

After completing this chapter, the students will be able to:

- Explain what artificial intelligence (AI) is.
- Describe the eras of AI.
- Explain the types and approaches of AI.
- Describe the applications of AI in health, agriculture, business and education
- List the factors that influenced the advancement of AI in recent years.
- Understand the relationship between the human's way of thinking and AI systems
- Identify AI research focus areas.
- Identify real-world AI applications, some platforms, and tools.

What is Artificial Intelligence (AI)

Artificial Intelligence is composed of two words Artificial and Intelligence.

Artificial defines "man-made," and intelligence defines "thinking power", or "the ability to learn and solve problems" hence Artificial Intelligence means "a man-made thinking power."

So, we can define Artificial Intelligence (AI) as the branch of computer science by which we can create intelligent machines which can behave like a human, think like humans, and able to make decisions.

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). Summing the terms up, we get artificial intelligence as the "copy of something natural (i.e., human beings) 'WHO' is capable of acquiring and applying the information it has gained through exposure."

Artificial Intelligence exists when a machine can have human-based skills such as learning, reasoning, and solving problems with Artificial Intelligence you do not need to preprogram a machine to do some work, despite that you can create a machine with programmed algorithms which can work with own intelligence.

Intelligence is composed of:

- Reasoning
- Learning
- Problem Solving
- Perception
- Linguistic Intelligence

An AI system is composed of an agent and its environment. An agent (e.g., human or robot) is anything that can perceive its environment through sensors and acts upon that environment through effectors. Intelligent agents must be able to set goals and achieve them. In classical planning problems, the agent can assume that it is the only system acting in the world, allowing the agent to be certain of the consequences of its actions. However, if the agent is not the only actor, then it requires that the agent can reason under uncertainty. This calls for an agent that cannot only assess its environment and make predictions but also evaluate its predictions and adapt based on its assessment. Machine perception is the ability to use input from sensors (such as cameras, microphones, sensors, etc.) to deduce aspects of the world. e.g., Computer Vision.

High-profile examples of AI include autonomous vehicles (such as drones and self-driving cars), medical diagnosis, creating art (such as poetry), proving mathematical theorems, playing games (such as Chess or Go), search engines (such as Google search), online assistants (such as Siri), image recognition in photographs, spam filtering, prediction of judicial decisions and targeting online advertisements. AI deals with the area of developing computing systems that are capable of performing tasks that humans are very good at, for example recognizing objects, recognizing and making sense of speech, and decision making in a constrained environment.

The advent of Big Data, driven by the arrival of the internet, smart mobile and social media has enabled AI algorithms, in particular from Machine Learning and Deep Learning, to leverage Big Data and perform their tasks more optimally. This combined with cheaper and more powerful hardware such as Graphical Processing Units (GPUs) has enabled AI to evolve into more complex architectures. Machine Learning is an advanced form of AI where the machine can learn as it goes rather than having every action programmed by humans.

Many times, students get confused between Machine Learning and Artificial Intelligence (see figure 3.1), but Machine learning, a fundamental concept of AI research since the field’s inception, is the study of computer algorithms that improve automatically through experience. The term machine learning was introduced by Arthur Samuel in 1959. Neural networks are biologically inspired networks that extract features from the data in a hierarchical fashion. The field of neural networks with several hidden layers is called deep learning.

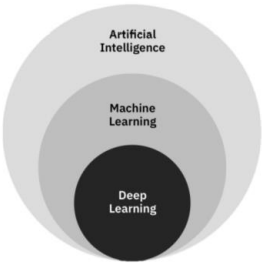


Figure 3.1 Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL)

Need for Artificial Intelligence

- 1. To create expert systems that exhibit intelligent behavior with the capability to learn, demonstrate, explain and advice its users.
- 2. Helping machines find solutions to complex problems like humans do and applying them as algorithms in a computer-friendly manner.

Goals of Artificial Intelligence

Following are the main goals of Artificial Intelligence:

- 1. Replicate human intelligence
- 2. Solve Knowledge-intensive tasks
- 3. An intelligent connection of perception and action
- 4. Building a machine which can perform tasks that requires human intelligence such as:
 - ✓ Proving a theorem
 - ✓ Playing chess
 - ✓ Plan some surgical operation
 - ✓ Driving a car in traffic
- 5. Creating some system which can exhibit intelligent behavior, learn new things by itself, demonstrate, explain, and can advise to its user.

