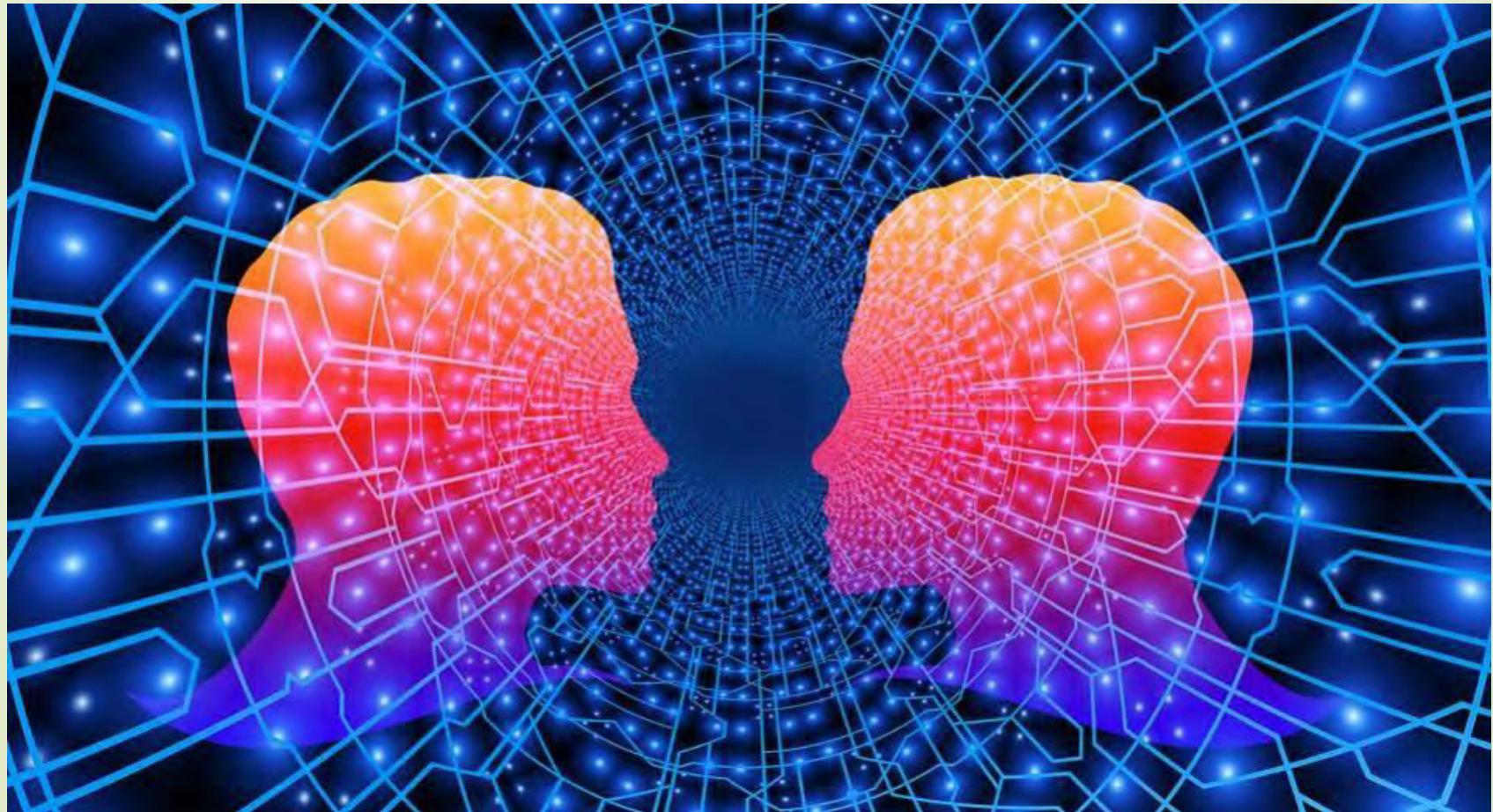


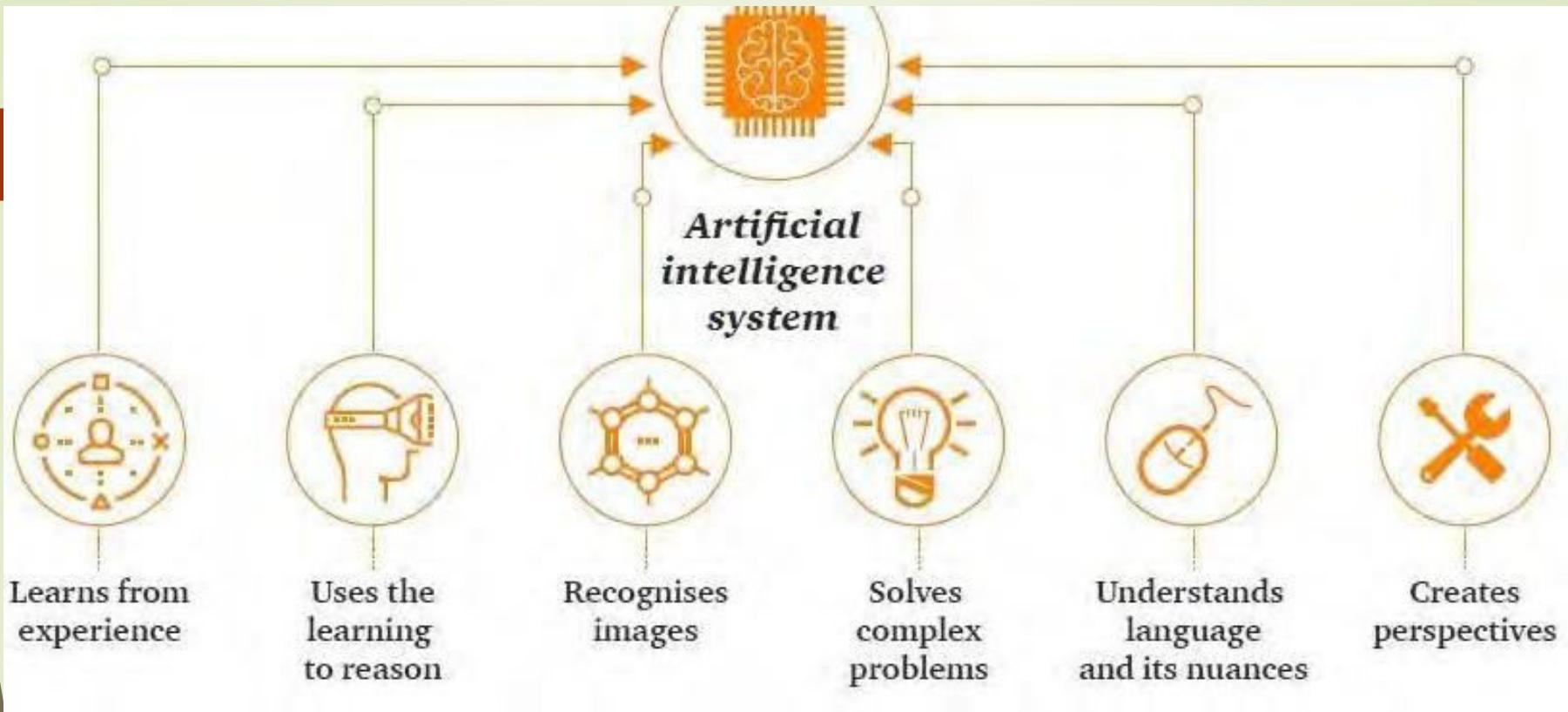
CHAPTER ONE

INTRODUCTION TO ARTIFICIAL INTELLIGENCE



What is Artificial Intelligence ?

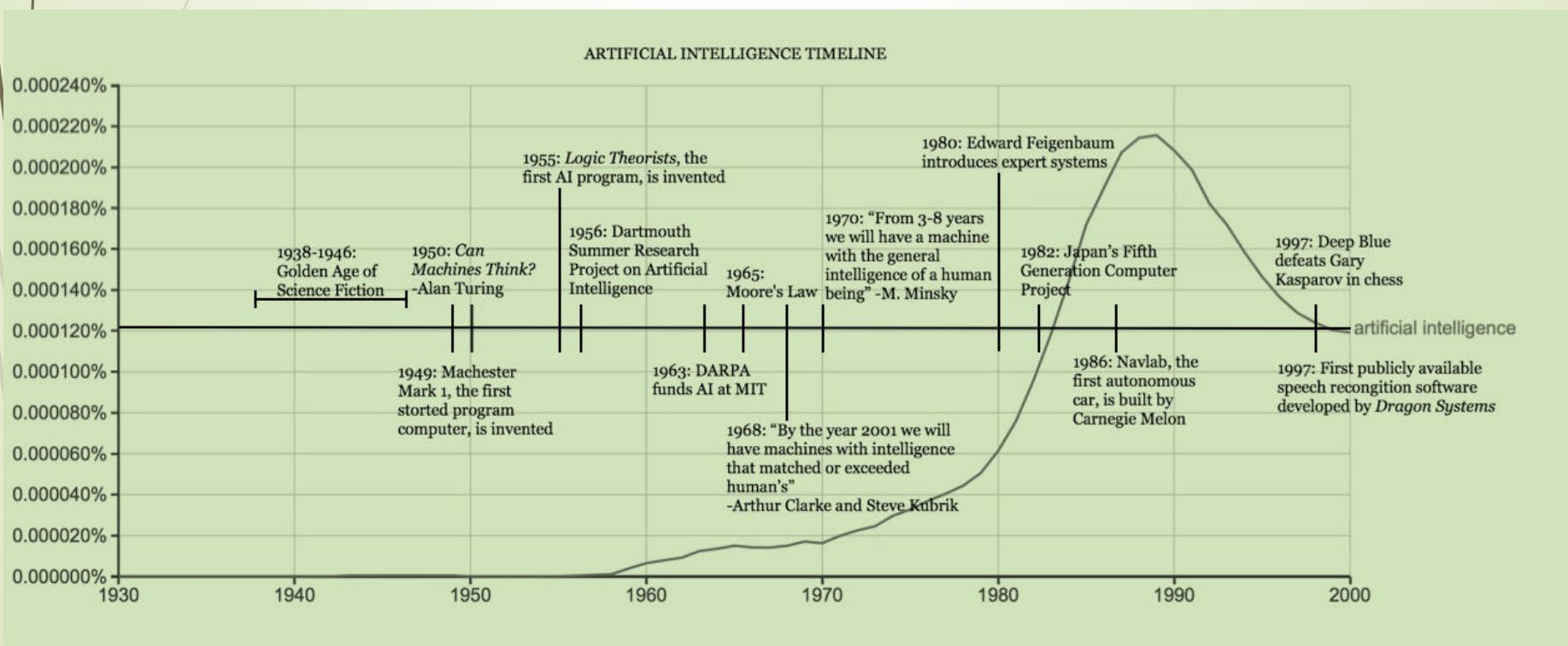
- ▶ making computers that think?
- ▶ the automation of activities we associate with human thinking, like decision making, learning ... ?
- ▶ the art of creating machines that perform functions that require intelligence when performed by people ?
- ▶ the study of mental faculties through the use of computational models ?



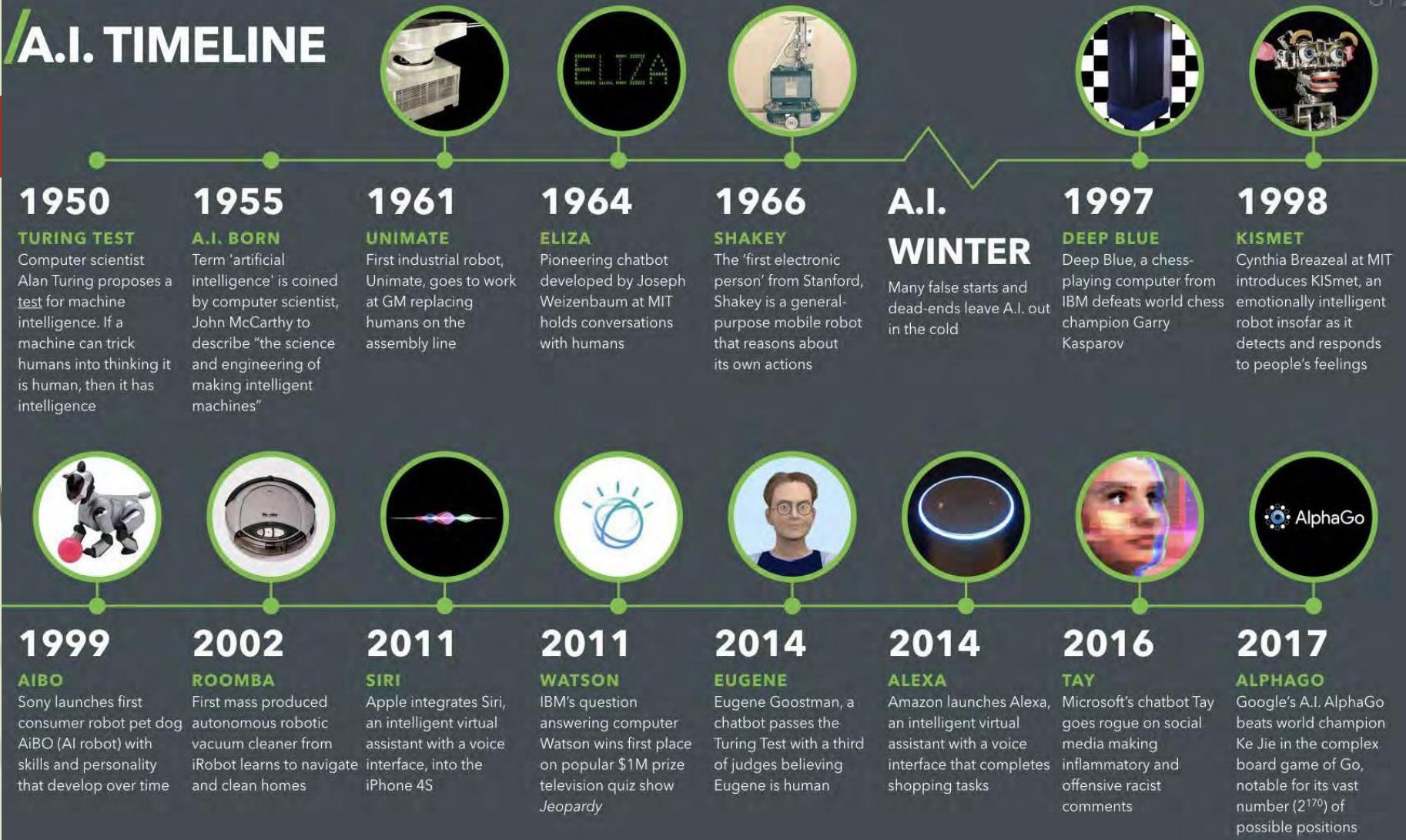
- **Artificial intelligence (AI)**, sometimes called **machine intelligence**, is intelligence demonstrated by machines, in contrast to the **natural intelligence** displayed by humans and other animals, such as "learning" and "problem solving. . .
- In **computer science** AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals.

