

Notes

Subject: Artificial Intelligence

Subject Code: ((BTCS 602-18))

Unit 1 AI Introduction

What is Intelligence?

The ability of a system to calculate, reason, perceive relationships and analogies, learn from experience, store and retrieve information from memory, solve problems, comprehend complex ideas, use natural language fluently, classify, generalize, and adapt new situations.

Types of Intelligence

As described by Howard Gardner, an American developmental psychologist, the Intelligence comes in multifold –

Intelligence	Description	Example
Linguistic intelligence	The ability to speak, recognize, and use mechanisms of phonology (speech sounds), syntax (grammar), and semantics (meaning).	Narrators, Orators
Musical intelligence	The ability to create, communicate with, and understand meanings made of sound, understanding of pitch, rhythm.	Musicians, Singers, Composers
Logical-mathematical intelligence	The ability of use and understand relationships in the absence of action or objects. Understanding complex and abstract ideas.	Mathematicians, Scientists

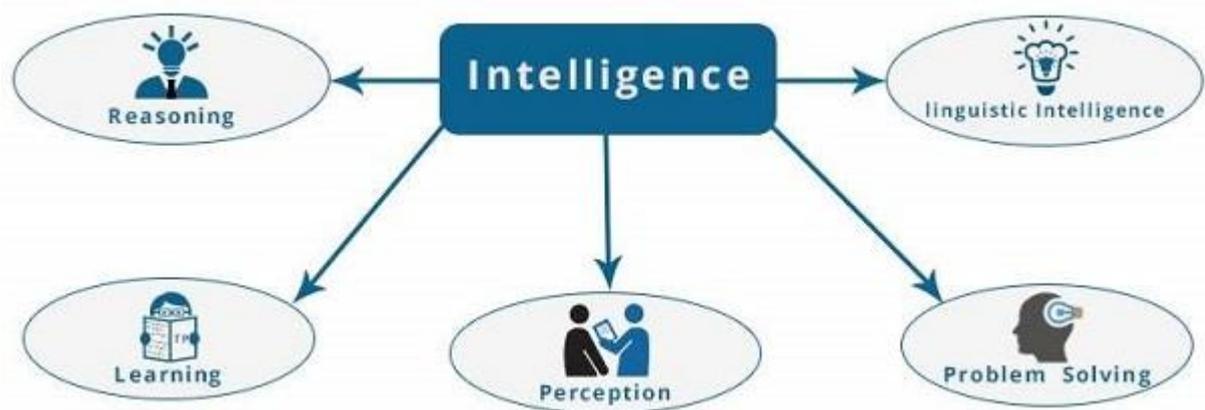
Spatial intelligence	The ability to perceive visual or spatial information, change it, and re-create visual images without reference to the objects, construct 3D images, and to move and rotate them.	Map readers, Astronauts, Physicists
Bodily-Kinesthetic intelligence	The ability to use complete or part of the body to solve problems or fashion products, control over fine and coarse motor skills, and manipulate the objects.	Players, Dancers
Intra-personal intelligence	The ability to distinguish among one's own feelings, intentions, and motivations.	Gautam Buddha
Interpersonal intelligence	The ability to recognize and make distinctions among other people's feelings, beliefs, and intentions.	Mass Communicators, Interviewers

You can say a machine or a system is **artificially intelligent** when it is equipped with at least one and at most all intelligences in it.

What is Intelligence Composed of?

The intelligence is intangible. 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 enables us to provide basis for judgement, making decisions, and prediction. There are broadly two types

Inductive Reasoning	Deductive Reasoning
It conducts specific observations to makes broad general statements.	It starts with a general statement and examines the possibilities to reach a specific, logical conclusion.
Even if all of the premises are true in a statement, inductive reasoning allows for the conclusion to be false.	If something is true of a class of things in general, it is also true for all members of that class.
Example – "Nita is a teacher. All teachers are studious. Therefore, Nita is studious."	Example – "All women of age above 60 years are grandmothers. Shalini is 65 years. Therefore, Shalini is a grandmother."

Learning – It is the activity of gaining knowledge or skill by studying, practising, being taught, or experiencing something. Learning enhances the awareness of the subjects of the study.

The ability of learning is possessed by humans, some animals, and AI-enabled systems. Learning is categorized as –

Auditory Learning – It is learning by listening and hearing. For example, students listening to recorded audio lectures.

Episodic Learning – To learn by remembering sequences of events that one has witnessed or experienced. This is linear and orderly.

Motor Learning – It is learning by precise movement of muscles. For example, picking objects, Writing, etc.

Observational Learning – To learn by watching and imitating others. For example, child tries to learn by mimicking her parent.

Perceptual Learning – It is learning to recognize stimuli that one has seen before. For example, identifying and classifying objects and situations.

