

Artificial Intelligence-BSCE-306L

Module 1: Introduction

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Outline

- ❑ Introduction to AI
- ❑ Applications of AI
- ❑ Evolution of AI
- ❑ State of Art
- ❑ Different Types of Artificial Intelligence
- ❑ Subfields of AI
- ❑ Intelligent Agents
- ❑ Structure of Intelligent Agents
- ❑ AI Environments

Definitions of AI:

1. Thinking Humanly

- ❑ “The exciting new effort to make computers think . . . *machines with minds, in the full and literal sense.*” (*Haugeland, 1985*).
- ❑ “[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . .” (*Bellman, 1978*)

2. Acting Humanly

- ❑ “The art of creating machines that perform functions that require intelligence when performed by people.” (*Kurzweil, 1990*)
- ❑ “The study of how to make computers do things at which, at the moment, people are better.” (*Rich and Knight, 1991*)

Definitions of AI:

3. Thinking Rationally

- ❑ “The study of mental faculties through the use of computational models.” (*Charniak and McDermott, 1985*)
- ❑ “The study of the computations that make it possible to perceive, reason, and act.” (*Winston, 1992*)

4. Acting Rationally

- ❑ “Computational Intelligence is the study of the design of intelligent agents.” (*Poole et al., 1998*)
- ❑ “AI . . . is concerned with intelligent behavior in artifacts.” (*Nilsson, 1998*)

Introduction of Artificial Intelligence

❑ Acting Humanly: The Turing Test approach:

- The Turing Test, proposed by Alan Turing (1950), was designed to provide a satisfactory operational definition of intelligence.
- A computer passes the test if a human interrogator, after posing some written questions, cannot tell whether the written responses come from a person or from a computer.
- We note that programming a computer to pass a rigorously applied test provides plenty to work on.
- The computer would need to possess the following capabilities:
 - I. **Natural Language Processing** to enable it to communicate successfully in English;
 - II. **Knowledge Representation** to store what it knows or hears;
 - III. **Automated Reasoning** to use the stored information to answer questions and to draw new conclusions;
 - IV. **Machine Learning** to adapt to new circumstances and to detect and extrapolate patterns.

Introduction of Artificial Intelligence

❑ **Thinking Humanly: The cognitive modeling approach:**

❑ 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 three ways to do this:

I. Through introspection: trying to catch our own thoughts as they go by;

II. Through psychological experiments: observing a person in action;

III. Through brain imaging: observing the brain in action.

❑ Once we have a sufficiently precise theory of the mind, it becomes possible to express the theory as a computer program.

❑ If the program's input–output behavior matches corresponding human behavior, that is evidence that some of the program's mechanisms could also be operating in humans.

Introduction of Artificial Intelligence

❑ Thinking Rationally: The “laws of thought” approach

❑ The Greek philosopher Aristotle was one of the first to attempt to codify “right thinking,” that is, irrefutable reasoning processes, his **sylogisms provided patterns for argument structures** that always yielded correct conclusions when given correct premises—for example, “Socrates is a man; all men are mortal; therefore, Socrates is mortal.”

❑ These laws of thought were supposed to govern the operation of the mind; their study initiated the field called **logic**, Logicians in the 19th century **developed a precise notation for statements about all kinds of objects in the world and the relations among them.**

❑ *By 1965, programs existed that could, in principle, solve any solvable problem described in logical notation.*

❑ The so-called **logicist tradition within** artificial intelligence hopes to build on such programs to create **intelligent systems.**

Introduction of Artificial Intelligence

❑ Acting Rationally: The rational agent approach

❑ An agent is just something that acts.

❑ All computer programs do something, but computer agents are expected to do more: operate autonomously, perceive their environment, persist over a prolonged time period, adapt to change, and create and pursue goals.

❑ A rational agent is one that acts so as to achieve the best outcome or, when there is uncertainty, the best expected outcome.

❑ In the “laws of thought” approach to AI, the emphasis was on correct inferences.

❑ Making correct inferences is sometimes *part of being a rational agent, because one way to 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.

Introduction of Artificial Intelligence

❑ **Artificial Intelligence** (AI) refers to the *simulation of human intelligence in machines that are programmed to think and act like humans*.

❑ It involves the *development of algorithms and computer programs* that can perform tasks that typically require human intelligence such as visual perception, speech recognition, decision-making, and language translation.