History of AI

- **John McCarthy** is considered as the father of Artificial Intelligence. John McCarthy was an American computer scientist. The term "artificial intelligence" was coined by him.
- He is one of the founder of artificial intelligence, together with **Alan Turing**, **Marvin Minsky**, **Allen Newell**, and **Herbert A.**



A.I. TIMELINE

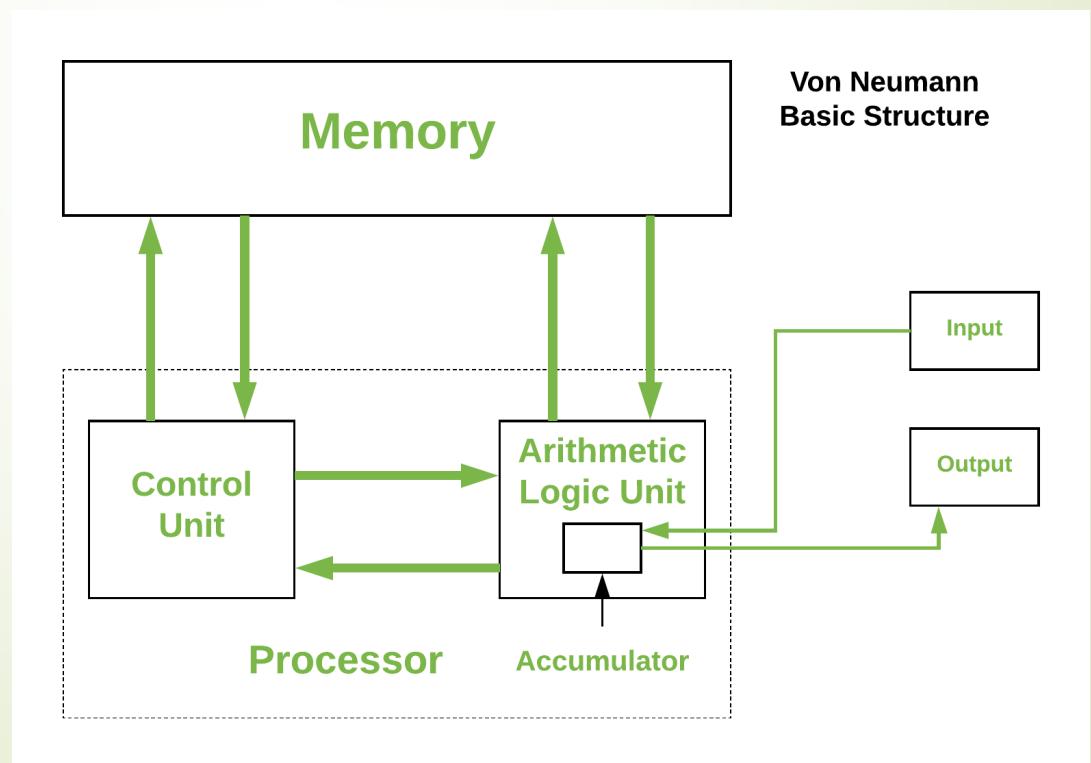


❑ **Sophia** is marketed as a "social robot" that can mimic social behavior and induce feelings of love in humans. **Sophia** was first activated on Valentines Day, February 14, 2016..

What is the most advanced robot in 2024?

The ‘von Neuman’ Architecture

- ! Refers to a design model for computers where the processing unit, memory, and input-output devices are interconnected through a single, central system bus.
- ! This architecture was first proposed by **John von Neumann**, a Hungarian-American mathematician and physicist, in the mid-20th century.



History of AI

► Origins

- The Dartmouth conference: 1956
 - John McCarthy (Stanford)
 - Marvin Minsky (MIT)
 - Herbert Simon (CMU)
 - Allen Newell (CMU)
 - Arthur Samuel (IBM)
- The Turing Test (1950)
- “Machines who Think”
 - By Pamela McCorkindale

Periods in AI

- ▶ Early period - 1950's & 60's
 - ▶ Game playing
 - ▶ brute force (calculate your way out)
 - ▶ Theorem proving
 - ▶ symbol manipulation
 - ▶ Biological models
 - ▶ neural nets
- ▶ Symbolic application period - 70's
 - ▶ Early expert systems, use of knowledge
- ▶ Commercial period - 80's
 - ▶ boom in knowledge/ rule bases

Periods in AI cont'd

- ▶ ? period - 90's and New Millenium
- ▶ Real-world applications, modelling, better evidence, use of theory,?
- ▶ **Applications**
 - ▶ visual recognition of traffic
 - ▶ medical diagnosis
 - ▶ directory enquiries
 - ▶ power plant control
 - ▶ automatic cars

Fashions in AI

Progress goes in stages, following funding booms and crises: Some examples:

1. Machine translation of languages

1950's to 1966 - Syntactic translators

1966 - all US funding cancelled

1980 - commercial translators available

2. Neural Networks

1943 - first AI work by McCulloch & Pitts

1950's & 60's - Minsky's book on "Perceptrons" stops nearly all work on nets

1986 - rediscovery of solutions leads to massive growth in neural nets research

Symbolic and Sub-symbolic AI

- ▶ **Symbolic** AI is concerned with describing and manipulating our knowledge of the world as explicit symbols, where these symbols have clear relationships to entities in the real world.
- ▶ **Sub-symbolic** AI (e.g. neural-nets) is more concerned with obtaining the correct response to an input stimulus without 'looking inside the box' to see if parts of the mechanism can be associated with discrete real world objects.

Goals of AI

- ▶ To make computers more useful by letting them take over dangerous or tedious tasks from human
- ▶ Understand principles of human intelligence
- ▶ **The main goals are:**
 - ▶ to create a system that can exhibit intelligent behavior,
 - ▶ learn new things, and
 - ▶ help in decision-making for its users.

What is Artificial Intelligence ?

THOUGHT

BEHAVIOUR

	<p>Systems that think like humans</p>	<p>Systems that think rationally</p>
	<p>Systems that act like humans</p>	<p>Systems that act rationally</p>

HUMAN

RATIONAL



Systems that act like humans: Turing Test

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

Systems that act rationally

- Study AI as rational agent –

2 advantages:

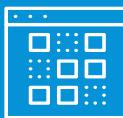
- It is more general than using logic only
 - **Because:** LOGIC + Domain knowledge
- It allows extension of the approach with more scientific methodologies

Advantages of AI

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.

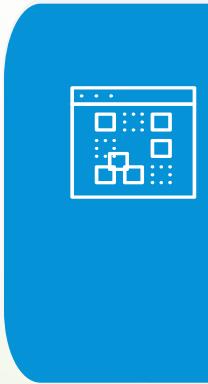


Digital Assistant: AI can be very useful to provide digital assistant to users such as AI technology is currently used by various E-commerce websites to show the products as per customer requirements.

Advantages of AI



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.



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 AI

High Cost: The hardware and software requirement of AI is very costly as it requires lots of maintenance to meet current world requirements.

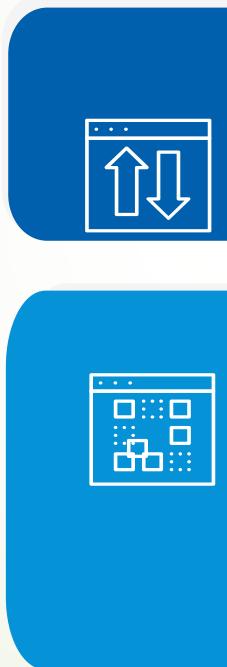


Can't think out of the box: Even we are making smarter machines with AI, but still they cannot work out of the box, as the robot will only do that work for which they are trained, or programmed.



Increase dependence on machines: With the increment of technology, people are getting more dependent on devices and hence they are losing their mental capabilities.

Disadvantages of AI

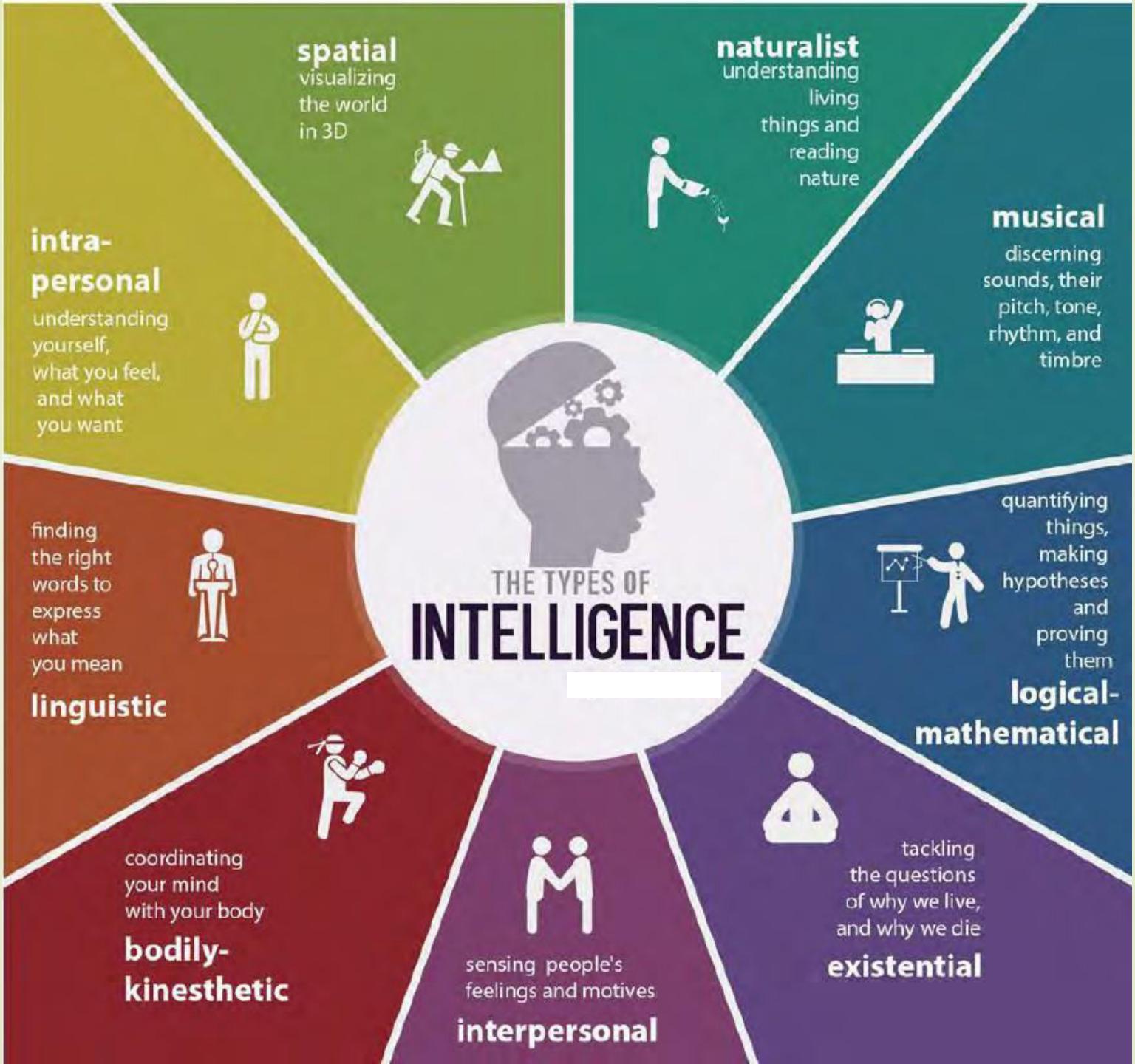


No Original Creativity: As humans are so creative and can imagine some new ideas but still AI machines cannot beat this power of human intelligence and cannot be creative and imaginative.

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.

HOW ARE HUMANS INTELLIGENT ?

- Learning
- Reasoning
- Problem Solving and Creativity
- Social Behavior
- Experiencing our Environment with our senses:
 - Hearing
 - Sight
 - Touch
 - Taste
 - Smelling



THE TYPES OF INTELLIGENCE

intra-personal

understanding yourself, what you feel, and what you want



spatial

visualizing the world in 3D



naturalist

understanding living things and reading nature



musical

discerning sounds, their pitch, tone, rhythm, and timbre



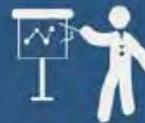
linguistic

finding the right words to express what you mean



logical-mathematical

quantifying things, making hypotheses and proving them



bodily-kinesthetic

coordinating your mind with your body



interpersonal

sensing people's feelings and motives



existential

tackling the questions of why we live, and why we die



Ways that People Think and Learn About Things

- If you have a problem, think of a past situation where you solved a similar problem.
- If you take an action, anticipate what might happen next.
- If you fail at something, imagine how you might have done things differently.
- If you observe an event, try to infer what prior event might have caused it.
- If you see an object, wonder if anyone owns it.
- If someone does something, ask yourself what the person's purpose was in doing that.

Interacting with the Environment

- ▶ In order to enable intelligent behaviour, we will have to interact with our environment.
- ▶ Properly intelligent systems may be expected to:
 - ▶ **accept sensory input**
 - ▶ vision, sound, ...
 - ▶ **interact with humans**
 - ▶ understand language, recognise speech, generate text, speech and graphics, ...
 - ▶ **modify the environment**
 - ▶ robotics

Artificial intelligence (AI) - The study of computer systems that attempt to model and apply the intelligence of the human mind.

For example, writing a program to pick out objects in a picture:

This is what Humans do best

Can you list the items in this picture ?

A computer might have trouble identifying the cat there.



FIGURE 13.1 A computer might have trouble identifying the cat in this picture

This is what Computers do best

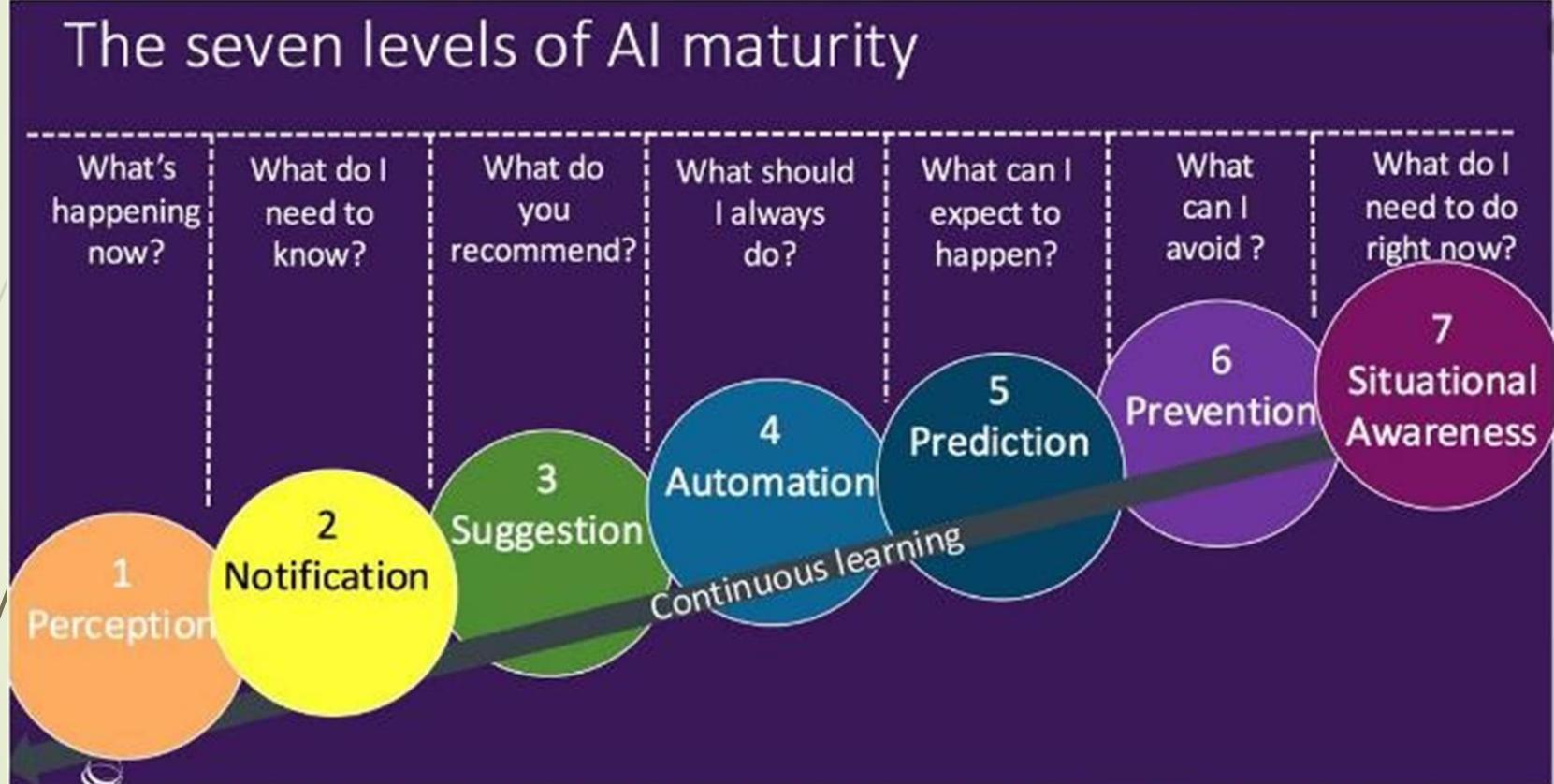
Can you count the distribution of letters in a book?

Add a thousand 4-digit numbers?

Match finger prints?

Search a list of a million values for duplicates?