Relational Learning – It involves learning to differentiate among various stimuli on the basis of relational properties, rather than absolute properties. For Example, Adding ‘little less’ salt at the time of cooking potatoes that came up salty last time, when cooked with adding say a tablespoon of salt.

Spatial Learning – It is learning through visual stimuli such as images, colors, maps, etc. For Example, A person can create roadmap in mind before actually following the road.

Stimulus-Response Learning – It is learning to perform a particular behavior when a certain stimulus is present. For example, a dog raises its ear on hearing doorbell.

Problem Solving – It is the process in which one perceives and tries to arrive at a desired solution from a present situation by taking some path, which is blocked by known or unknown hurdles.

Problem solving also includes **decision making**, which is the process of selecting the best suitable alternative out of multiple alternatives to reach the desired goal are available.

Perception – It is the process of acquiring, interpreting, selecting, and organizing sensory information.

Perception presumes **sensing**. In humans, perception is aided by sensory organs. In the domain of AI, perception mechanism puts the data acquired by the sensors together in a meaningful manner.

Linguistic Intelligence – It is one’s ability to use, comprehend, speak, and write the verbal and written language. It is important in interpersonal communication.

Difference between Human and Machine Intelligence

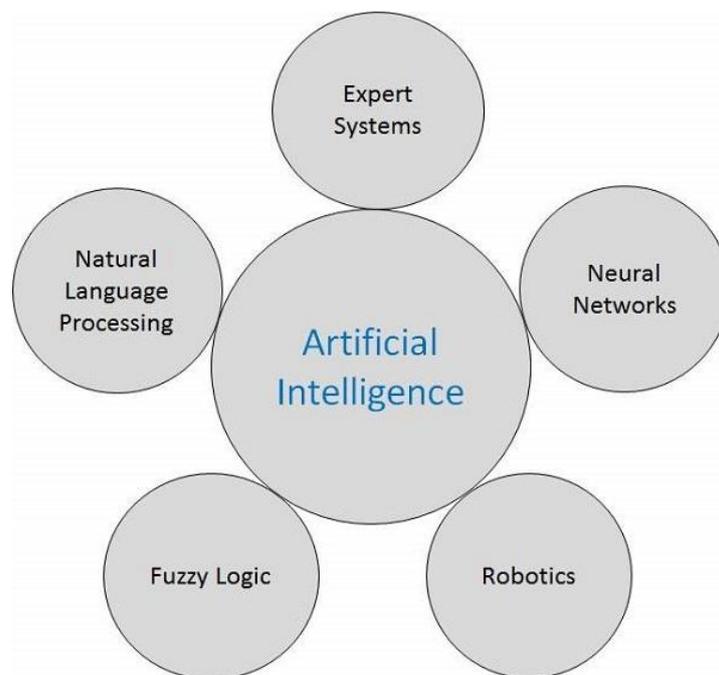
Humans perceive by patterns whereas the machines perceive by set of rules and data.

Humans store and recall information by patterns, machines do it by searching algorithms. For example, the number 40404040 is easy to remember, store, and recall as its pattern is simple.

Humans can figure out the complete object even if some part of it is missing or distorted; whereas the machines cannot do it correctly.

The domain of artificial intelligence is huge in breadth and width. While proceeding, we consider the broadly common and prospering research areas in the domain of AI

–



Speech and Voice Recognition

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

Speech Recognition	Voice Recognition
---------------------------	--------------------------

The speech recognition aims at understanding and comprehending WHAT was spoken.	The objective of voice recognition is to recognize WHO is speaking.
It is used in hand-free computing, map, or menu navigation.	It is used to identify a person by analysing its tone, voice pitch, and accent, etc.
Machine does not need training for Speech Recognition as it is not speaker dependent.	This recognition system needs training as it is person oriented.
Speaker independent Speech Recognition systems are difficult to develop.	Speaker dependent Speech Recognition systems are comparatively easy to develop.

Working of Speech and Voice Recognition Systems

The user input spoken at a microphone goes to sound card of the system. The converter turns the analog signal into equivalent digital signal for the speech processing. The database is used to compare the sound patterns to recognize the words. Finally, a reverse feedback is given to the database.

This source-language text becomes input to the Translation Engine, which converts it to the target language text. They are supported with interactive GUI, large database of vocabulary, etc.