❑ AI has the potential to revolutionize many industries and has a wide range of applications, from virtual personal assistants to self-driving cars.

❑ **Intelligence:** The ability to learn and solve problems.

- *Intelligence*, as we know, is the ability to acquire and apply *knowledge*.
- *Knowledge* is the information acquired through *experience*.
- *Experience* is the knowledge gained through *exposure(training)*.

Introduction of Artificial Intelligence

□ Intelligence is composed of:

1. **Reasoning:** The process of thinking about something in a logical way in order to form a conclusion or judgment.
2. **Learning:** Knowledge/Experience that you get from studying/working.
3. **Problem-Solving:** Act of defining a problem; determining the cause of the problem; identifying, prioritizing, and selecting alternatives for a solution; and implementing a solution
4. **Perception:** Act of perceiving or the ability to perceive; mental grasp of objects, qualities, etc. by means of the senses; awareness; comprehension.
5. **Linguistic Intelligence:** The ability to think in words and to use language to express and appreciate complex meanings.

Introduction of Artificial Intelligence

- ❑ Many tools are used in AI, including versions of search and **mathematical optimization, logic, and methods based on probability and economics.**
- ❑ The AI field draws upon **computer science, mathematics, psychology, linguistics, philosophy, neuroscience, artificial psychology,** and many others.
- ❑ The main focus of artificial intelligence is towards understanding human behavior and performance.
- ❑ This can be done by **creating computers with human-like intelligence and capabilities.**
- ❑ This includes natural language processing, facial analysis and robotics.
- ❑ The main applications of AI are in military, healthcare, and computing; however, it's expected that these applications will start soon and become part of our everyday lives.

Applications of Artificial Intelligence

❑ Artificial Intelligence has many practical applications across various industries and domains, including:

1. **Healthcare:** AI is used for medical diagnosis, drug discovery, and predictive analysis of diseases.
2. **Finance:** AI helps in credit scoring, fraud detection, and financial forecasting.
3. **Retail:** AI is used for product recommendations, price optimization, and supply chain management.
4. **Manufacturing:** AI helps in quality control, predictive maintenance, and production optimization.
5. **Transportation:** AI is used for autonomous vehicles, traffic prediction, and route optimization.
6. **Customer service:** AI-powered chatbots are used for customer support, answering frequently asked questions, and handling simple requests.
7. **Security:** AI is used for facial recognition, intrusion detection, and cybersecurity threat analysis.
8. **Marketing:** AI is used for targeted advertising, customer segmentation, and sentiment analysis.
9. **Education:** AI is used for personalized learning, adaptive testing, and intelligent tutoring systems.

Evolution of Artificial Intelligence

❑ Birth of AI: 1950-1956

- ❑ This range of time was when the interest in AI really came to a head. Alan Turing published his work “Computer Machinery and Intelligence” which eventually became The Turing Test, which experts used to measure computer intelligence.
- ❑ The term “artificial intelligence” was coined and came into popular use.
- ❑ Dates of note:
 - **1950:** Alan Turing published “[Computer Machinery and Intelligence](#)” which proposed a test of machine intelligence called The Imitation Game.
 - **1952:** A computer scientist named [Arthur Samuel](#) developed a program to play checkers, which is the first to ever learn the game independently.
 - **1955:** [John McCarthy](#) held a workshop at Dartmouth on “artificial intelligence” which is the first use of the word, and how it came into popular usage.

Evolution of Artificial Intelligence

❑ AI maturation: 1957-1979

- ❑ The time between when the phrase “artificial intelligence” was created, and the 1980s was a period of both rapid growth and struggle for AI research.
- ❑ The late 1950s through the 1960s was a time of creation.
- ❑ From programming languages that are still in use to this day to books and films that explored the idea of robots, AI became a mainstream idea quickly.
- ❑ The 1970s showed similar improvements, such as the first anthropomorphic robot being built in Japan, to the first example of an autonomous vehicle being built by an engineering grad student.
- ❑ However, it was also a time of struggle for AI research, as the U.S. government showed little interest in continuing to fund AI research.

Evolution of Artificial Intelligence

❑ AI maturation: 1957-1979

❑ Notable dates include:

- **1958:** John McCarthy created [LISP](#) (acronym for List Processing), the first programming language for AI research, which is still in popular use to this day.
- **1959:** [Arthur Samuel created the term “machine learning”](#) when doing a speech about teaching machines to play chess better than the humans who programmed them.
- **1961:** The first industrial robot [Unimate](#) started working on an assembly line at General Motors in New Jersey, tasked with transporting die casings and welding parts on cars (which was deemed too dangerous for humans).
- **1965:** Edward Feigenbaum and Joshua Lederberg created [the first “expert system”](#) which was a form of AI programmed to replicate the thinking and decision-making abilities of human experts.

