unsupervised learning methods are clustering & Association Rule Mining (ARM). Commonly used clustering examples are K-means clustering and Apriori for ARM.

There are 2 types of Unsupervised Learning:



**Figure 1.5: Types of Unsupervised Learning**

**5. Natural Language Processing**

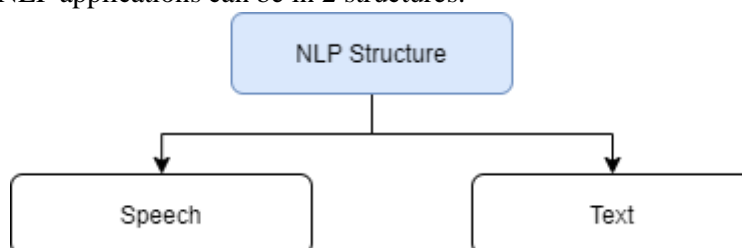
Natural language processing (NLP) is one of the most important and latest trends in AI. “NLP involves machines or robots understanding and processing the language that human speak” [5]. The following



tasks can be done by NLP: Speech recognition, Sentimental Analysis, Machine Translation, Summarization and chat bots etc. The most common examples of Speech recognition are Google Assistant and Siri ( a product of Apple).

The two components of NLP are NLU & NLG. NLU stands for Natural Language Understanding and NLG stands for Natural Language Generation. There are 5 steps involved in NLP: Lexical Analysis, Syntactic Analysis, Semantic Analysis, Disclosure Analysis, and Pragmatic Analysis. In some books Lexical analysis is replaced by words like “Morphological Analysis”.

The i/p and o/p of NLP applications can be in 2 structures:



**Figure 1.6: NLP Structure**

## 6. Deep Learning

Deep learning (DL) is a subset of machine learning. The main logic behind DL is to mimic human brain, which means how human actually learn those concepts similarly we are creating models over here which are learning those things. In DL, we created an architecture called as Multi Neural Network Architecture. DL can handle huge amounts of data (Structured data or unstructured data) where as Machine Learning can't.

Various techniques of Deep Learning are:

1. ANN – Artificial Neural Network
2. CNN – Convolution Neural Network
3. RNN – Recurrent Neural Network

Most of the problem statement and data will be in the form of numbers which will be solved using ANN. Suppose our problem statement is in the form of images, and then we will go with CNN. Suppose our input in the form of time series data, at that time we will be using RNN. Apart from this, there are some techniques like Transfer Learning, which is an extension of the advanced CNN and the base is also CNN. At the end of the day we derive an AI application.

Application areas include the medical field (detect tumor cell or cancer cell), Robotics (perform human-like assignments without human association), Self-Driving cars (based on the DL Algorithm, a car can drive itself, without a driver), Translation (conversion of one language into another).

### ➤ How Deep learning functions:

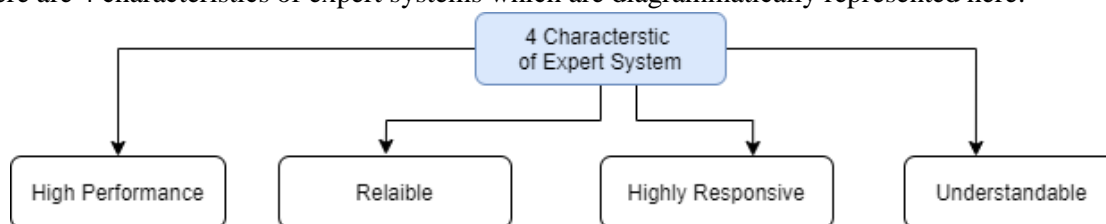
Here is a Neural Network to identify the digits. Suppose we have 3 students. Each of them writes down the digit 6 on a piece of paper. Notably, they don't all write identically. The human brain can easily recognize these digits, but what would if a computer recognized them? That's why DL comes in. Suppose this number is represented in  $28 \times 28$  pixels = 784 pixels now. The core entity of the neural network is neurons where the processing takes place. Each of the 784 pixels is fed to a neuron in the first layer of neural network, this forms the input layer. On the other hand we have the output layer with each neuron representing a digit with hidden layers existing between them. The information is transferred from one layer to another over connecting channels. Each of these has a value attached to it, and hence is called a weighted channel. All neurons have a unique number associated with them called BIOS. This BIOS is added to the weighted sum of inputs reaching the neurons which is then applied to the function known as “Activation function”. This function determines whether the neurons get



activated or not? Every activated neuron passes on information to the following layers. This continues to the 2<sup>nd</sup> last layer. The one neuron activated in the output layer corresponds to the input digit. The weights and BIOS are continuously adjusted to produce a well trained network