What Comprises to Artificial Intelligence?

Artificial Intelligence is not just a part of computer science even it's so vast and requires lots of other factors that can contribute to it. To create the AI-first we should know that how intelligence is composed, so Intelligence is an intangible part of our brain which is a combination of Reasoning, learning, problem-solving, perception, language understanding, etc.

To achieve the above factors for a machine or software Artificial Intelligence requires the following disciplines (see Figure 3.2):

- ✓ Mathematics
- ✓ Biology
- ✓ Psychology
- ✓ Sociology
- ✓ Computer Science
- ✓ Neurons Study
- ✓ Statistics



Figure 3.2 Artificial Intelligence is multidisciplinary

ADVANTAGES OF ARTIFICIAL INTELLIGENCE

Following are some main advantages of Artificial Intelligence:

- **High Accuracy with fewer errors:** AI machines or systems are prone to fewer errors and high accuracy as it takes decisions as per pre-experience or information.
- **High-Speed:** AI systems can be of very high-speed and fast-decision making, because of that AI systems can beat a chess champion in the Chess game.
- **High reliability:** AI machines are highly reliable and can perform the same action multiple times with high accuracy.
- **Useful for risky areas:** AI machines can be helpful in situations such as defusing a bomb, exploring the ocean floor, where to employ a human can be risky.
- **Digital Assistant:** AI can be very useful to provide digital assistant to users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirements.
- **Useful as a public utility:** AI can be very useful for public utilities such as a self-driving car which can make our journey safer and hassle-free, facial recognition for security purposes, Natural language

processing (for search engines, for spelling checker, for assistant like Siri, for translation like google translate), etc.

DISADVANTAGES OF ARTIFICIAL INTELLIGENCE

One of the key features that distinguishes us, humans, from everything else in the world is intelligence. This ability to understand, apply knowledge and improve skills has played a significant role in our evolution and establishing human civilization. But many people (including Elon Musk the founder of) believe that the advancement in technology can create a superintelligence that can threaten human existence.

Every technology has some disadvantages, and the same goes for Artificial intelligence. Being so advantageous technology still, it has some disadvantages which we need to keep in our mind while creating an AI system. Following are the disadvantages of AI:

- **High Cost:** The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.
- **Can't think out of the box:** Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.
- **No feelings and emotions:** AI machines can be an outstanding performer, but still it does not have the feeling so it cannot make any kind of emotional attachment with humans, and may sometime be harmful for users if the proper care is not taken.
- **Increase dependence on machines:** With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.
- **No Original Creativity:** As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

History of AI

Artificial Intelligence is not a new word and not a new technology for researchers. This technology is much older than you would imagine. Even there are the myths of Mechanical men in Ancient Greek and Egyptian Myths. The following are some milestones in the history of AI which define the journey from the AI generation to till date development (see Figure 3.3).