Evolution of Artificial Intelligence

❑ AI maturation: 1957-1979

❑ Notable dates include:

- **1966:** Joseph Weizenbaum created the first “chatterbot” (later shortened to chatbot), [ELIZA, a mock psychotherapist](#), that used natural language processing (NLP) to converse with humans. 1968: Soviet mathematician Alexey Ivakhnenko published “Group Method of Data Handling” in the journal “Avtomatika,” which proposed a new approach to AI that would later become what we now know as “Deep Learning.”
- **1973:** An applied mathematician named [James Lighthill](#) gave a report to the British Science Council, underlining that strides were not as impressive as those that had been promised by scientists, which led to much-reduced support and funding for AI research from the British government.
- **1979:** James L. Adams created [The Stanford Cart](#) in 1961, which became one of the first examples of an autonomous vehicle. In ‘79, it successfully navigated a room full of chairs without human interference.
- **1979:** The American Association of Artificial Intelligence which is now known as the [Association for the Advancement of Artificial Intelligence](#) (AAAI) was founded.

Evolution of Artificial Intelligence

❑ AI boom: 1980-1987

- ❑ Most of the 1980s showed a period of rapid growth and interest in AI, now labeled as the “AI boom.”
- ❑ This came from both breakthroughs in research, and additional government funding to support the researchers.
- ❑ Deep Learning techniques and the use of Expert System became more popular, both of which allowed computers to learn from their mistakes and make independent decisions.
- ❑ Notable dates in this time period include:
 - **1980:** First conference of the AAAI was held at Stanford.
 - **1980:** The [first expert system came into the commercial market](#), known as XCON (expert configurer). It was designed to assist in the ordering of computer systems by automatically picking components based on the customer’s needs.

Evolution of Artificial Intelligence

❑ AI boom: 1980-1987

❑ Notable dates in this time period include:

- **1981:** The Japanese government allocated \$850 million (over \$2 billion dollars in today's money) to the [Fifth Generation Computer project](#). Their aim was to create computers that could translate, converse in human language, and express reasoning on a human level.
- **1984:** The AAAI warns of an incoming "[AI Winter](#)" where funding and interest would decrease, and make research significantly more difficult.
- **1985:** An autonomous drawing program known as [AARON](#) is demonstrated at the AAAI conference.
- **1986:** Ernst Dickmann and his team at Bundeswehr University of Munich created and demonstrated the [first driverless car](#) (or robot car). It could drive up to 55 mph on roads that didn't have other obstacles or human drivers.
- **1987:** Commercial launch of Alacrity by Alactrious Inc. Alacrity was the first strategy managerial advisory system, and used a complex expert system with 3,000+ rules.

Evolution of Artificial Intelligence

❑ AI winter: 1987-1993

❑ As the AAAI warned, an AI Winter came, the term describes a period of low consumer, public, and private interest in AI which leads to decreased research funding, which, in turn, leads to few breakthroughs.

❑ Both private investors and the government lost interest in AI and halted their funding due to high cost versus seemingly low return.

❑ This AI Winter came about because of some setbacks in the machine market and expert systems, including the end of the Fifth Generation project, cutbacks in strategic computing initiatives, and a slowdown in the deployment of expert systems.

❑ Notable dates include:

▪ **1987:** The [market for specialized LISP-based hardware collapsed](#) due to cheaper and more accessible competitors that could run LISP software, including those offered by IBM and Apple.

▪ **1988:** A computer programmer named [Rollo Carpenter invented the chatbot Jabberwacky](#), which he programmed to provide interesting and entertaining conversation to humans.

Evolution of Artificial Intelligence

❑ AI agents: 1993-2011

- ❑ Despite the lack of funding during the AI Winter, the early 90s showed some impressive strides forward in AI research, including the introduction of the first AI system that could beat a reigning world champion chess player.
- ❑ This era also introduced AI into everyday life via innovations such as the first Roomba and the first commercially-available speech recognition software on Windows computers.
- ❑ The surge in interest was followed by a surge in funding for research, which allowed even more progress to be made.
- ❑ Notable dates include:
 - **1997:** [Deep Blue](#) (developed by IBM) beat the world chess champion, Gary Kasparov, in a highly-publicized match, becoming the first program to beat a human chess champion.
 - **1997:** Windows released a speech recognition software (developed by Dragon Systems).