#### ➤ Expert Systems

The name itself says it is an expert system. Expert systems are computer applications developed to solve complex problems in a particular domain, at the level of extra-ordinary human intelligence and expertise. The Inference engine is the brain of the expert system, and it performs the deduction of rules, which means what these rules tell us and how to solve the problem. One of the best examples of a specialist framework is a suggestion for a spelling error while composing in the Google search box. There are 4 characteristics of expert systems which are diagrammatically represented here:



**Figure 1.7: Characteristics of Expert System**

#### ➤ Robotics

Robots are used to automate the human tasks in a day-to-day manner. Robotics is one of the components inside the AI umbrella. Robotics is a field of engineering that is basically focused on building and operating robots. Robotics is specially governed by these 3 engineering principles named as Electronics engineering, Mechanical Engineering and Computer science engineering. Electronics engineering is the responsible for designing circuits, Mechanical engineering is the responsible for the physical creation of robots and finally, Computer science Engineering is responsible for the application of those particular areas in which robots should be used. Robots are used in n numbers of areas, like industry, medical applications, learning purposes and so on. Robots + A.I = The Future. Here Robots is the body and AI is the brains. “Mechanical technology is a part of artificial intelligence and building which is utilized for planning and assembling of robots. Robots are the customized machines which can play out a progression of activities naturally or semi-consequently” [6]. “Computer based intelligence can be applied to robots to make shrewd robots which can play out the assignment with their intelligence. Artificial intelligence calculations are important to enable a robot to perform increasingly complex assignments” [7].

#### ➤ Machine Vision

Machine vision is a utilization of PC vision which empowers a machine to perceive the item. Machine vision catches and examinations visual information utilizing at least one camcorders, simple to-computerized discussions and advanced sign handling. Machine vision frameworks are customized to perform barely characterized errands for example checking objects, perusing the sequential number and so forth. PC frameworks don't find similarly as human eyes can see, however it is likewise not limited by human restrictions, for example to see through the divider. With the assistance of ML & Machine Vision, an AI specialist can have the option to see through dividers.

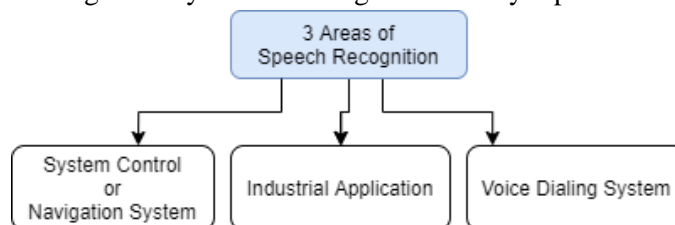
#### ➤ Discourse Recognition:

Discourse acknowledgment is an innovation that converts machine-communicated language into a machine-intelligible format. It is also possible to say "programmed speech acknowledgement" & "PC disclosure acknowledgement." Based on chat with a PC, a PC can play out a particular assignment. This product requires unambiguous communicated in language to comprehend and perform explicit undertaking. The present there are different programming or gadgets which contains discourse



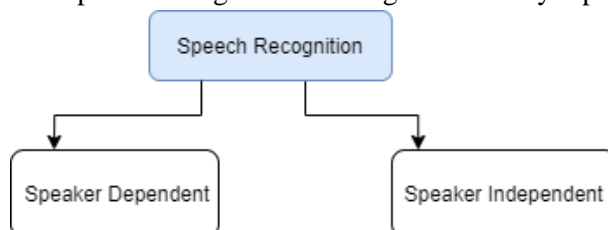
acknowledgment innovation, for example, Cortana, Google remote helper, Apple Siri and so on. We have to prepare our discourse acknowledgment framework to comprehend our language. In earlier days, these frameworks were just intended to change over the discourse to content, yet now there are different gadgets which can legitimately change over discourse into directions.

3 (Three) areas Speech Recognition systems are diagrammatically represented here :



**Figure 1.8: Areas of Speech Recognition**

2 (two) types of Speech Recognition are diagrammatically represented here:



**Figure 1.9: Types of Speech Recognition**

## CONCLUSION

In this article, we will go over some of the fundamental ideas of artificial intelligence, as well as its subsets and the many classifications of algorithms. The development of machine learning algorithms is unavoidable, and their applications may be found in almost every industry imaginable. They may be used for the purpose of conducting analyses on data originating from a wide range of data sources as well as various business sectors. All of these algorithms are assisting us in analysing the data with an extremely high degree of precision and enhancing the effectiveness of our work. In addition to that, we went through the various methods of machine learning, such as supervised, unsupervised, semi-supervised, and reinforcement based learning, as well as deep learning algorithms.

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