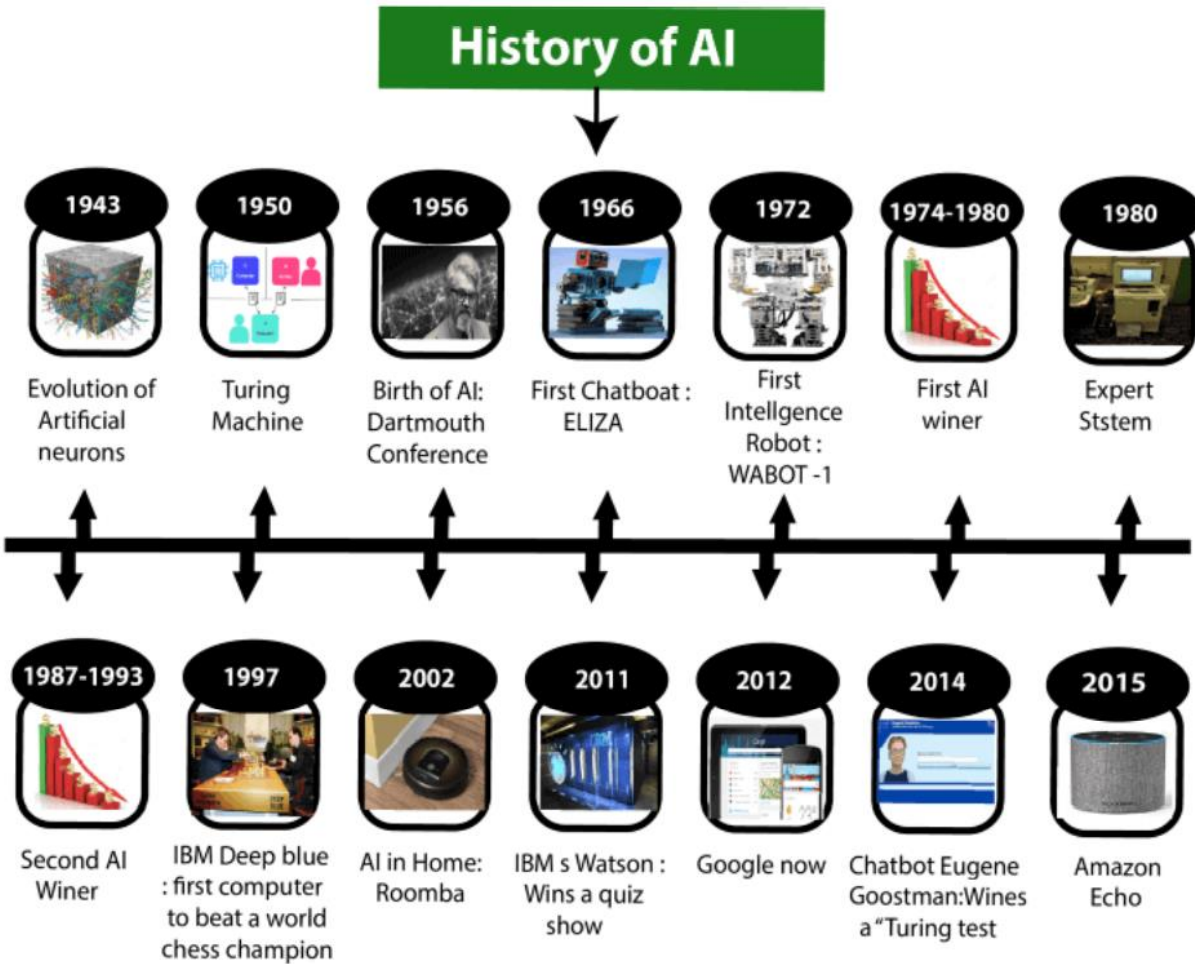


Figure 3.3 History of Artificial Intelligence (AI)

A. Maturation of Artificial Intelligence (1943-1952)

- The year 1943: The first work which is now recognized as AI was done by Warren McCulloch and Walter Pitts in 1943. They proposed a model of artificial neurons.
- The year 1949: Donald Hebb demonstrated an updating rule for modifying the connection strength between neurons. His rule is now called Hebbian learning.
- The year 1950: The Alan Turing who was an English mathematician and pioneered Machine learning in 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.

B. The birth of Artificial Intelligence (1952-1956)

- The year 1955: Allen Newell and Herbert A. Simon created the "first artificial intelligence program" which was named "Logic Theorist". This program had proved 38 of 52 Mathematics theorems, and found new and more elegant proofs for some theorems.
- The year 1956: The word "Artificial Intelligence" first adopted by American Computer scientist John McCarthy at the Dartmouth Conference. For the first time, AI coined as an academic field. At that time high-level computer languages such as FORTRAN, LISP, or COBOL were invented. And the enthusiasm for AI was very high at that time.

C. The golden years-Early enthusiasm (1956-1974)

- The year 1966: The researchers emphasized developing algorithms that can solve mathematical problems. Joseph Weizenbaum created the first chatbot in 1966, which was named as ELIZA.
- The year 1972: The first intelligent humanoid robot was built in Japan which was named WABOT-1.

D. The first AI winter (1974-1980)

- The duration between the years 1974 to 1980 was the first AI winter duration. AI winter refers to the time period where computer scientists dealt with a severe shortage of funding from the government for AI researches.
- During AI winters, an interest in publicity on artificial intelligence was decreased.

E. A boom of AI (1980-1987)

- The 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.

F. 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 due to high cost but not efficient results. The expert system such as XCON was very cost-effective.

G. The emergence of intelligent agents (1993-2011)

- The 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.
- The year 2002: for the first time, AI entered the home in the form of Roomba, a vacuum cleaner.
- The year 2006: AI came into the Business world until the year 2006. Companies like Facebook, Twitter, and Netflix also started using AI.