Evolution of Artificial Intelligence

❑ AI agents: 1993-2011

❑ Notable dates include:

- **2000:** Professor Cynthia Breazeal developed the first robot that could simulate human emotions with its face, which included eyes, eyebrows, ears, and a mouth. It was called Kismet.
- **2002:** The first Roomba was released.
- **2003:** [Nasa landed two rovers onto Mars](#) (Spirit and Opportunity) and they navigated the surface of the planet without human intervention.
- **2006:** Companies such as Twitter, Facebook, and Netflix started utilizing AI as a part of their advertising and user experience (UX) algorithms.
- **2010:** Microsoft launched the Xbox 360 Kinect, the first gaming hardware designed to track body movement and translate it into gaming directions.
- **2011:** An NLP computer programmed to answer questions named [Watson](#) (created by IBM) won Jeopardy against two former champions in a televised game.
- **2011:** Apple released Siri, the first popular virtual assistant.

Evolution of Artificial Intelligence

❑ Artificial General Intelligence: 2012-present

- ❑ That brings us to the most recent developments in AI, up to the present day.
- ❑ We've seen a surge in common-use AI tools, such as virtual assistants, search engines, etc.
- ❑ This time period also popularized Deep Learning and Big Data..

Notable dates include:

- **2012:** Two researchers from Google (Jeff Dean and Andrew Ng) trained a neural network to recognize cats by showing it unlabeled images and no background information.
- **2015:** Elon Musk, Stephen Hawking, and Steve Wozniak (and over 3,000 others) signed an open letter to the worlds' government systems banning the development of (and later, use of) autonomous weapons for purposes of war.
- **2016:** Hanson Robotics created a humanoid robot named Sophia, who became known as the first “robot citizen” and was the first robot created with a realistic human appearance and the ability to see and replicate emotions, as well as to communicate.

Evolution of Artificial Intelligence

❑ Artificial General Intelligence: 2012-present

❑ Notable dates include:

- **2017:** Facebook programmed two AI chatbots to converse and learn how to negotiate, but as they went back and forth they ended up forgoing English and developing their own language, completely autonomously.
- **2018:** A Chinese tech group called Alibaba's language-processing AI beat human intellect on a Stanford reading and comprehension test.
- **2019:** Google's AlphaStar reached Grandmaster on the video game StarCraft 2, outperforming all but .2% of human players.
- **2020:** OpenAI started beta testing GPT-3, a model that uses Deep Learning to create code, poetry, and other such language and writing tasks. While not the first of its kind, it is the first that creates content almost indistinguishable from those created by humans.
- **2021:** OpenAI developed DALL-E, which can process and understand images enough to produce accurate captions, moving AI one step closer to understanding the visual world.

❑ Following are few the State of Arts of Artificial Intelligence

❑ **Robotic vehicles:** A driverless robotic car named STANLEY sped through the rough terrain of the Mojave dessert at 22 mph, finishing the 132-mile course first to win the 2005 DARPA Grand Challenge. STANLEY is a Volkswagen Touareg outfitted with cameras, radar, and laser rangefinders to sense the environment and onboard software to command the steering, braking, and acceleration.

❑ **Speech recognition:** A traveler calling United Airlines to book a flight can have the entire conversation guided by an automated speech recognition and dialog management system.

❑ **Autonomous planning and scheduling:** A hundred million miles from Earth, NASA's Remote Agent program became the first on-board autonomous planning program to control the scheduling of operations for a spacecraft. *REMOTE AGENT generated* plans from high-level goals specified from the ground and monitored the execution of those plans—detecting, diagnosing, and recovering from problems as they occurred.

❑ Following are few the State of Arts of Artificial Intelligence

❑ **Game playing:** IBM's DEEP BLUE became the first computer program to defeat the world champion in a chess match when it bested Garry Kasparov by a score of 3.5 to 2.5 in an exhibition match. Kasparov said that he felt a “new kind of intelligence” across the board from him.

❑ **Spam fighting:** Each day, learning algorithms classify over a billion messages as spam, saving the recipient from having to waste time deleting what, for many users, could comprise 80% or 90% of all messages, if not classified away by algorithms.