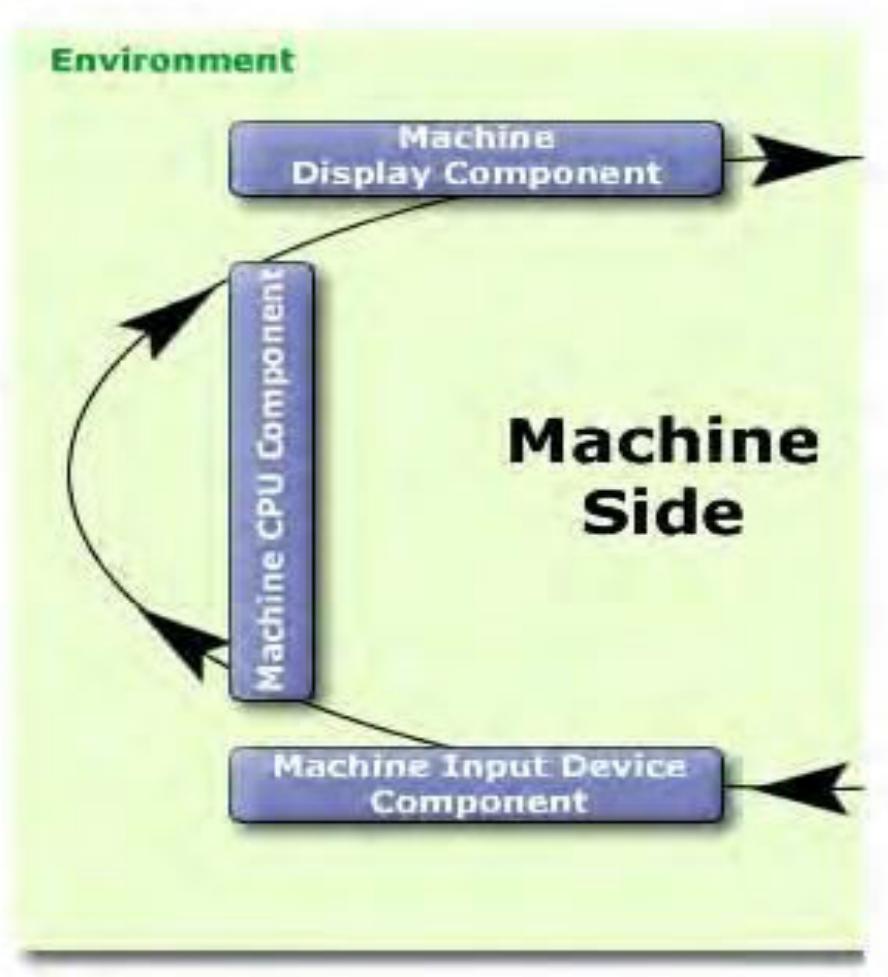
Levels of AI Maturity



When we compare Humans to Machines, it is important to note that a Machine can be a car, a Smart Phone, a Digital Television, etc.

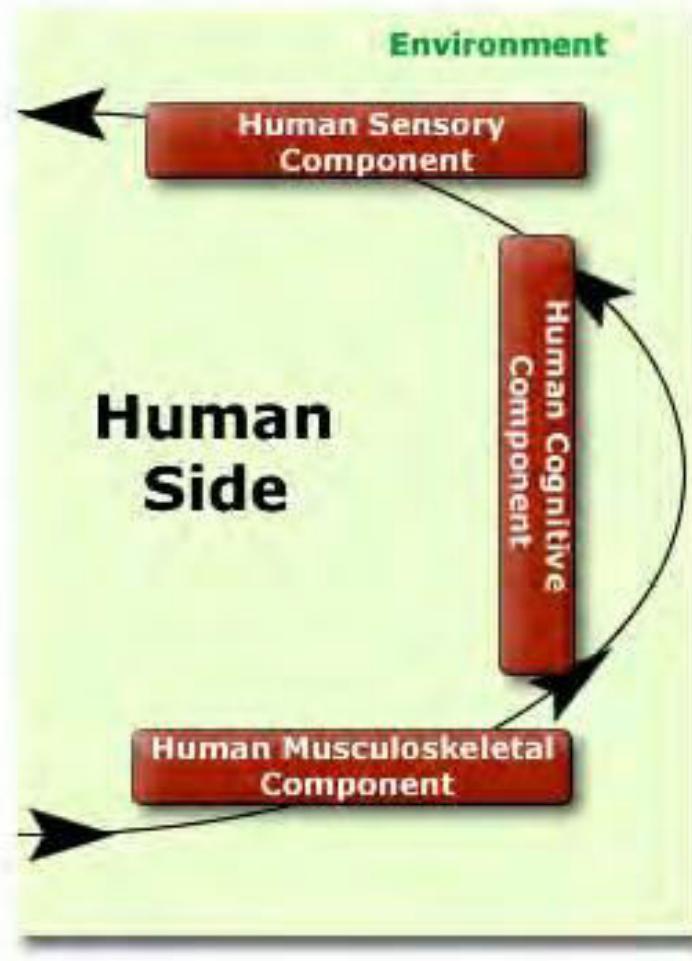
Machines are Better Than Humans in:

- Alertness
- Speed and Power
- Sensor Detection Outside Human Range
- Routine Work
- Computation
- Short-term Memory Storage
- Simultaneous Activities

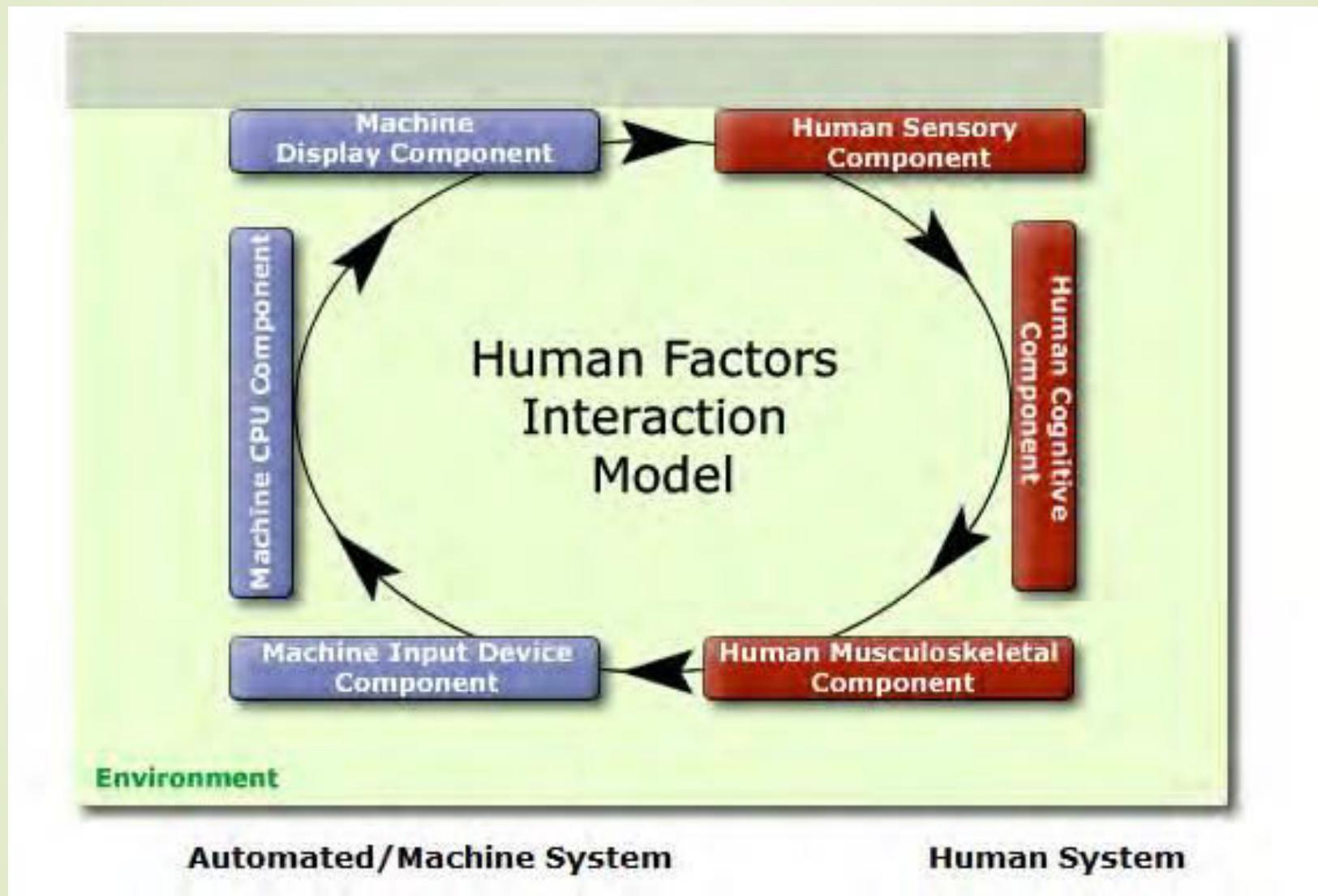


Humans are Better than Machines in:

- Sensory Functions
- Perceptual Abilities
 - Stimulus
 - Generalization
 - Abstract Concepts
- Flexibility
 - Ability to Improvise
- Judgment
- Selective Recall
- Inductive Reasoning



The illustration below illustrates a typical information flow between the "human" and "machine" components of a system. For a properly designed system, it's important to know the capabilities and flexibilities of both.



KEY RESEARCH AREAS IN AI

- **Problem solving, planning, and search** --- generic problem solving architecture based on ideas from cognitive science (game playing, robotics).
- **Knowledge Representation** – to store and manipulate information (logical and probabilistic representations)
- **Automated reasoning / Inference** – to use the stored information to answer questions and draw new conclusions
- **Machine Learning** – intelligence from data; to adapt to new circumstances and to detect and extrapolate patterns
- **Natural Language Processing** – to communicate with the machine
- **Computer Vision** --- processing visual information
- **Robotics** --- Autonomy, manipulation, full integration of AI capabilities

TYPES OF ARTIFICIAL INTELLIGENCE

BASED ON CAPABILITIES

NARROW AI

SUPER AI

GENERAL AI

BASED ON FUNCTIONALITIES

REACTIVE MACHINE

SELF AWARENESS

LIMITED MEMORY

THEORY OF MIND

From SIRI and Alexa, to self-driving cars, artificial intelligence (AI) is progressing rapidly.

While science fiction often portrays AI as robots with human-like characteristics, AI can encompass anything from Google's search algorithms, to IBM's Watson, to autonomous weapons.

Artificial intelligence today is properly known as narrow AI (or weak AI), in that it is designed to perform a narrow task such as only facial recognition, or only internet searches, or only driving a car).

However, the long-term goal of many researchers is to create general AI (AGI or strong AI).

While narrow AI may outperform humans at whatever its specific task is, like playing chess or solving equations, AGI would outperform humans at nearly every thinking task.

We've been
waiting for such a
time as this....

AI is not necessarily smarter than a human, but is able to think differently and process LARGE amounts of data.
- Kevin Kelley (Wired)

1

LOW Cost Chips

Cheap computer chips, particularly developed for gaming has resulted in Graphics Processing Units (GPUs)
Lowered the cost to explore and enable AI

2

LARGE Scale Neural Networks

Neural networks are now working in large scale.
Increased the ability for Deep Learning

3

LIMITLESS Training Sets

Training sets are now able to be created or enable in large, large numbers, thanks to the neural networks.
Reduced the time to train and refine, and Increased the scale of deployment of these data sets..

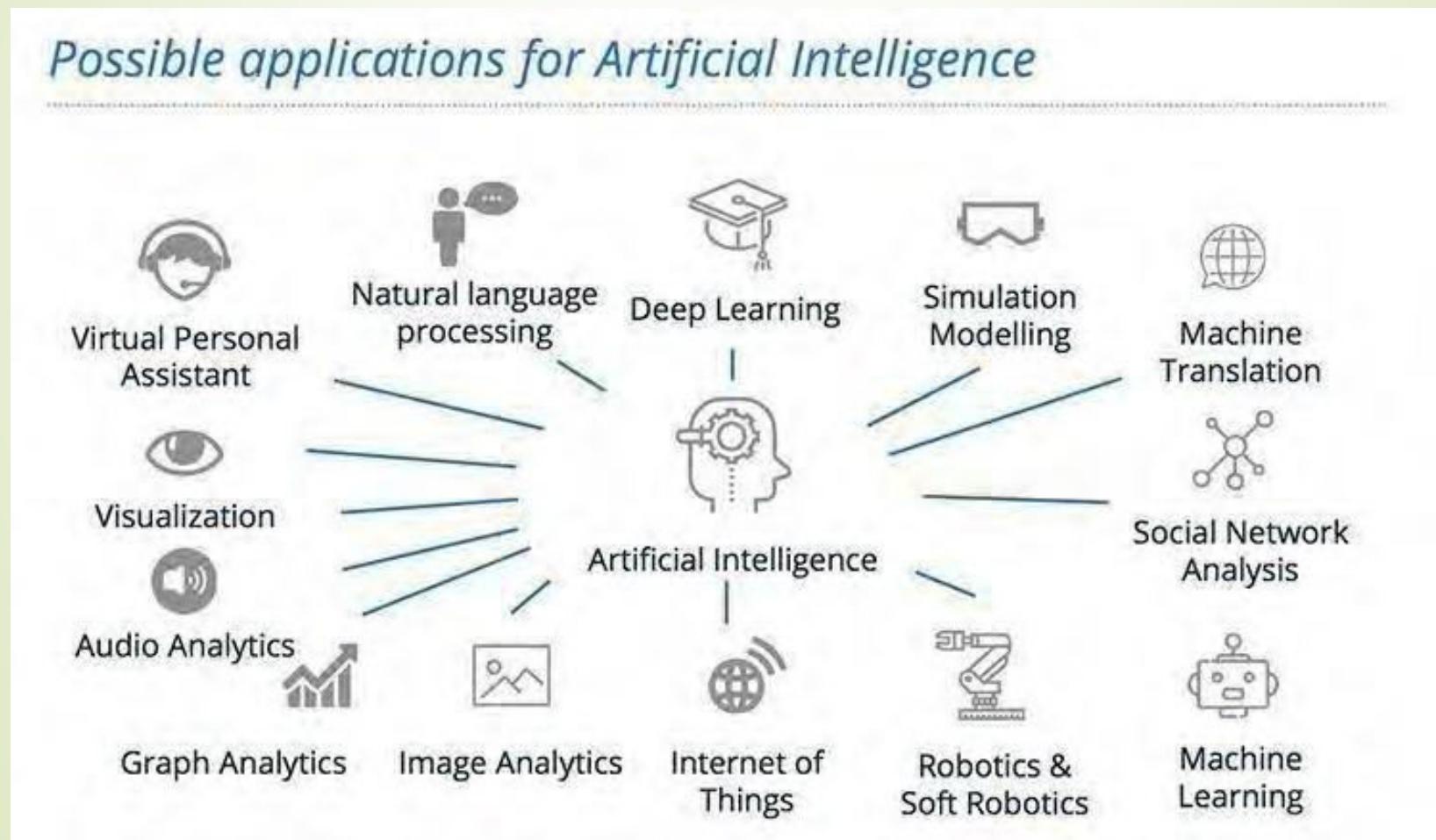
The potential benefits from self-learning computer chips are limitless as these types of devices can learn to perform the most complex thinking tasks, such as interpreting critical cardiac rhythms, detecting anomalies to prevent cyber-hacking and composing music.

This is a new one made by the Intel company and many other companies are making special AI chips too.



Artificial Intelligence (AI) has entered our daily lives like never before and we are yet to unravel the many other ways in which it could flourish.

All of the tech giants such as Microsoft, Uber, Google, Facebook, Apple, Amazon, Oracle, Intel, IBM or Twitter are competing in the race to lead the market and acquire the most innovative and promising AI businesses.



Five Skills of AI

(AI) is similar to our perception of human intelligence – this isn't built on a single element, it's a combination of senses, experiences, and knowledge.

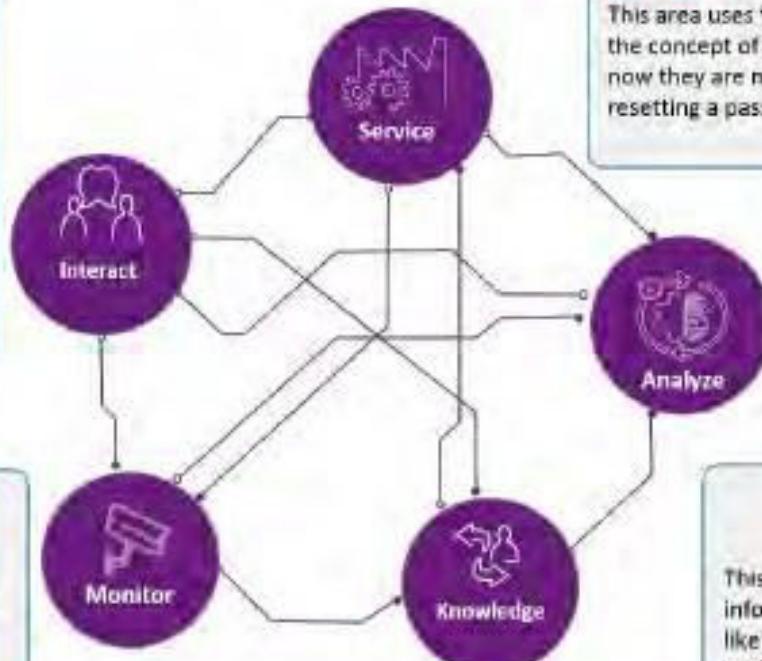
– Christopher Stancombe

Listen/Talk

The ability to listen, read, talk, write and respond to users of the IA solution. The aim here is for technology to ensure that the interaction feels intuitive and the customer is happy. Examples in this space include chatbots and voicebots.