H. Deep learning, big data and artificial general intelligence (2011-present)

- The year 2011: In the year 2011, IBM's Watson won jeopardy, a quiz show, where it had to solve complex questions as well as riddles. Watson had proved that it could understand natural language and can solve tricky questions quickly.
- The year 2012: Google has launched an Android app feature "Google now", which was able to provide information to the user as a prediction.
- The year 2014: In the year 2014, Chatbot "Eugene Goostman" won a competition in the infamous "Turing test."
- The year 2018: The "Project Debater" from IBM debated on complex topics with two master debaters and also performed extremely well.

➤ Google has demonstrated an AI program "Duplex" which was a virtual assistant and which had taken hairdresser appointment on call, and the lady on the other side didn't notice that she was talking with the machine.

Now AI has developed to a remarkable level. The concept of Deep learning, big data, and data science are now trending like a boom. Nowadays companies like Google, Facebook, IBM, and Amazon are working with AI and creating amazing devices. The future of Artificial Intelligence is inspiring and will come with high intelligence.

LEVELS OF AI

Stage 1 – Rule-Based Systems

The most common uses of AI today fit in this bracket, covering everything from business software (Robotic Process Automation) and domestic appliances to aircraft autopilots.

Stage 2 – Context Awareness and Retention

➤ Algorithms that develop information about the specific domain they are being applied in. They are trained on the knowledge and experience of the best humans, and their knowledge base can be updated as new situations and queries arise. Well, known applications of this level are chatbots and “roboadvisors”.

Stage 3 – Domain-Specific Expertise

➤ Going beyond the capability of humans, these systems build up expertise in a specific context taking in massive volumes of information which they can use for decision making. Successful use cases have been seen in cancer diagnosis and the well-known Google Deepmind’s AlphaGo. Currently, this type is limited to one domain only would forget all it knows about that domain if you started to teach it something else.

Stage 4 – Reasoning Machines

➤ These algorithms have some ability to attribute mental states to themselves and others – they have a sense of beliefs, intentions, knowledge, and how their own logic works. This means they could reason or negotiate with humans and other machines. At the moment these algorithms are still in development, however, commercial applications are expected within the next few years.

Stage 5 – Self Aware Systems / Artificial General Intelligence (AGI)

➤ These systems have human-like intelligence – the most commonly portrayed AI in media – however, no such use is in evidence today. It is the goal of many working in AI and some believe it could be realized already from 2024.

Stage 6 – Artificial Superintelligence (ASI)

➤ AI algorithms can outsmart even the most intelligent humans in every domain. Logically it is difficult for humans to articulate what the capabilities might be, yet we would hope examples would include solving problems we have failed to so far, such as world hunger and dangerous environmental change. Views vary as to when and whether such a capability could even be possible, yet there a few experts who claim it can be realized by 2029. Fiction has tackled this idea for a long time, for example in the film Ex Machina or Terminator.

Stage 7 – Singularity and Transcendence

➤ This is the idea that development provided by ASI (Stage 6) leads to a massive expansion in human capability. Human augmentation could connect our brains to each other and to a future successor of the current internet, creating a “hive mind” that shares ideas, solves problems collectively, and even gives others access to our dreams as observers or participants. Pushing this idea further, we might go beyond the limits of the human body and connect to other forms of intelligence on the planet – animals, plants, weather systems, and the natural environment. Some proponents of singularity such as Ray Kurzweil, Google’s Director of Engineering, suggest we could see it happen by 2045 as a result of exponential rates of progress across a range of science and technology disciplines. The other side of the fence argues that singularity is impossible and human consciousness could never be digitized.

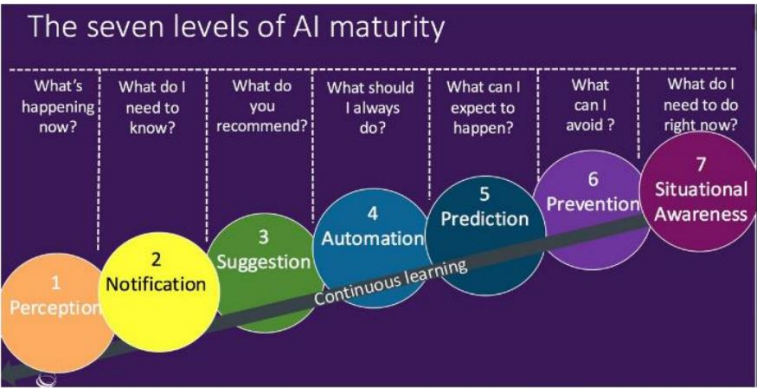


Figure 3.4 The seven layers of AI maturity

Types of AI

Artificial Intelligence can be divided into various types, there are mainly two types of the main categorization which are based on capabilities and based on functionality of AI, as shown in figure 3.5. Following is the flow diagram which explains the types of AI.