❑ **Logistics planning:** During the Persian Gulf crisis of 1991, U.S. forces deployed a Dynamic Analysis and Replanning Tool, DART, to do automated logistics planning and scheduling for transportation. This involved up to 50,000 vehicles, cargo, and people at a time, and had to account for starting points, destinations, routes, and conflict resolution among all parameters. The AI planning techniques generated in hours a plan that would have taken weeks with older methods. The Defense Advanced Research Project Agency (DARPA) stated that this single application more than paid back DARPA's 30-year investment in AI.

❑ Following are few the State of Arts of Artificial Intelligence

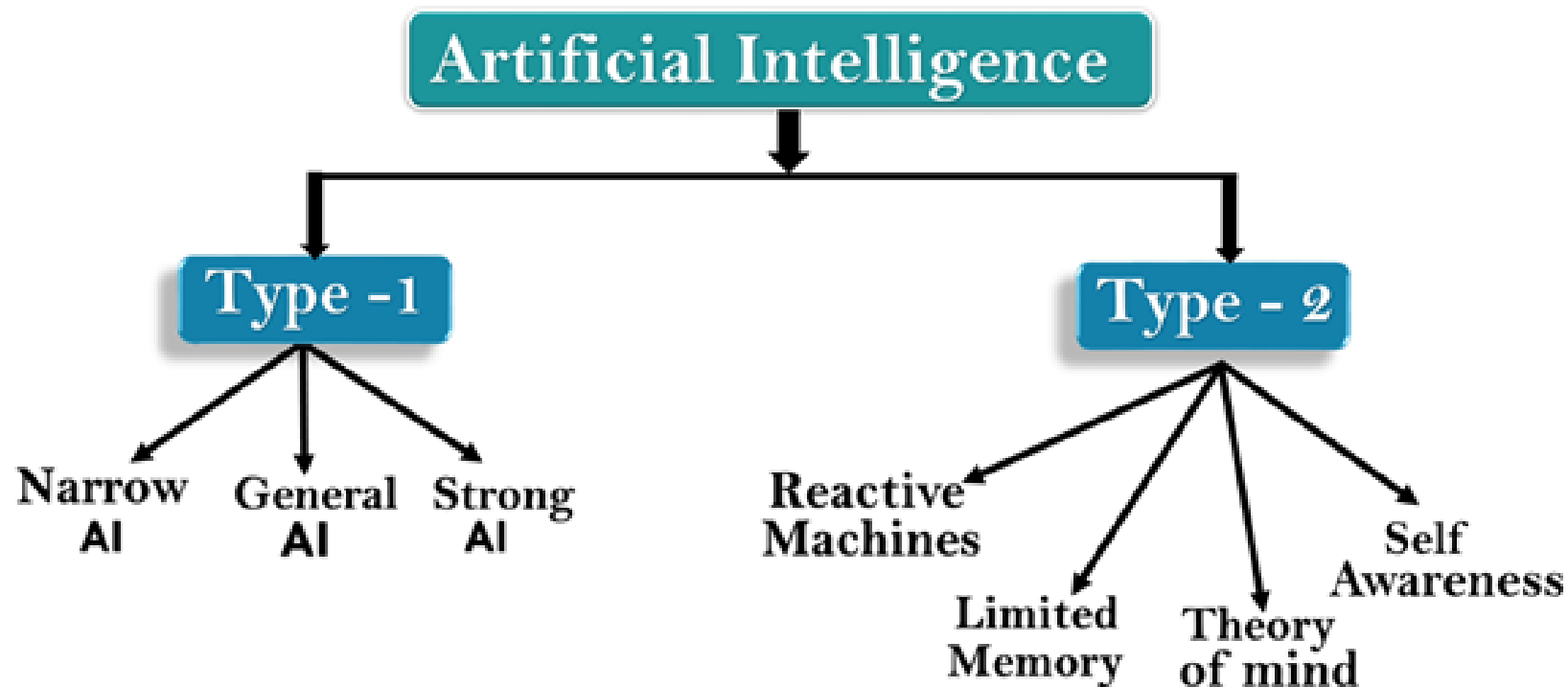
❑ **Robotics:** The iRobot Corporation has sold over two million Roomba robotic vacuum cleaners for home use. The company also deploys the more rugged PackBot to Iraq and Afghanistan, where it is used to handle hazardous materials, clear explosives, and identify the location of snipers.