Watch

Here technology is used to watch and record key business data. It is used to create knowledge. This would include CCTV and IoT sensors.



Act

This area uses technology to take action. We are used to the concept of Robots working on an assembly line and now they are moving into the office. Examples include resetting a password and placing a customer order.

Think

This is the ability to detect patterns and recognise trends. It applies algorithms to knowledge to determine appropriate action or predict future consequences.

Remember

This is about being able to store and find information effectively using components like databases and search engines. This is probably the least developed area within corporations, but examples include Wikipedia and employee's hard drives.

How AI communicates with humans?

Google announced their **Duplex** system, a new technology for conducting natural conversations to carry out “real world” tasks over the phone.

The technology is directed towards completing specific tasks, such as scheduling certain types of appointments.

For such tasks, the system makes the conversational experience as natural as possible, allowing people to speak normally, like they would to another person, without having to adapt to a machine.



<https://www.youtube.com/watch?v=GoXp1leA5Qc>

Neural network tracks treatment of brain tumors on MRI

Physicians and scientists in Germany have developed an artificial neural network that's capable of interpreting brain MRI scans to tell neuroradiologists how brain tumors are responding to chemotherapy and radiation therapy, according to a [study](#) published in *The Lancet Oncology*.



The Turing Test

Turing test

A test to determine whether a computer has achieved intelligence

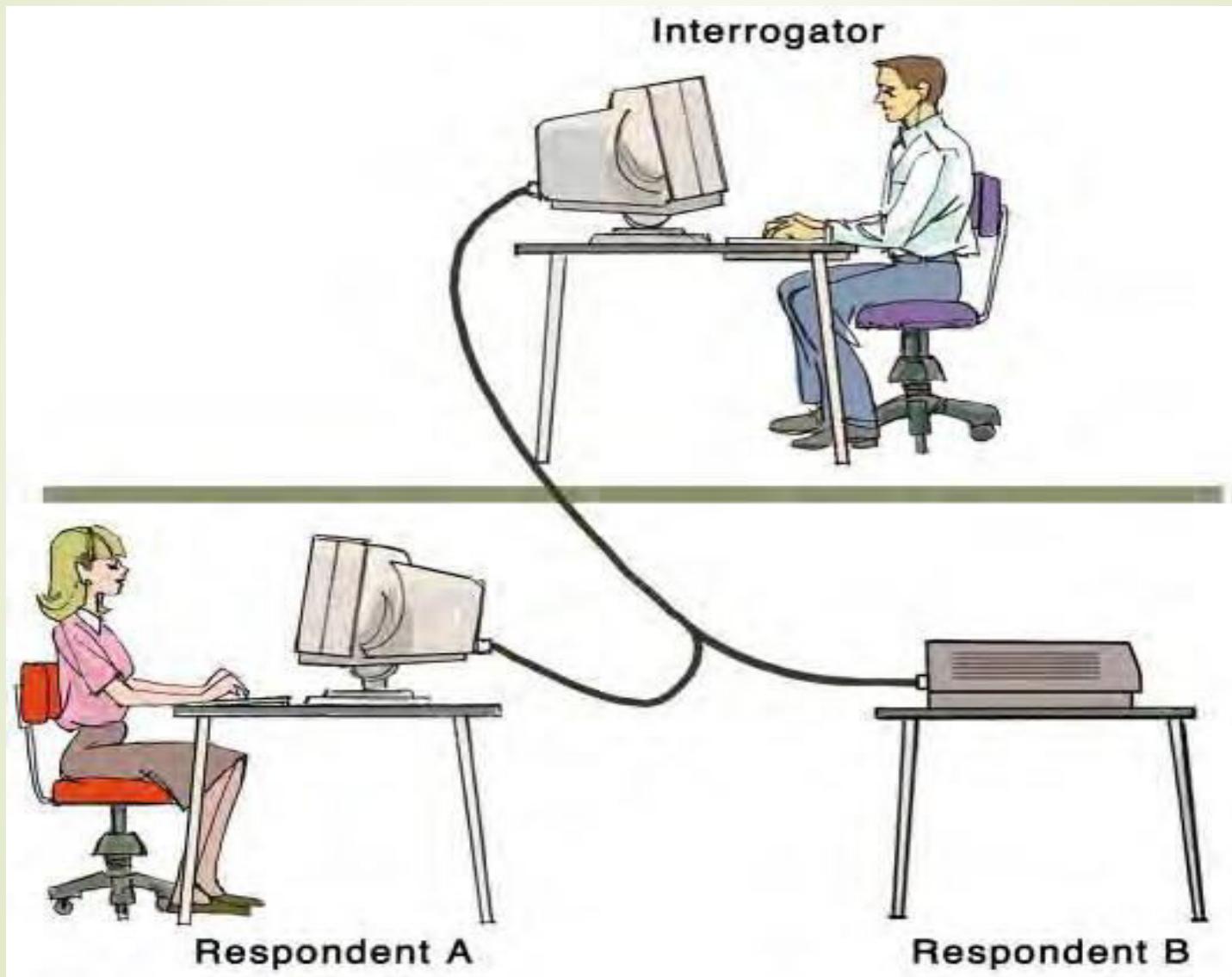
Alan Turing

An English mathematician who wrote a landmark paper in 1950 that asked the question: *Can machines think?*

He proposed a test to answer the question "How will we know when we have succeeded?"

He said that a machine passes the test when it successfully generates responses appropriate enough to convince the evaluator that it is human.

In the Turing test, the interrogator must determine which respondent is the computer and which is the human.



THE LOEBNER PRIZE FOR COMPLETING THE TURING TEST

The Loebner Prize is an annual competition in artificial intelligence that **awards prizes** to the computer programs considered by the judges to be the most human-like, using the Turing Test computer and person arrangement.

The contest was launched in 1990 by Hugh Loebner and there are bronze, silver, and gold coin prizes, plus money.

KNOWLEDGE REPRESENTATION

- We need to create a logical view of the data, based on how we want to process it
 - Natural language is very descriptive, but does not lend itself to efficient processing.
-

What are the different ways that we can represent knowledge so it can be reviewed by an Artificial Intelligence computer program ?

- 1) **Expert Learning Systems**(represented mainly as "if-then" rules rather than through conventional procedural code.)
- 2) **Semantic Networks** - A knowledge representation technique that focuses on the relationships and word descriptions of objects. A graph is used to represent a semantic network or net
- 3) **Decision or Search tree**
- 4) **Neural networks** – creating a computer version of the neurons of the brain and how they work

1) Expert Learning Systems

- **Expert Learning Systems** were commercially the first and most successful domain in Artificial Intelligence.
 - Somewhat out of favor today
 - These programs mimic the experts in whatever field is being studied.

Auto mechanic

Cardiologist

Organic

compounds Mineral

prospecting

Infectious diseases

Diagnostic internal medicine

computer configuration

Engineering structural analysis

Audiologist

Telephone networking

Delivery routing

Professional auditor

Manufacturing

Pulmonary function

Weather forecasting

Battlefield tactician

Space-station life support

Civil law

- **Rule-based or Expert systems** - Knowledge bases consisting of hundreds or thousands of rules of the form:
- **IF (condition) THEN (action).**
 - Use rules to store knowledge (“rule-based”).
 - The rules are usually gathered from experts in the field being represented (“expert system”).
 - Most widely used knowledge model in the commercial world.

IF (it is raining AND you must go outside)
THEN (put on your raincoat)

- Rules can fire off a chain of other rules

IF (raincoat is on)
THEN (you will not get wet)



2) Semantic (word description) Networks

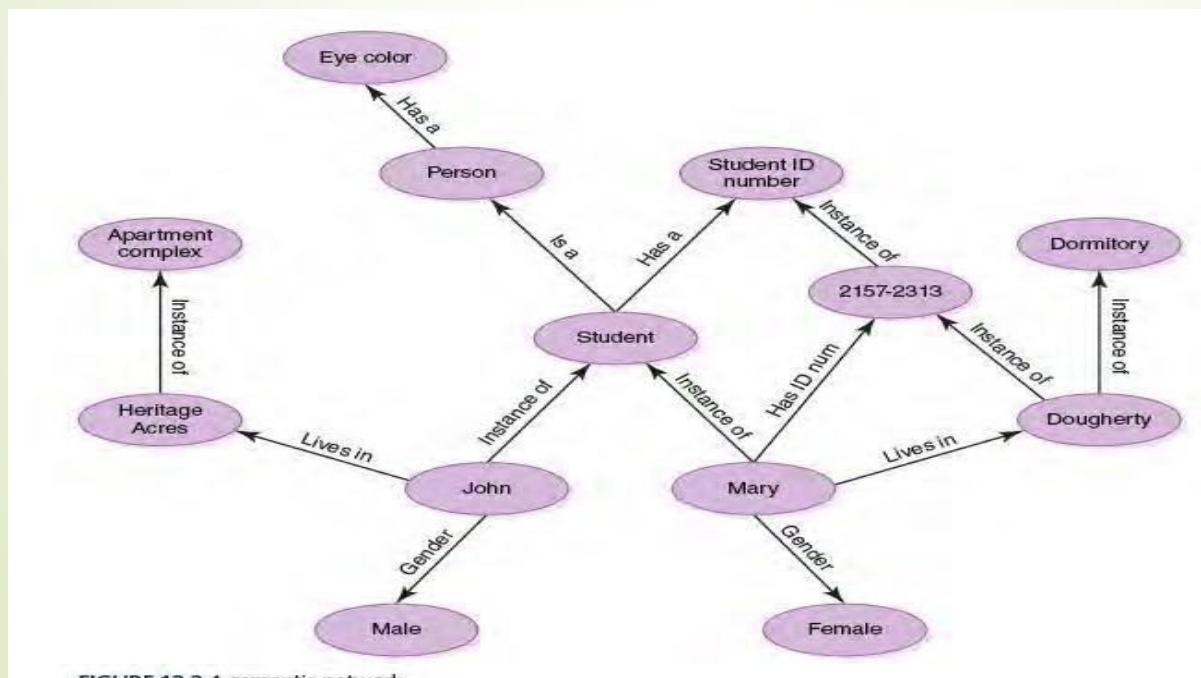
Semantic network

A knowledge representation technique that focuses on the relationships between objects

A directed graph or word chart is used to represent a semantic network or netuses a graph of interconnected nodes and edges. Each node represents a concept or entity, while edges represent the relationships between them.

Nodes: Represent objects, concepts, or events.

Edges: Represent relationships or associations between the nodes, such as "is a," "part of," or "related to."

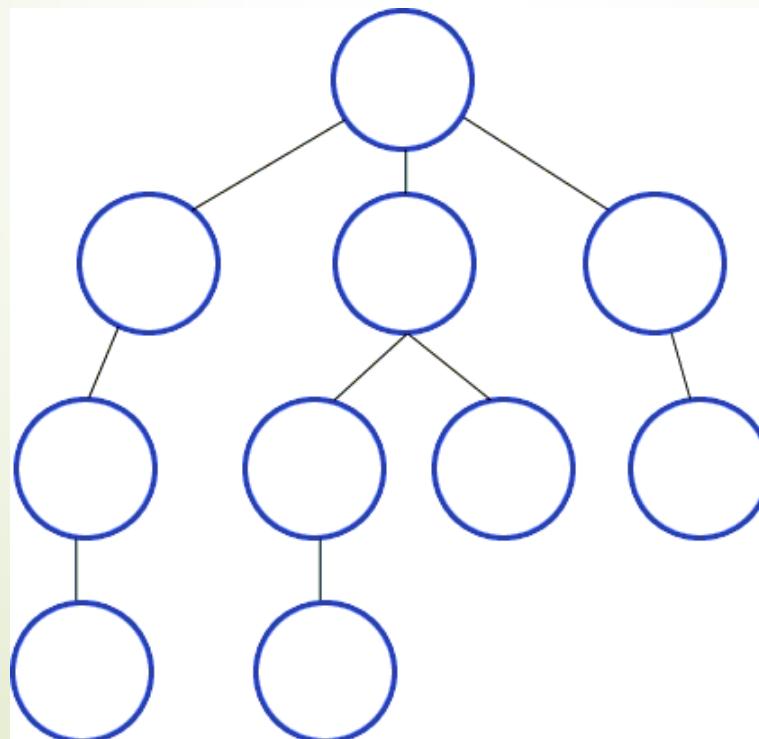


3) Search Trees

AI often revolves around the use of algorithms.

An **algorithm** is a set of instructions that a mechanical computer can execute.

A **complex algorithm** is often built on top of another, simpler, one and a common way to visualize it is with a tree design.

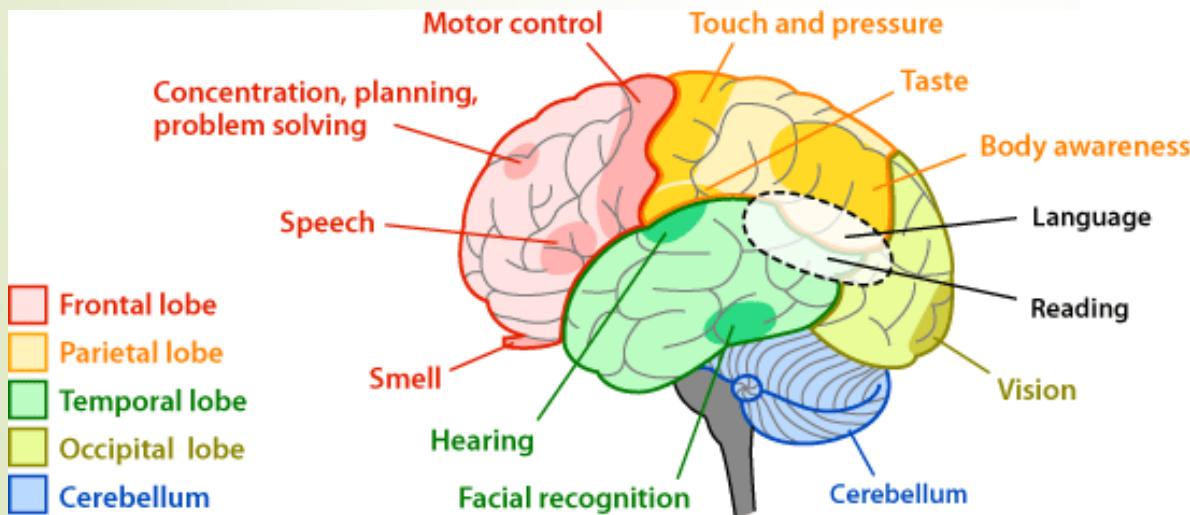
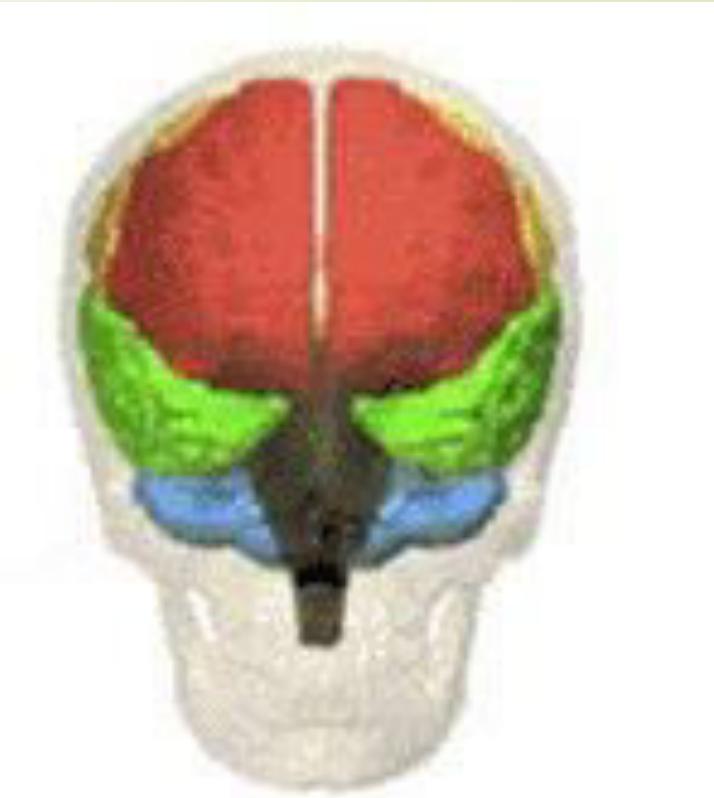


THE HUMAN BRAIN AND NEURONS IN IT

The **human brain** has often been viewed as outstanding among mammalian brains: the most cognitively able, the largest-than-expected from body size, endowed with an overdeveloped cerebral cortex that **represents over 80% of brain mass**, and purportedly containing **100 billion neurons** and **10x more glial cells**(Any of the cells that hold nerve cells in place and help them work the way they should).