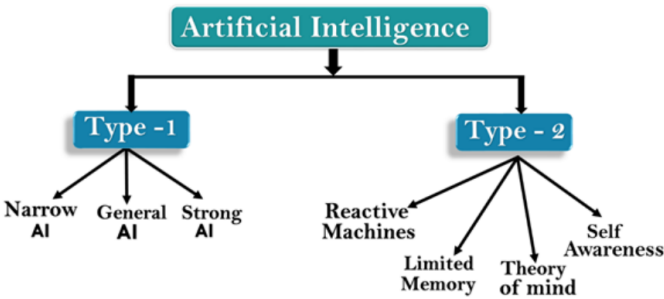


Figure 3.5 types of Artificial Intelligence (AI)

A. Based on Capabilities

1. Weak AI or Narrow AI:

- Narrow AI is a type of AI which is able to perform a dedicated task with intelligence. The most common and currently available AI is Narrow AI in the world of Artificial Intelligence.
- 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. Narrow AI can fail in unpredictable ways if it goes beyond its limits.
- Apple Siri is a good example of Narrow AI, but it operates with a limited predefined range of functions.
- IBM's Watson supercomputer also comes under Narrow AI, as it uses an Expert system approach combined with Machine learning and natural language processing.
- Some Examples of Narrow AI are Google translate, playing chess, purchasing suggestions on e-commerce sites, self-driving cars, speech recognition, and image recognition.

2. General AI:

- General AI is a type of intelligence that could perform any intellectual task with efficiency like a human.
- The idea behind the general AI to make such a system that could be smarter and think like a human on its own.
- Currently, there is no such system exists which could come under general AI and can perform any task as perfect as a human. It may arrive within the next 20 or so years but it has challenges relating to hardware, the energy consumption required in today's powerful machines, and the need to solve for catastrophic memory loss that affects even the most advanced deep learning algorithms of today
- The worldwide researchers are now focused on developing machines with General AI.
- As systems with general AI are still under research, and it will take lots of effort and time to develop such systems.

3. Super AI:

- Super AI is a level of Intelligence of Systems at which machines could surpass human intelligence, and can perform any task better than a human with cognitive properties. This refers to aspects like general wisdom, problem solving and creativity. It is an outcome of general AI.
- Some key characteristics of strong AI include capability include the ability to think, to reason solve the puzzle, make judgments, plan, learn, and communicate on its own.
- Super AI is still a hypothetical concept of Artificial Intelligence. The development of such systems in real is still a world-changing task.

B. Based on the functionality

1. Reactive Machines

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

2. Limited Memory

- Limited memory machines can store past experiences or some data for a short period of time.
- These machines can use stored data for a limited time period only.

➤ Self-driving cars are one of the best examples of Limited Memory systems. These cars can store the recent speed of nearby cars, the distance of other cars, speed limits, and other information to navigate the road.

3. *Theory of Mind*

➤ Theory of Mind AI should understand human emotions, people, beliefs, and be able to interact socially like humans.

➤ This type of AI machines is still not developed, but researchers are making lots of efforts and improvement for developing such AI machines.

4. *Self-Awareness*

➤ 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.

➤ These machines will be smarter than the human mind.

➤ Self-Awareness AI does not exist in reality still and it is a hypothetical concept.

HOW HUMANS THINK

The goal of many researchers is to create strong and general AI that learns like a human and can solve general problems as the human brain does. Achieving this goal might require many more years.

How does a human being think? Intelligence or the cognitive process is composed of three main stages:

- Observe and input the information or data in the brain.
- Interpret and evaluate the input that is received from the surrounding environment.
- Make decisions as a reaction towards what you received as input and interpreted and evaluated.

AI researchers are simulating the same stages in building AI systems or models. This process represents the main three layers or components of AI systems.

Mapping human thinking to artificial intelligence components

Because AI is the science of simulating human thinking, it is possible to map the human thinking stages to the layers or components of AI systems.