❑ **Machine Translation:** A computer program automatically translates from Arabic to English, allowing an English speaker to see the headline “Ardogan Confirms That Turkey Would Not Accept Any Pressure, Urging Them to Recognize Cyprus.” The program uses a statistical model built from examples of Arabic-to-English translations and from examples of English text totaling two trillion words. *None of the computer scientists* on the team speak Arabic, but they do understand statistics and machine learning algorithms.

Types of Artificial Intelligence

❑ Artificial Intelligence can be divided in various types, there are mainly two types of main categorization which are **based on capabilities (Type-1)** and **based on functionally (Type-2)** of AI.

❑ Following is flow diagram which explain the types of AI.



Types of Artificial Intelligence

□Type-1: Based on Capabilities

A. Weak AI or Narrow AI:

- I. Narrow AI is a type of AI which is able to perform a dedicated task with intelligence.
- II. Narrow AI cannot perform beyond its field or limitations, as it is only trained for one specific task, hence it is also termed as weak AI.
- III. Apple Siri is a good example of Narrow AI, but it operates with a limited pre-defined range of functions.
- IV. IBM's Watson supercomputer also comes under Narrow AI, as it uses an Expert system approach combined with Machine learning and natural language processing.
- V. Some Examples of Narrow AI are playing chess, purchasing suggestions on e-commerce site, self-driving cars, speech recognition, and image recognition.

Types of Artificial Intelligence

□Type-1: Based on Capabilities

B. General AI:

- I. General AI is a type of intelligence which could perform any intellectual task with efficiency like a human.
- II. The idea behind the general AI to make such a system which could be smarter and think like a human by its own.
- III. Currently, there is no such system exist which could come under general AI and can perform any task as perfect as a human.
- IV. The worldwide researchers are now focused on developing machines with General AI.

Types of Artificial Intelligence

□Type-1: Based on Capabilities

C. Super AI:

- I. Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than human with cognitive properties.
- II. It is an outcome of general AI.
- III. Some key characteristics of strong AI include capability include the ability to think, to reason, solve the puzzle, make judgments, plan, learn, and communicate by its own.
- IV. Super AI is still a hypothetical concept of Artificial Intelligence.
- V. Development of such systems in real is still world changing task.

Types of Artificial Intelligence

□Type-2: Based on Functionality

A. Reactive Machines

- I. Purely reactive machines are the most basic types of Artificial Intelligence.
- II. Such AI systems do not store memories or past experiences for future actions.
- III. These machines only focus on current scenarios and react on it as per possible best action.
- IV. IBM's Deep Blue system is an example of reactive machines.
- V. Google's AlphaGo is also an example of reactive machines.

Types of Artificial Intelligence

□Type-2: Based on Functionality

B. Limited Memory

- I. Limited memory machines can store past experiences or some data for a short period of time.
- II. These machines can use stored data for a limited time period only.
- III. Self-driving cars are one of the best examples of Limited Memory systems.
- IV. These cars can store recent speed of nearby cars, the distance of other cars, speed limit, and other information to navigate the road.

Types of Artificial Intelligence

□ Type-2: Based on Functionality

C. Theory of Mind

- I. Theory of Mind AI should understand the human emotions, people, beliefs, and be able to interact socially like humans.
- II. This type of AI machines are still not developed, but researchers are making lots of efforts and improvement for developing such AI machines.

Types of Artificial Intelligence

□ Type-2: Based on Functionality

D. Self-Awareness

- I. Self-awareness AI is the future of Artificial Intelligence. These machines will be super intelligent, and will have their own consciousness, sentiments, and self-awareness.
- II. These machines will be smarter than human mind.
- III. Self-Awareness AI does not exist in reality still and it is a hypothetical concept.