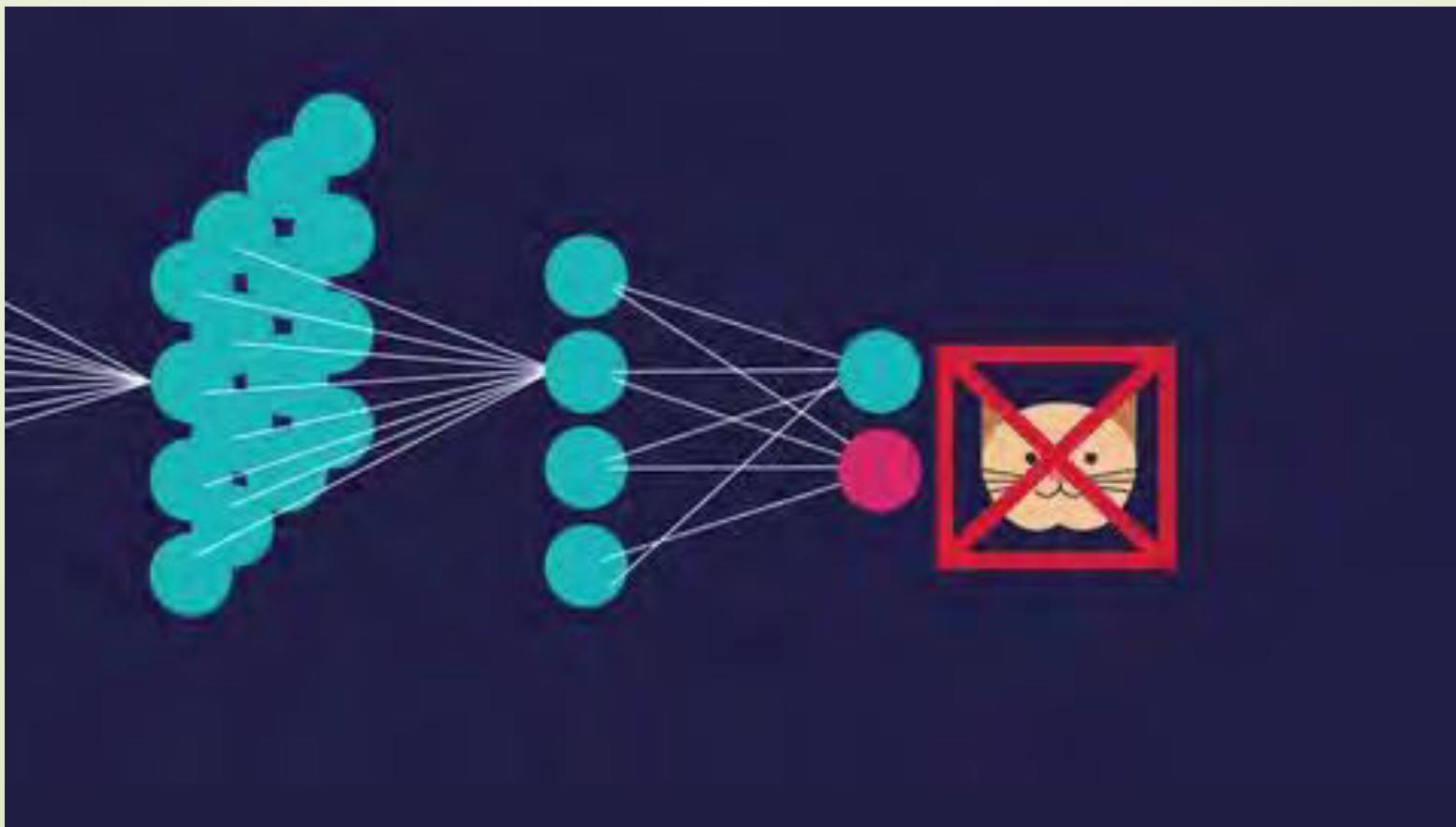


THE BRAIN IS DIVIDED INTO 4 PARTS AND THE CEREBELLUM WHICH IS LOCATED AT THE BOTTOM, BACK AREA



AI technology called machine learning today, is great at helping for taking good photos, translating languages, recognizing your friends on Facebook, delivering search results, screening out spam and many other chores.

It usually uses an approach called **neural networks** that works something like a human brain, not a sequence of IF THIS, THEN steps as in traditional computing.

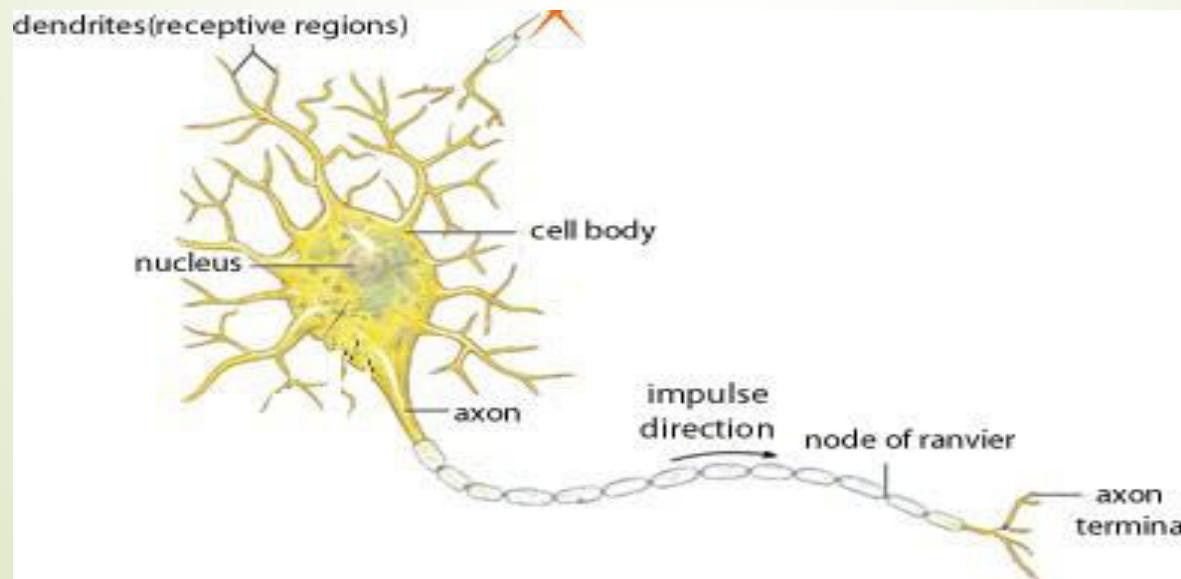


TYPES AND FUNCTION OF NEURONS

Neurons are essential for every action that our body and brain carry out. It is responsible for transmitting and processing information throughout the body. They are specialized cells that communicate with each other and with other types of cells through electrical and chemical signals.

It is the complexity of neuronal networks that gives us our personalities and our consciousness.

They make up around 10 percent of the brain; the rest consists of glial cells and other cells that support and nourish the neurons.



Incoming signals to the neuron can be either **excitatory** – which means they tend to make the neuron **fire** (generate an electrical impulse) – or **inhibitory** – which means that they tend to keep the neuron from firing.

A single neuron may have more than one set of dendrites, and may receive many thousands of input signals.

Whether or not a neuron is excited into firing an impulse depends on the sum of all of the excitatory and inhibitory signals it receives.

If the neuron does end up firing, the nerve impulse is conducted down the axon.

Axon:- it carries electrical impulses that are the means of communication within the brain and between the brain and the rest of the body.

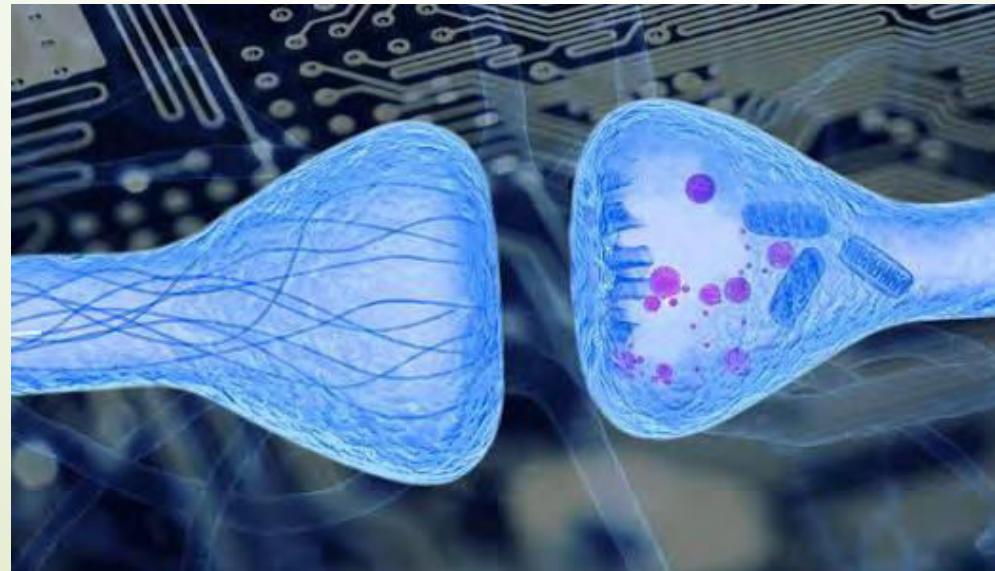


How synapses work - Neurons are connected to each other at a location called a Synapse, so that they can communicate messages

Amazingly, where each cell connects with the other one, NONE of these cells ever touch each other !!

The signal that is carried from the first nerve fiber to the next one is transmitted by an electrical signal or a chemical one, up to a speed of 268 miles per hour !

There is new evidence that both types closely interact with each other and that the transmission of a nerve signal is both **chemical and electrical**, which is actually required for normal brain development and function.



4) Artificial Neural Network (ANN)

A computer representation of knowledge that attempts to mimic the neural networks of the human brain

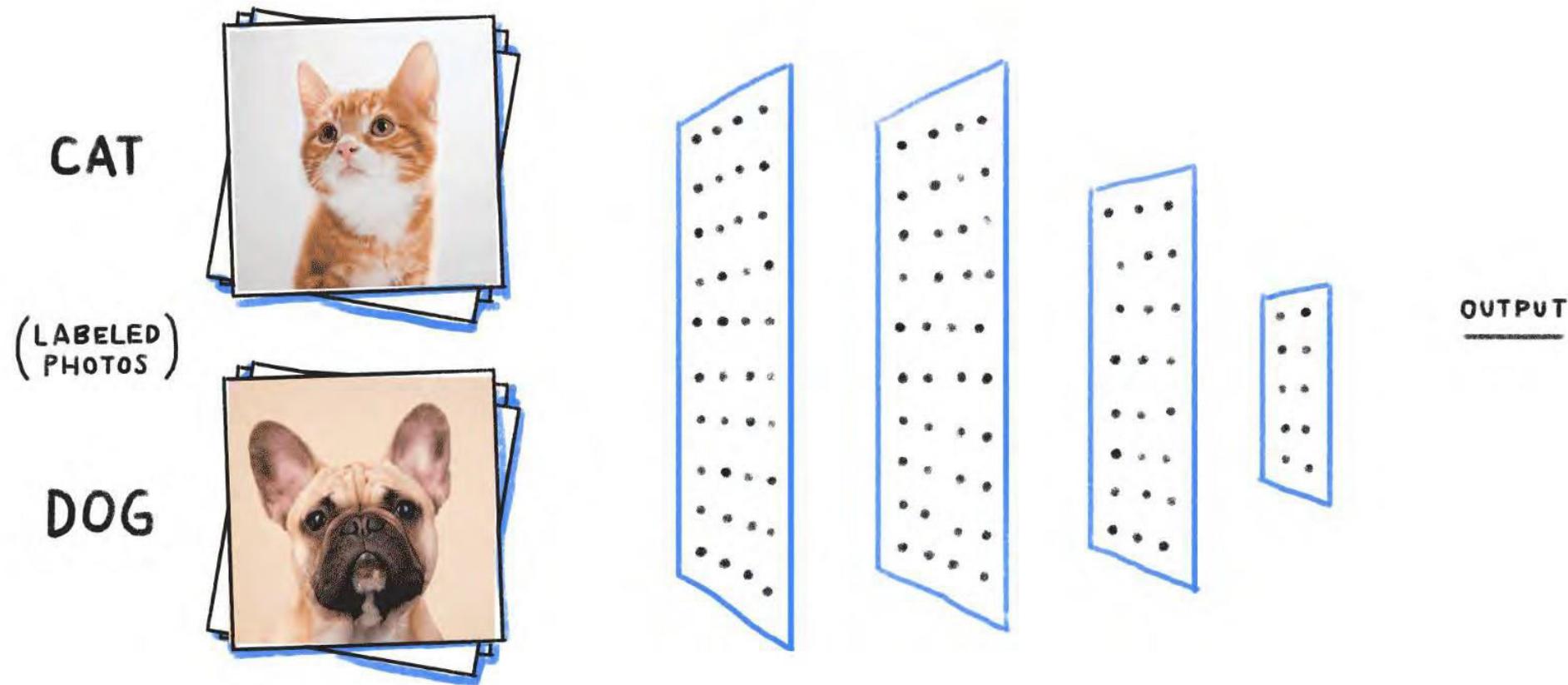
Yes, but what is a human neural network?

Neural networks, or neural nets, were inspired by the architecture of neurons in the human brain.

A simple "neuron" N accepts input from multiple other neurons, each of which, when activated (or "fired"), cast a weighted "vote" for or against whether neuron N should itself activate.

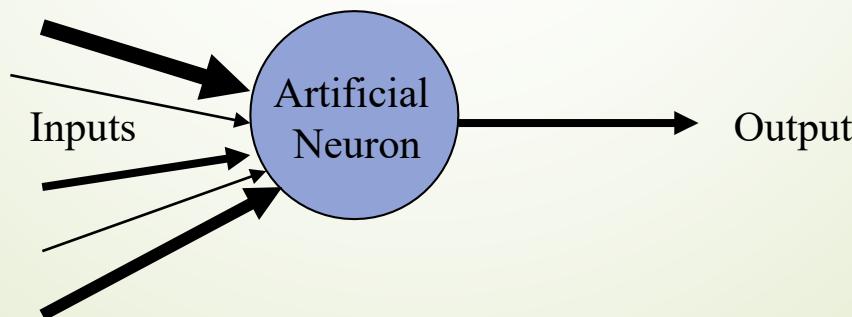
An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain.

Each connection, like the synapses in a biological brain, can transmit a signal from one artificial neuron to another. An artificial neuron that receives a signal can process it and then signal additional artificial neurons connected to it.



ARTIFICIAL NEURAL NETWORK

- **Artificial neurons:** Commonly called processing elements, are modeled after real neurons of humans and other animals.
 - Has many inputs and one output.
 - The inputs are signals that are strengthened or weakened (weighted).
 - If the sum of all the signals is strong enough, the neuron will put out a signal to the next neuron output of a 1.



Artificial Neural Networks

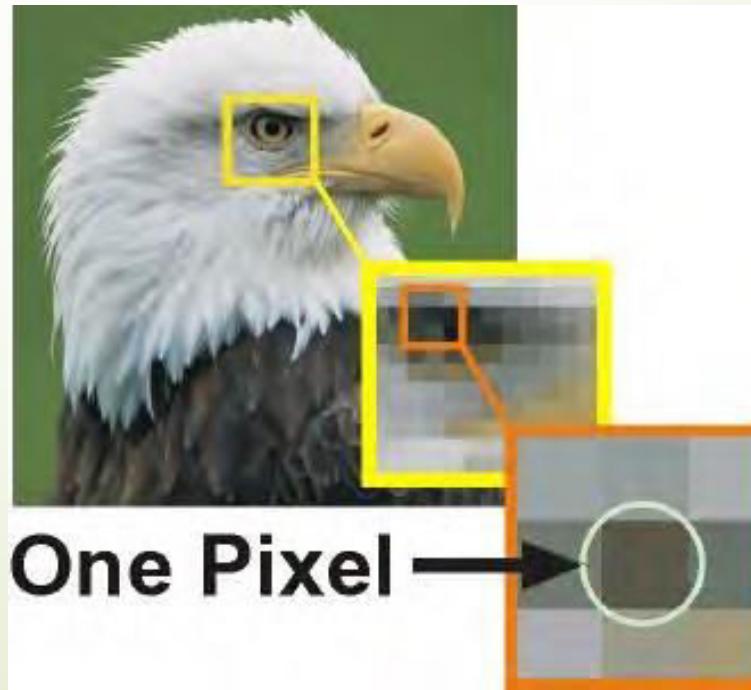
Training

The process of adjusting the weights and threshold values in a neural net

How does this all work?