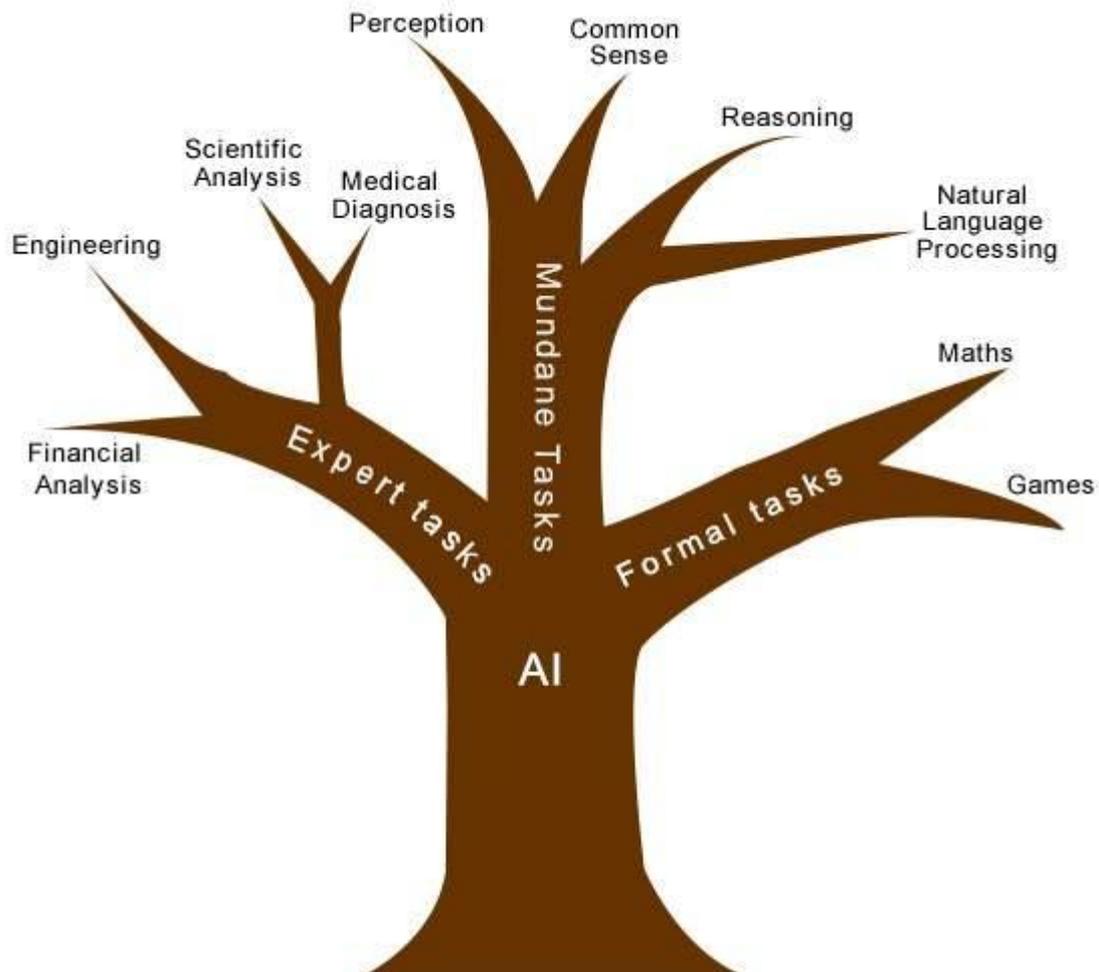
Real Life Applications of AI Research Areas

There is a large array of applications where AI is serving common people in their day-to-day lives –

Sr.No.	Research Areas	Example
1	<p>Expert Systems</p> <p>Examples – Flight-tracking systems, Clinical systems.</p>	
2	<p>Natural Language Processing</p> <p>Examples: Google Now feature, speech recognition, Automatic voice output.</p>	
3	<p>Neural Networks</p> <p>Examples – Pattern recognition systems such as face recognition, character recognition, handwriting recognition.</p>	
4	<p>Robotics</p> <p>Examples – Industrial robots for moving, spraying, painting, precision checking, drilling, cleaning, coating, carving, etc.</p>	
5	<p>Fuzzy Logic Systems</p> <p>Examples – Consumer electronics, automobiles, etc.</p>	

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
Perception <ul style="list-style-type: none"> • Computer Vision • Speech, Voice 	<ul style="list-style-type: none"> • Mathematics • Geometry • Logic • Integration and Differentiation 	<ul style="list-style-type: none"> • Engineering • Fault Finding • Manufacturing • Monitoring
Natural Language Processing	Games	Scientific Analysis

<ul style="list-style-type: none"> • Understanding • Language Generation • Language Translation 	<ul style="list-style-type: none"> • Go • Chess (Deep Blue) • Ccheckers 	
Common Sense	Verification	Financial Analysis
Reasoning	Theorem Proving	Medical Diagnosis
Planing		Creativity
Robotics		
<ul style="list-style-type: none"> • Locomotive 		

Humans learn **mundane (ordinary) tasks** since their birth. They learn by perception, speaking, using language, and locomotives. They learn Formal Tasks and Expert Tasks later, in that order.

For humans, the mundane tasks are easiest to learn. The same was considered true before trying to implement mundane tasks in machines. Earlier, all work of AI was concentrated in the mundane task domain.

Later, it turned out 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 prospering in the Expert Tasks domain** now, as the expert task domain needs expert knowledge without common sense, which can be easier to represent and handle.