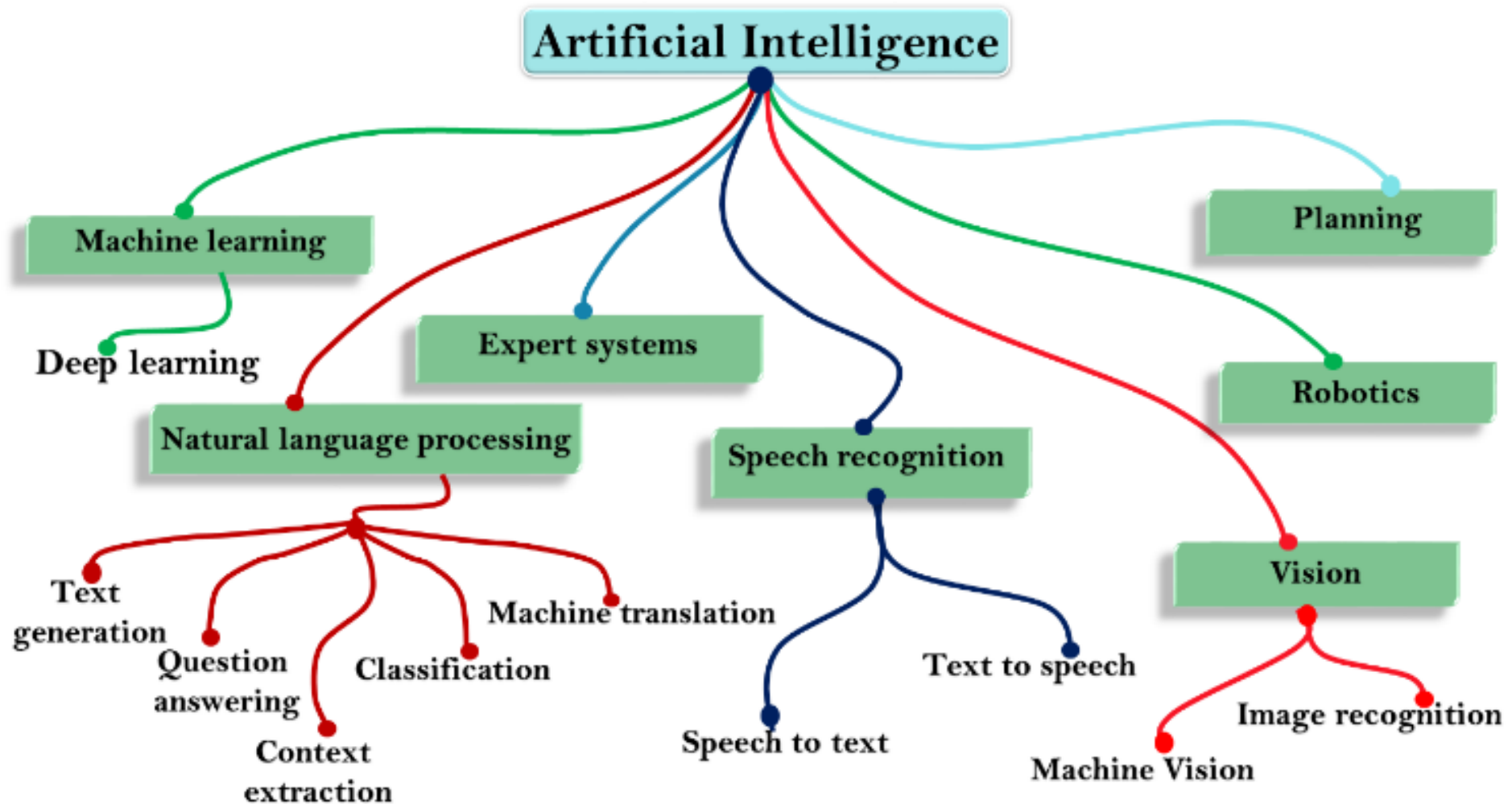
Subfields of Artificial Intelligence

❑ Following are the most common subsets of AI

- 1. Machine Learning**
- 2. Deep Learning**
- 3. Natural Language processing**
- 4. Expert System**
- 5. Robotics**
- 6. Machine Vision**
- 7. Speech Recognition**

Subfields of Artificial Intelligence

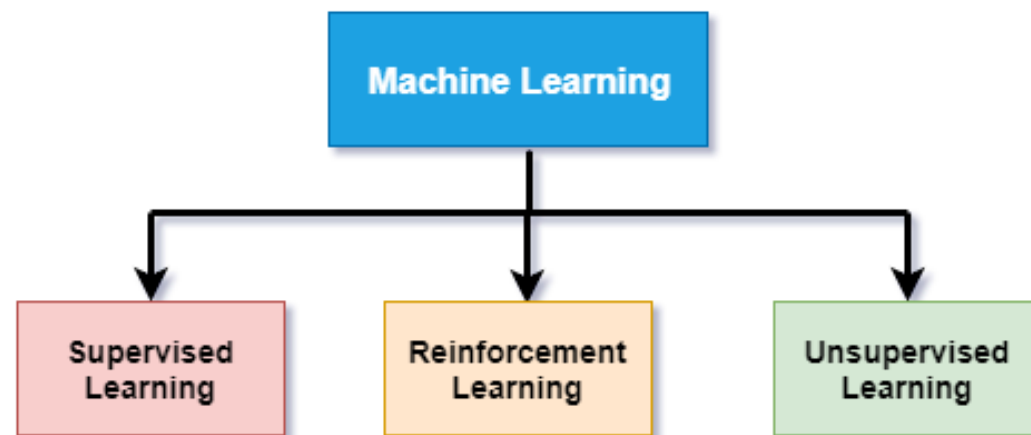
□ Following are the most common subsets of AI