Train a neural net to recognize An eagle in a picture.

Given one output value per pixel, train network to produce an output value of 1 for every pixel that contributes to the eagle and 0 for every one that doesn't.



DeepMind is a subsidiary of **Google** that focuses on the development of **artificial intelligence** and deep reinforcement machine learning.

The deep reinforcement learning of its **AI** algorithms has been used in both research and applied contexts

DeepMind is built around the framework of neural networks and uses a method called deep-reinforced-learning.

This means that the A.I can learn from it's experiences and become more efficient at whatever it **does**.

The A.I is general-purpose meaning that it's NOT pre-programmed for a specific task from the go.

https://www.youtube.com/watch?v=TnUYcTuZJpM&ab_channel=ColdFusion

Agents

- **An agent** is anything that can be viewed as a device that can perceive its environment through sensors and act upon that environment through actuators.
- **Human agent:** eyes, ears, and other organs for sensors; hands, legs, mouth, and other body parts for actuators
- **Robotic agent:** cameras and infrared range finders for sensors
- **Rational Agent:**
 - For each possible sequence, a rational agent should select an action that is expected to maximize its performance measure, given the evidence provided by the perception sequence and whatever built-in knowledge the agent has.

Why “meaning” is the central concept of AI

- For an agent to be “intelligent”, it must be able to understand the meaning of information.
- Information is acquired / delivered / conveyed in messages which are phrased in a selected representation language.
- There are two sides in information exchange:
- **The source** (text, image, person, program, etc.) and
- **The receiver** (person or an AI agent). They must speak the same “language” for the information to be exchanged in a meaningful way.
- The receiver must have the ability to interpret the information correctly according to the intended by the source meaning or semantics of it.

Artificial Intelligence

Machine Learning

Deep Learning

The subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural networks to vast amounts of data.

A subset of AI that includes abstruse statistical techniques that enable machines to improve at tasks with experience. The category includes deep learning

Any technique that enables computers to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning)

Machine Learning

The phrase 'machine learning' dates back to the middle of the last century where Arthur Samuel in 1959 defined machine learning as "the ability to learn without being explicitly programmed."

Machine learning is a type of AI that helps a computer's ability to learn and essentially teach itself to evolve as it becomes exposed to new and ever-changing data.

For example, Facebook's news feed uses machine learning in an effort to personalize each individual's feed based on what they like.

DRONE CHASSIS DESIGN USING MACHINE LEARNING



https://www.youtube.com/watch?v=WNniGZMmd84&ab_channel=TimStation

Deep Learning

Deep Learning is a new area of machine learning research, which has been introduced with the objective of moving machine learning closer to artificial intelligence.

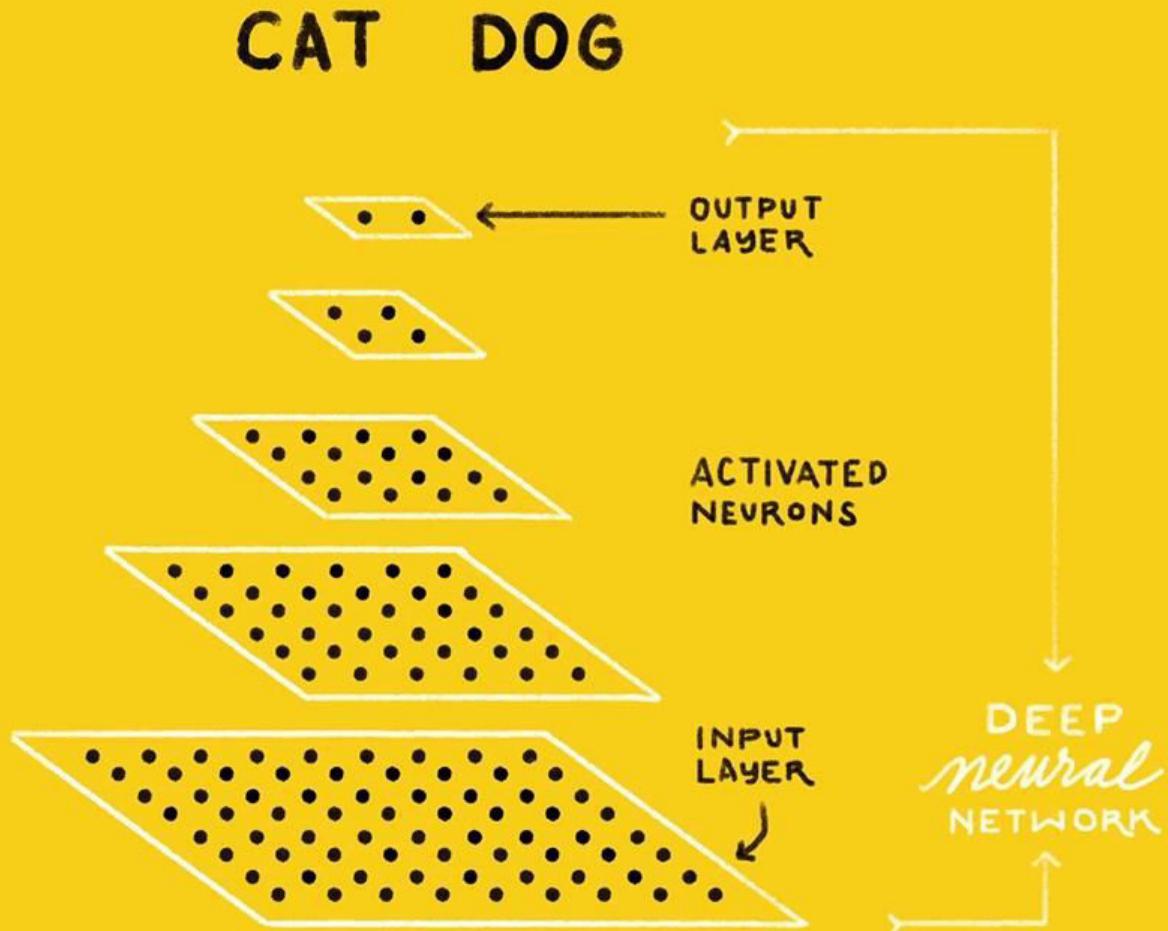
It relates to study of ‘deep neural networks’ in the human brain and, under this perspective, the deep learning tries to emulate the functions of inner layers of the human brain, creating knowledge from multiple layers of information processing.

Since the deep learning technology is modelled after the human brain, each time new data is poured in, its capabilities get better.

Deep artificial neural networks are a set of algorithms reaching new levels of accuracy for many important problems, such as image recognition, sound recognition, recommender systems, etc.

For example, a deep learning algorithm could be trained to

IS THIS A
CAT or DOG?



CONCERNS ABOUT AI TAKING OVER THE WORLD

The computer that wins at games of Chess or Go, is analyzing data for patterns. It has no idea it's playing Go as opposed to golf, or what would happen if more than half of a Go board was pushed beyond the edge of a table.

When you ask Amazon's Alexa to reserve you a table at a restaurant you name, its voice recognition system, made very accurate by machine learning, saves you the time of entering a request in Open Table's reservation system.

But Alexa doesn't know what a restaurant is or what eating is.

If you asked it to book you a table for two at 6 p.m. at the Mayo Clinic, it would try.

DIGITALISATION



"Creating better humans will always be more important than creating smarter machines".

Garry Kasparov, former world chess champion and author of "Deep Thinking", opened the OECD conference "Artificial Intelligence: Intelligent Machines, Smart Policies" on 26 October 2017.

Thanks for the weather forecast, Alexa.

Wayne®
& 4
Piraro.
6.9.18

Whatever.



ARTIFICIAL INDIFFERENCE

Application Areas and Natural Language Processing



Chapter 2

CONTENT

- ▶ INTRODUCTION
- ▶ RECENT UPDATE
- ▶ DIFFERENCE BETWEEN AI AND NI
- ▶ APPLICATION
- ▶ FUTURE
- ▶ CONCLUSION

INTRODUCTION

- ▶ Artificial intelligence -The theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages
- ▶ An area of computer science that deals with machines ability to seem like they have human intelligence
- ▶ The power of a machine to copy intelligent human behavior
- ▶ It is the study of ideas which enable computers to do the things that make people seem intelligent.
- ▶ The central principles of AI include such as reasoning, knowledge, planning, learning, communication, perception and the ability to move and manipulate objects.

Preparing for the Future: AI Development Trends You Need to Know in 2024

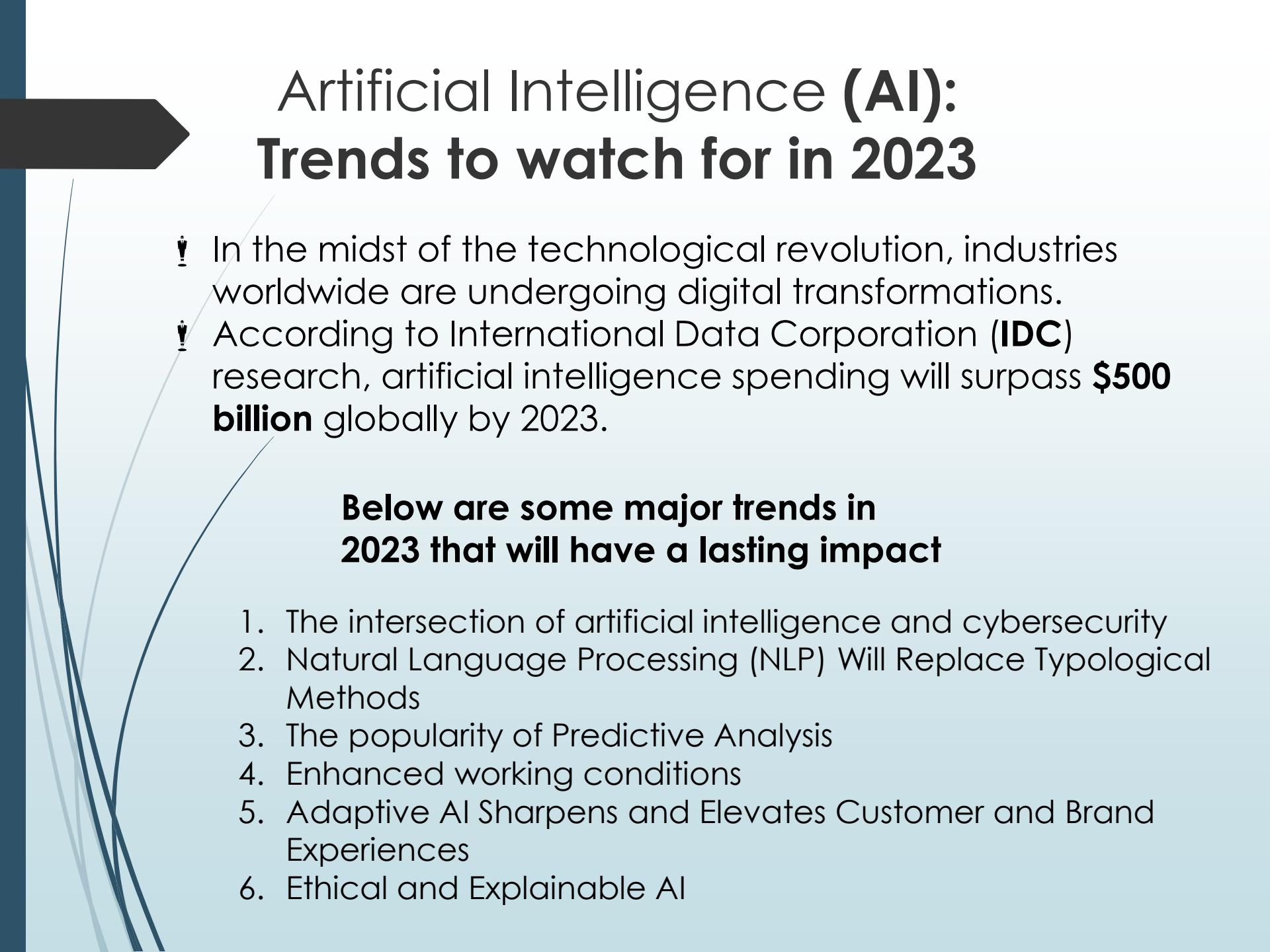
Security AI Development Trends in 2024

- ❑ **Security businesses** are employing AI to automate processes, enhance efficiency, and safeguard customers.
- ❑ **Automation of incident reaction processes** and **risk reduction** are just two of the advantages of using AI. **Furthermore**, AI-based systems may be used to safeguard security systems and spot potential vulnerabilities before they are exploited.
- ❑ The use of AI to **automate processes**, **enhance efficiency**, and **improve safety** is becoming more widespread as AI technology advances.
- ❑ Looking ahead to 2024, AI development will continue to **change and shape our world**.

HOW AI IS DIFFERENT ?

AI Vs Human

Using different
parameters??



Artificial Intelligence (AI): Trends to watch for in 2023

- ! In the midst of the technological revolution, industries worldwide are undergoing digital transformations.
- ! According to International Data Corporation (**IDC**) research, artificial intelligence spending will surpass **\$500 billion** globally by 2023.

**Below are some major trends in
2023 that will have a lasting impact**

1. The intersection of artificial intelligence and cybersecurity
2. Natural Language Processing (NLP) Will Replace Typological Methods
3. The popularity of Predictive Analysis
4. Enhanced working conditions
5. Adaptive AI Sharpens and Elevates Customer and Brand Experiences
6. Ethical and Explainable AI

AI Applications

Autonomous Planning & Scheduling:

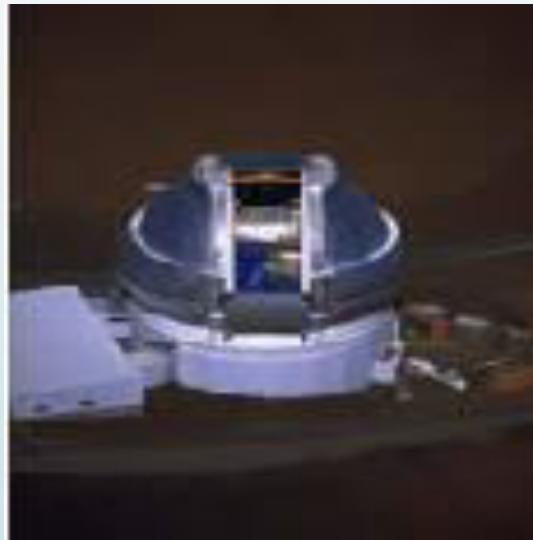
- Autonomous rovers.