In the **first stage**, humans acquire information from their surrounding environments through human senses, such as sight, hearing, smell, taste, and touch, through human organs, such as eyes, ears, and other sensing organs, for example, the hands.

In AI models, this stage is represented by the sensing layer, which perceives information from the surrounding environment. This information is specific to the AI application. For example, there are sensing agents such as voice recognition for sensing voice and visual imaging recognition for sensing images. Thus, these agents or sensors take the role of the hearing and sight senses in humans.

The **second stage** is related to interpreting and evaluating the input data. In AI, this stage is represented by the interpretation layer, that is, reasoning and thinking about the gathered input that is acquired by the sensing layer.

The **third stage** is related to taking action or making decisions. After evaluating the input data, the interacting layer performs the necessary tasks. Robotic movement control and speech generation are examples of functions that are implemented in the interacting layer.

Influencers of artificial intelligence

This section explores some of the reasons why AI is taking off now. The following influencers of AI are described in this section:

- Big data: Structured data versus unstructured data
- Advancements in computer processing speed and new chip architectures
- Cloud computing and APIs
- The emergence of data science

BIG DATA

Big data refers to huge amounts of data. Big data requires innovative forms of information processing to draw insights, automate processes, and help decision making. Big data can be structured data that corresponds to a formal pattern, such as traditional data sets and databases. Also, big data includes semi-structured and unstructured formats, such as word-processing documents, videos, images, audio, presentations, social media interactions, streams, web pages, and many other kinds of content. Figure 3.6 depicts the rapid change of the data landscape.

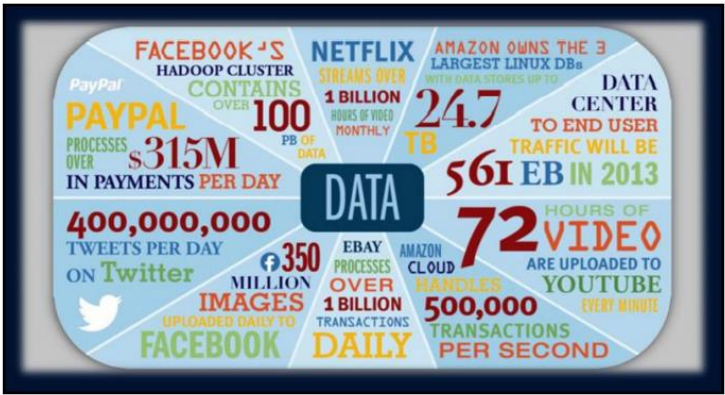


Figure 3.6 Current changes in the data landscape

Applications of AI

Artificial Intelligence has various applications in today's society. It is becoming essential for today's time because it can solve complex problems in an efficient way in multiple industries, such as Healthcare, entertainment, finance, education, etc. AI is making our daily life more comfortable and faster.

Following are some sectors which have the application of Artificial Intelligence:

1. AI in agriculture

➤ Agriculture is an area that requires various resources, labor, money, and time for the best result. Now a day's agriculture is becoming digital, and AI is emerging in this field. Agriculture is applying AI as agriculture robotics, solid and crop monitoring, predictive analysis. AI in agriculture can be very helpful for farmers.

2. AI in Healthcare

➤ In the last, five to ten years, AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry.

➤ Healthcare Industries are applying AI to make a better and faster diagnosis than humans. AI can help doctors with diagnoses and can inform when patients are worsening so that medical help can reach the patient before hospitalization.

3. AI in education:

➤ AI can automate grading so that the tutor can have more time to teach. AI chatbot can communicate with students as a teaching assistant.

➤ AI in the future can be work as a personal virtual tutor for students, which will be accessible easily at any time and any place.

4. AI in Finance and E-commerce

➤ AI and finance industries are the best matches for each other. The finance industry is implementing automation, chatbot, adaptive intelligence, algorithm trading, and machine learning into financial processes.

➤ AI is providing a competitive edge to the e-commerce industry, and it is becoming more demanding in the e-commerce business. AI is helping shoppers to discover associated products with recommended size, color, or even brand.

5. AI in Gaming

➤ AI can be used for gaming purposes. The AI machines can play strategic games like chess, where the machine needs to think of a large number of possible places.

6. AI in Data Security

➤ The security of data is crucial for every company and cyber-attacks are growing very rapidly in the digital world. AI can be used to make your data more safe and secure. Some examples such as AEG bot, AI2 Platform, are used to determine software bugs and cyber-attacks in a better way.