Subfields of Artificial Intelligence

1. Machine Learning:

- ❑ Machine learning is a part of AI which provides intelligence to machines with the ability to automatically learn with experiences without being explicitly programmed.
- ❑ It is primarily concerned with the design and development of algorithms that allow the system to learn from historical data.
- ❑ Machine Learning is based on the idea that machines can learn from past data, identify patterns, and make decisions using algorithms.
- ❑ Machine learning algorithms are designed in such a way that they can learn and improve their performance automatically.



2. Deep Learning

- ❑ Deep learning is a subset of machine learning which provides the ability to machine to perform human-like tasks without human involvement.
- ❑ It provides the ability to an AI agent to mimic the human brain.
- ❑ Deep learning can use both supervised and unsupervised learning to train an AI agent.
- ❑ Deep learning is implemented through neural networks architecture hence also called a deep neural network.
- ❑ Deep learning is the primary technology behind self-driving cars, speech recognition, image recognition, automatic machine translation, etc.
- ❑ The main challenge for deep learning is that it requires lots of data with lots of computational power.

3. Natural Language processing

- ❑ Natural language processing is a subfield of computer science and artificial intelligence.
- ❑ NLP enables a computer system to understand and process human language such as English.
- ❑ NLP plays an important role in AI as without NLP, AI agent cannot work on human instructions, but with the help of NLP, we can instruct an AI system on our language.
- ❑ Today we are all around AI, and as well as NLP, we can easily ask Siri, Google or Cortana to help us in our language.
- ❑ Natural language processing application enables a user to communicate with the system in their own words directly.

4. Expert System

- ❑ An expert system is an application of artificial intelligence.
- ❑ In artificial intelligence, expert systems are the computer programs that rely on obtaining the knowledge of human experts and programming that knowledge into a system.
- ❑ Expert systems emulate the decision-making ability of human experts.
- ❑ These systems are designed to solve the complex problem through bodies of knowledge rather than conventional procedural code.
- ❑ One of the examples of an expert system is a Suggestion for the spelling error while typing in the Google search box.
- ❑ Following are some characteristics of expert systems:
 - High performance
 - Reliable
 - Highly responsive
 - Understandable

5. Robotics

- ❑ Robotics is a branch of artificial intelligence and engineering which is used for designing and manufacturing of robots.
- ❑ Robots are the programmed machines which can perform a series of actions automatically or semi-automatically.
- ❑ AI can be applied to robots to make intelligent robots which can perform the task with their intelligence.
- ❑ AI algorithms are necessary to allow a robot to perform more complex tasks.
- ❑ Nowadays, AI and machine learning are being applied on robots to manufacture intelligent robots which can also interact socially like humans.
- ❑ One of the best examples of AI in robotics is Sophia robot.

6. Machine Vision

- ❑ Machine vision is an application of computer vision which enables a machine to recognize the object.
- ❑ Machine vision captures and analyses visual information using one or more video cameras, analog-to-digital conversions, and digital signal processing.
- ❑ Machine vision systems are programmed to perform narrowly defined tasks such as counting objects, reading the serial number, etc.
- ❑ Computer systems do not see in the same way as human eyes can see, but it is also not bounded by human limitations such as to see through the wall.
- ❑ With the help of machine learning and machine vision, an AI agent can be able to see through walls.

7. Speech Recognition

- ❑ Speech recognition is a technology which enables a machine to understand the spoken language and translate into a machine-readable format.
- ❑ It can also be said as automatic Speech recognition and computer speech recognition.
- ❑ It is a way to talk with a computer, and on the basis of that command, a computer can perform a specific task.

Note for Students

□ This power point presentation is for lecture, therefore it is suggested that also utilize the text books and lecture notes.