AI Applications

1. Autonomous Planning & Scheduling:

► Telescope scheduling

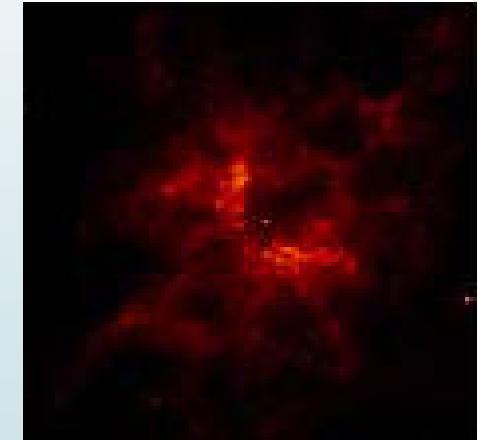
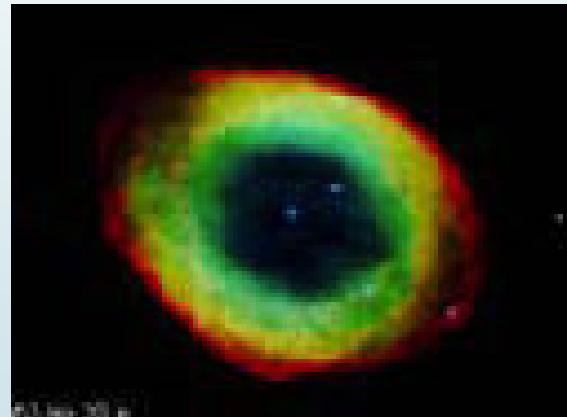


- **AI scheduling systems** have scheduling and workforce management capabilities that even the best human experts might not be able to compete with.
- The **scope** for **AI** is limitless

AI Applications

Autonomous Planning & Scheduling:

► Analysis of data:

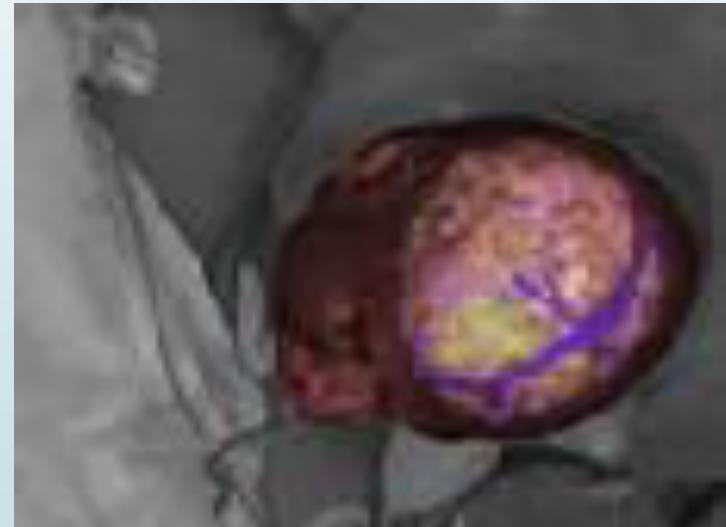


AI data analysis is the use of AI techniques and data science to enhance the processes of *cleaning, inspecting, and modeling* **structured** and **unstructured** data.

AI Applications

2. Medicine:

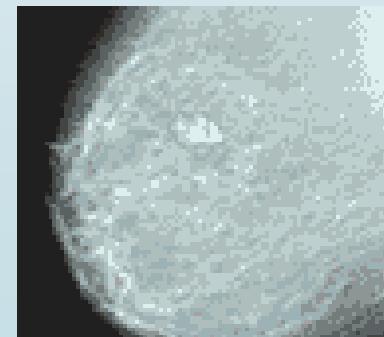
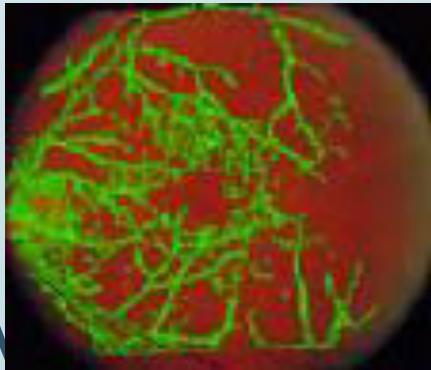
→ Image guided surgery



AI Applications

Medicine:

- Image analysis and enhancement



AI Applications

3. Transportation:

► Autonomous vehicle control:



An **autonomous car** is a vehicle capable of sensing its environment and operating without human involvement.

AI Applications

- Transportation:
 - **Pedestrian detection:**

Pedestrian detection is a computer vision and machine learning technology designed to identify and track people (pedestrians) in images or video feeds

Pedestrian detection systems serve as an extra set of "eyes" for the driver.

It helps to enhance situational awareness and reduce the likelihood of driver distraction.

This heightened awareness can help prevent accidents caused by driver inattention or blind spots.



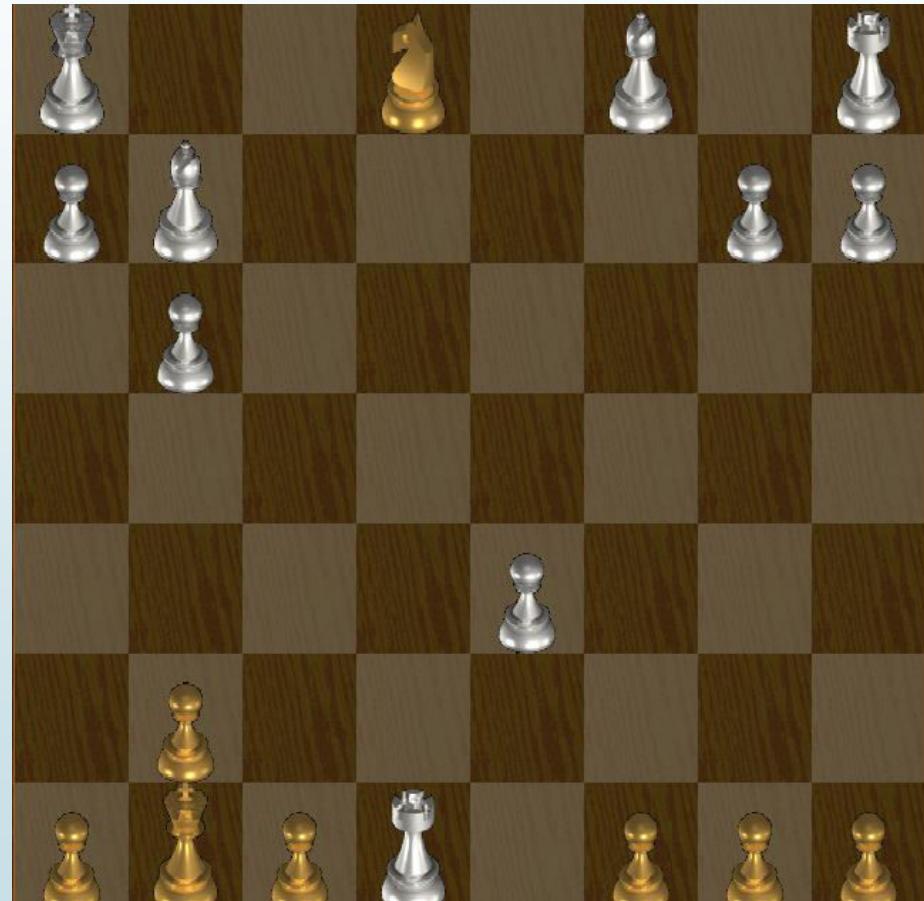
AI Applications

4. Games:



AI Applications

► Games:



AI Applications

5. Robotic toys:



AI Applications

Other application areas:

- ▶ **Bioinformatics:**

- ▶ Gene expression data analysis
- ▶ Prediction of protein structure

- ▶ **Text classification, document sorting:**

- ▶ Web pages, e-mails
- ▶ Articles in the news

- ▶ **Video, image classification**

- ▶ **Music composition, picture drawing**

- ▶ **Natural Language Processing .**

- ▶ **Perception.**

Natural Language Processing

- NLP is the technology used to assist computers (intelligent system) to understand the human's natural language.
- It deals with the interaction between computers and humans using the natural language.
 1. A human talks to the machine
 2. The machine captures the audio
 3. Audio to text conversion takes place
 4. Processing of the text's data
 5. Data to audio conversion takes place
 6. The machine responds to the human by playing the audio file

Two Components of NLP

1. Natural Language Understanding (NLU)

- NLU helps the machine to understand and analyse human language by extracting the metadata from content such as concepts, entities, keywords, emotion, relations, and semantic roles.
- NLU used in Business applications to understand the customer's problem in both spoken and written language.
- NLU involves the following tasks -
 - It is used to map the given input into useful representation.
 - It is used to analyze different aspects of the language.

2. Natural Language Generation (NLG)

- Natural Language Generation (NLG) acts as a translator that converts the computerized data into natural language representation. It
- involves Text planning, Sentence planning, and Text Realization.

Objectives of NLP

- Read the human languages in a manner that is valuable.
- Decipher the human languages
- Understand the human languages
- Make sense of the human languages

NLP Advantages

- NLP helps users to ask questions about any subject and get a direct response within seconds.
- NLP offers exact answers to the question i.e. does not offer unnecessary and unwanted information.
- NLP helps computers to communicate with humans in their languages.
- Improves the efficiency of documentation processes, accuracy of documentation, and identify the information from large databases.

NLP Disadvantages

- May not show context.
- Unpredictable
- May require more keystrokes.
- NLP is unable to adapt to the new domain, and it has a limited function. So, NLP is built for a single and specific task only.

NLP Applications

- Language translation applications such as Google Translate
- Word Processors such as Microsoft Word and Grammarly that employ NLP to check grammatical accuracy of texts.
- Interactive Voice Response (IVR) applications used in call centers to respond to certain users' requests.
- Personal assistant applications such as OK Google, Siri, Cortana, and Alexa.

Natural language understanding

- Mapping the given input in natural language into useful representations
- Analyzing different aspects of the language

Raw speech signal

↓ • **Speech recognition**

Sequence of words spoken

↓ • **Syntactic analysis** using knowledge of the grammar

Structure of the sentence

↓ • **Semantic analysis** using information about meaning of words

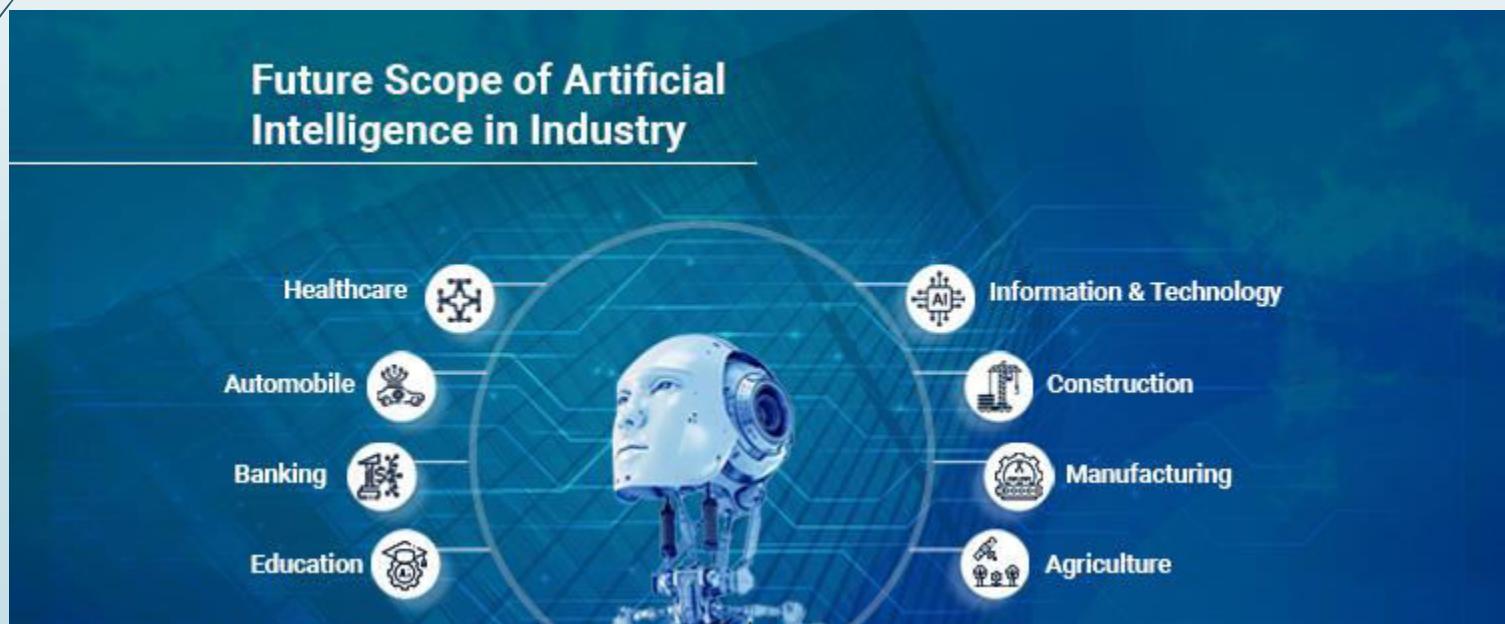
Partial representation of meaning of sentence

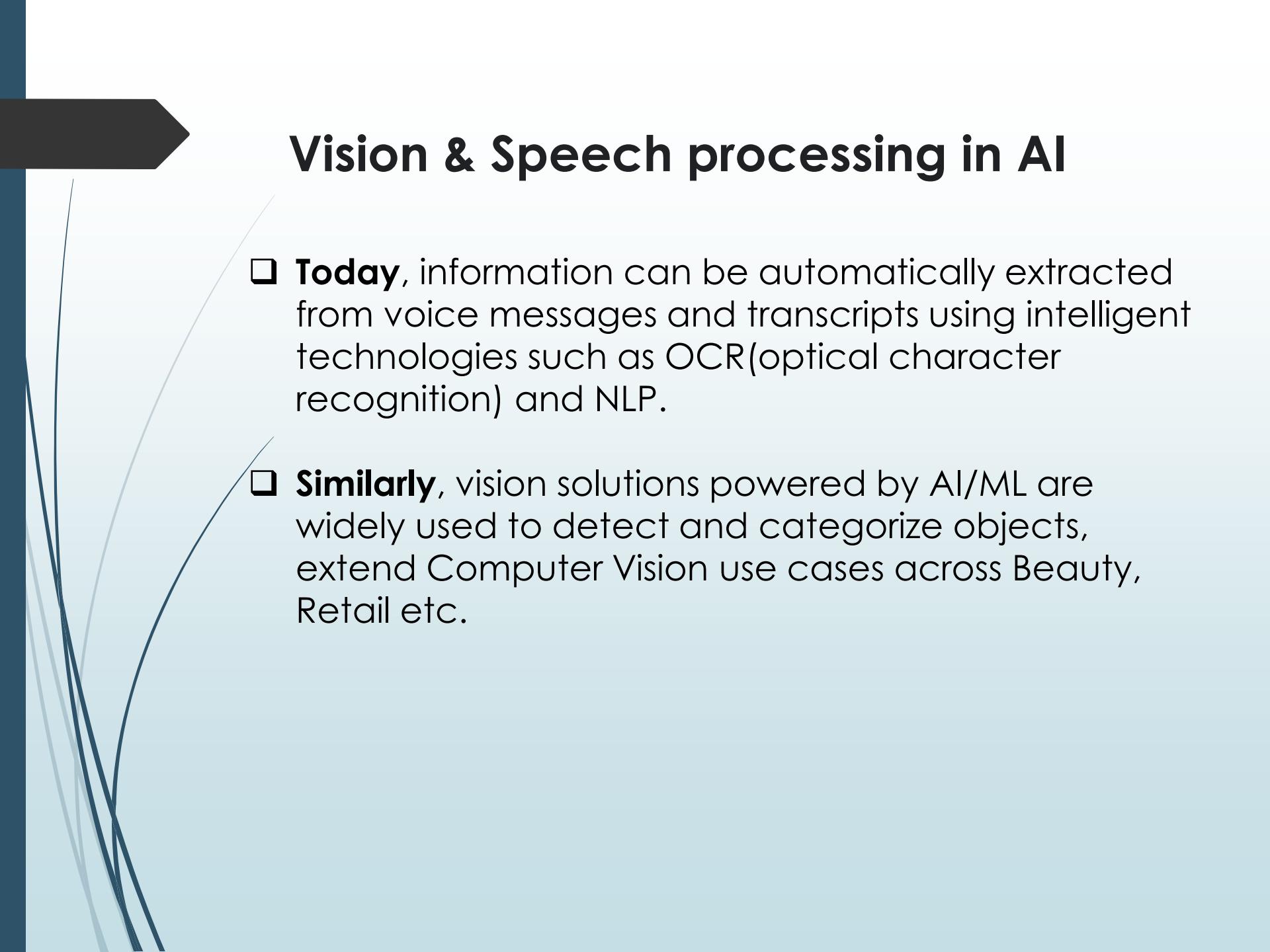
↓ • **Pragmatic analysis** using information about context