7. AI in Social Media

➤ Social Media sites such as Facebook, Twitter, and Snapchat contain billions of user profiles, which need to be stored and managed in a very efficient way. AI can organize and manage massive amounts of data. AI can analyze lots of data to identify the latest trends, hashtags, and requirements of different users.

8. AI in Travel &Transport

➤ AI is becoming highly demanding for travel industries. AI is capable of doing various travel related works such as from making travel arrangements to suggesting the hotels, flights, and best routes to the customers. Travel industries are using AI-powered chatbots which can make human-like interaction with customers for a better and fast response.

9. AI in the Automotive Industry

➤ Some Automotive industries are using AI to provide virtual assistants to their use for better performance. Such as Tesla has introduced TeslaBot, an intelligent virtual assistant.

➤ Various Industries are currently working for developing self-driven cars which can make your journey more safe and secure.

10. AI in Robotics:

➤ Artificial Intelligence has a remarkable role in Robotics. Usually, general robots are programmed such that they can perform some repetitive task, but with the help of AI, we can create intelligent robots which can perform tasks with their own experiences without pre-programmed.

➤ Humanoid Robots are the best examples for AI in robotics, recently the intelligent Humanoid robot named Erica and Sophia has been developed which can talk and behave like humans.

11. AI in Entertainment

➤ We are currently using some AI-based applications in our daily life with some entertainment services such as Netflix or Amazon. With the help of ML/AI algorithms, these services show the recommendations for programs or shows.

The most common artificial intelligence platforms include Microsoft AZURE Machine Learning, Google Cloud Prediction API, IBM Watson, TensorFlow, Infosys Nia, Wipro HOLMES, API.AI, Premonition, Rainbird, Ayasdi, MindMeld, and Meya.

Sample AI application

I. Commuting

- Google's AI-Powered Predictions
- Ridesharing Apps Like Uber and Lyft
- Commercial Flights Use an AI Autopilot

II. Email

- Spam Filters
- Smart Email Categorization

III. Social Networking

➤ Facebook - When you upload photos to Facebook, the service automatically highlights faces and suggests friends tag.

➤ Pinterest - Pinterest uses computer vision, an application of AI where computers are taught to “see,” in order to automatically identify objects in images (or “pins”) and then recommend visually similar pins. Other applications of machine learning at Pinterest includes spam prevention, search, and discovery, ad performance and monetization, and email marketing.

➤ Instagram - Instagram, which Facebook acquired in 2012, uses machine learning to identify the contextual meaning of emoji, which have been steadily replacing slang (for instance, a laughing emoji could replace “lol”)

➤ Snapchat - Snapchat introduced facial filters, called Lenses, in 2015. These filters track facial movements, allowing users to add animated effects or digital masks that adjust when their faces moved.

IV. Online Shopping

➤ Search - Your Amazon searches (“ironing board”, “pizza stone”, “Android charger”, etc.) quickly return a list of the most relevant products related to your search

➤ Recommendations - You see recommendations for products you’re interested in as “customers who viewed this item also viewed” and “customers who bought this item also bought”, as well as via personalized recommendations on the home page, bottom of item pages, and through email. Amazon uses artificial neural networks to generate these product recommendations.

V. Mobile Use

➤ **Voice-to-Text** - A standard feature on smartphones today is voice-to-text. By pressing a button or saying a particular phrase (“Ok Google”, for example), you can start speaking and your phone converts the audio into text

➤ **Smart Personal Assistants** - Now that voice-to-text technology is accurate enough to rely on for basic conversation, it has become the control interface for a new generation of smart personal assistants

o ***Siri and Google Now*** (now succeeded by the more sophisticated Google Assistant), which could perform internet searches, set reminders, and integrate with your calendar.

o ***Amazon*** expanded upon this model with the announcement of complementary hardware and software components:

o ***Alexa***, an AI-powered personal assistant that accepts voice commands to create to-do lists, order items online, set reminders, and answer questions (via internet searches)

o ***Echo*** (and later, Dot) smart speakers that allow you to integrate Alexa into your living room and use voice commands to ask natural language questions, play music, order pizza, hail an Uber, and integrate with smart home devices.

➤ Microsoft has followed suit with Cortana, its own AI assistant that comes pre-loaded on Windows computers and Microsoft smartphones.