Final representation of meaning of sentence

Future of AI

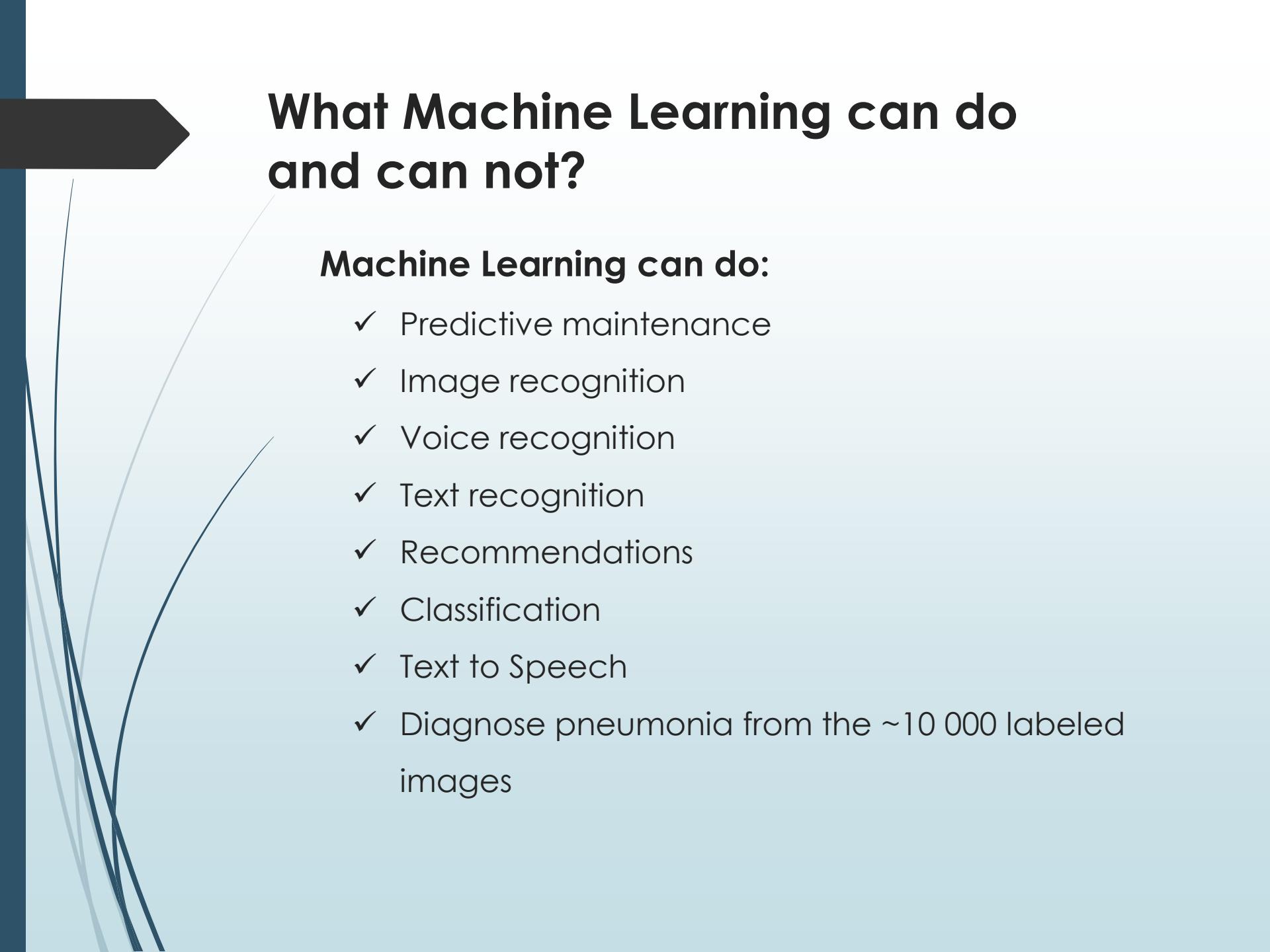
- ! AI is predicted to grow increasingly pervasive as technology develops, revolutionizing sectors including healthcare, banking, and transportation.
- ! The work market will change as a result of AI-driven automation, necessitating new positions and skills.





Vision & Speech processing in AI

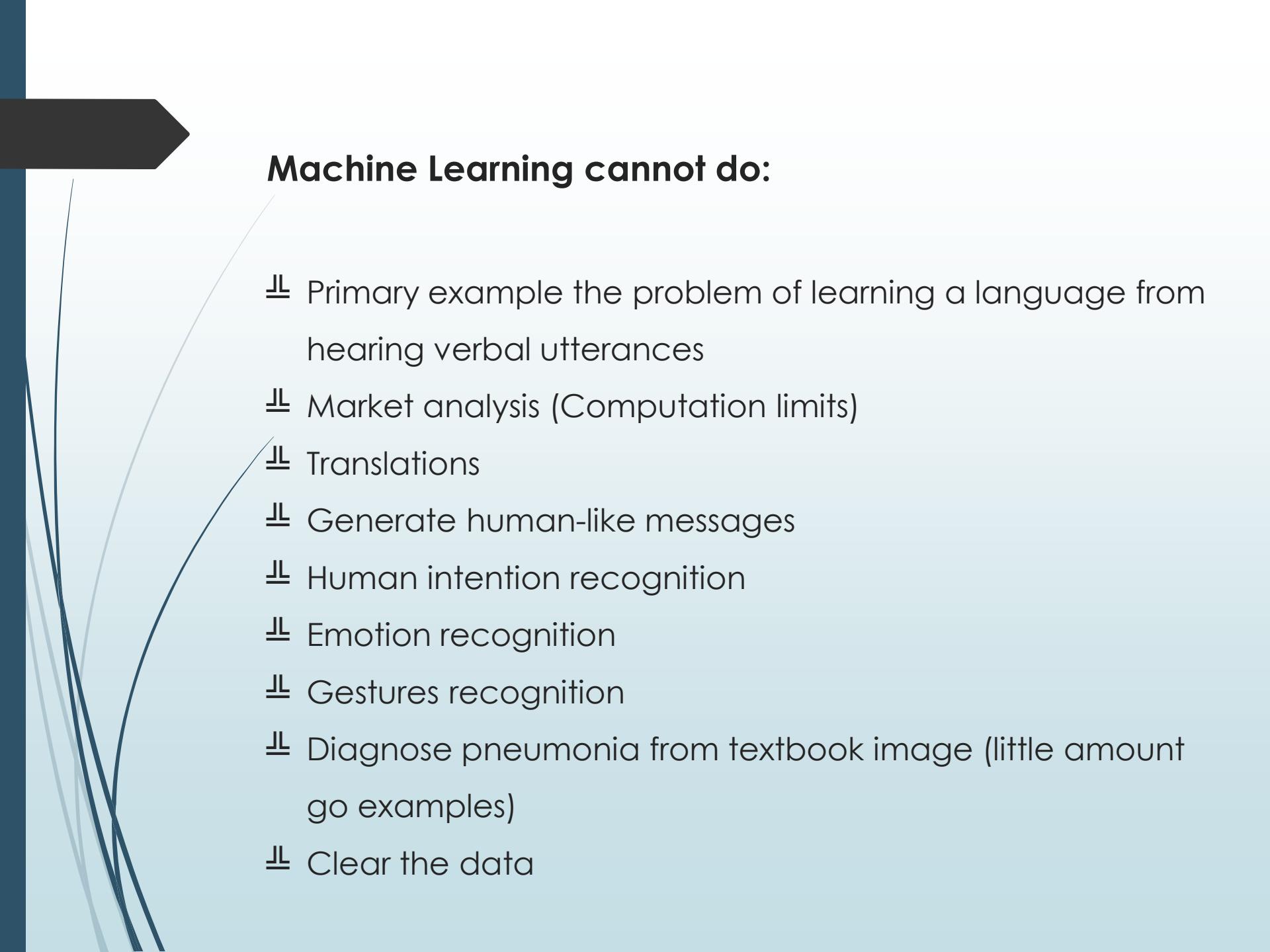
- **Today**, information can be automatically extracted from voice messages and transcripts using intelligent technologies such as OCR(optical character recognition) and NLP.
- **Similarly**, vision solutions powered by AI/ML are widely used to detect and categorize objects, extend Computer Vision use cases across Beauty, Retail etc.



What Machine Learning can do and can not?

Machine Learning can do:

- ✓ Predictive maintenance
- ✓ Image recognition
- ✓ Voice recognition
- ✓ Text recognition
- ✓ Recommendations
- ✓ Classification
- ✓ Text to Speech
- ✓ Diagnose pneumonia from the ~10 000 labeled images



Machine Learning cannot do:

- ↳ Primary example the problem of learning a language from hearing verbal utterances
- ↳ Market analysis (Computation limits)
- ↳ Translations
- ↳ Generate human-like messages
- ↳ Human intention recognition
- ↳ Emotion recognition
- ↳ Gestures recognition
- ↳ Diagnose pneumonia from textbook image (little amount go examples)
- ↳ Clear the data

Building AI Projects

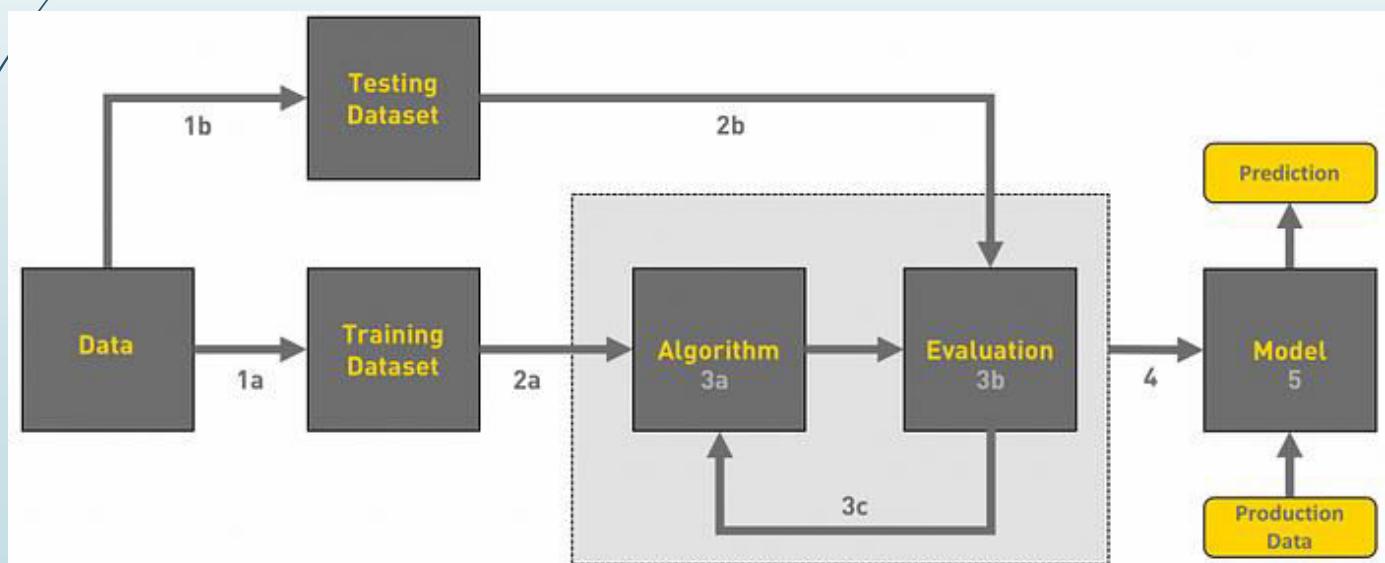
Chapter 3

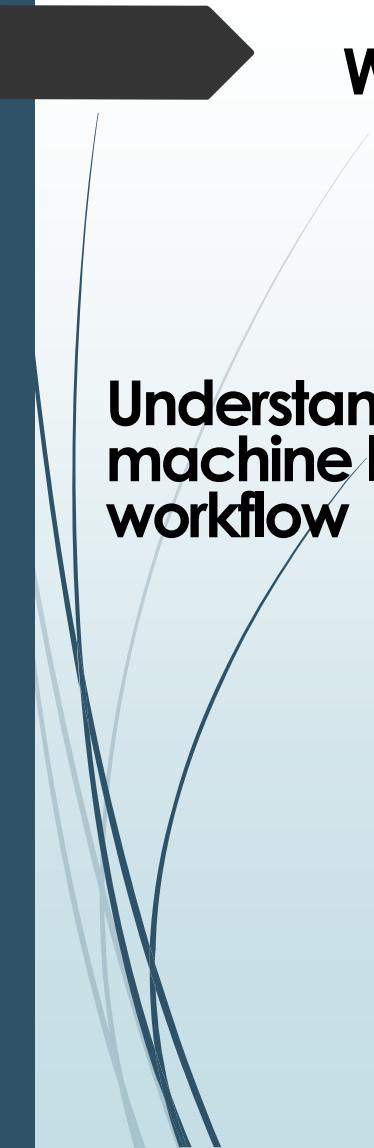
3.1. Step by step Machine Learning work flow

Introduction

In this chapter, we will discuss the workflow of a Machine learning project this includes all the steps required to build the proper machine learning project from scratch.

We will also go over data pre-processing, data cleaning, feature exploration and feature engineering and show the impact that it has on Machine Learning Model Performance.





Understanding the machine learning workflow

What is the machine learning Model?

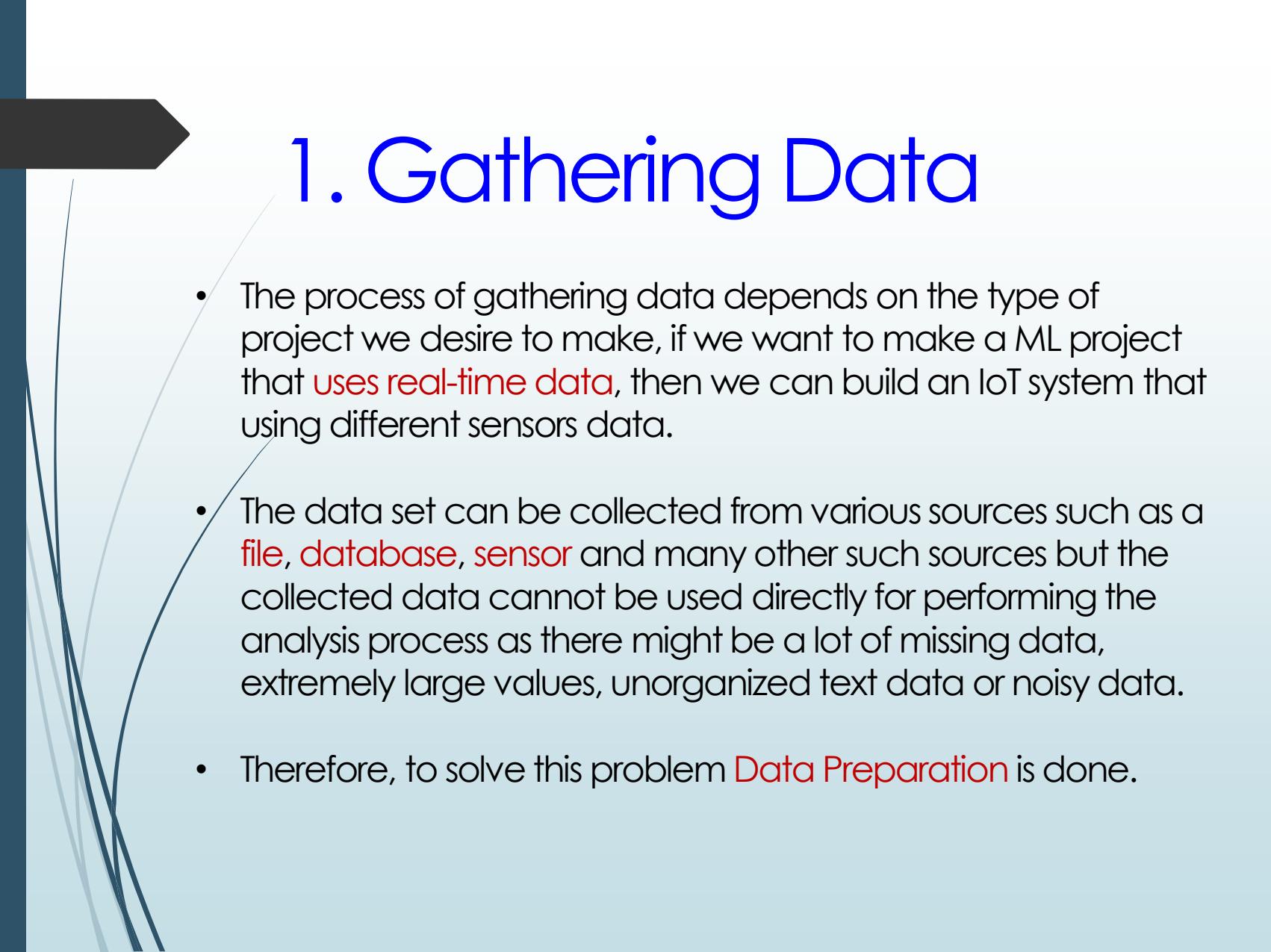
We can define the machine learning workflow in 5 stages.

- Gathering data
- Data pre-processing
- Researching the model that will be best for the type of data
- Training and testing the model
- Evaluation

Okay but first let's start from the basics

The machine learning model is nothing but a piece of code;

An engineer or data scientist makes it smart through training with data. So, if you give garbage to the model, you will get garbage in return, i.e. the trained model will provide false or wrong predictions.



1. Gathering Data

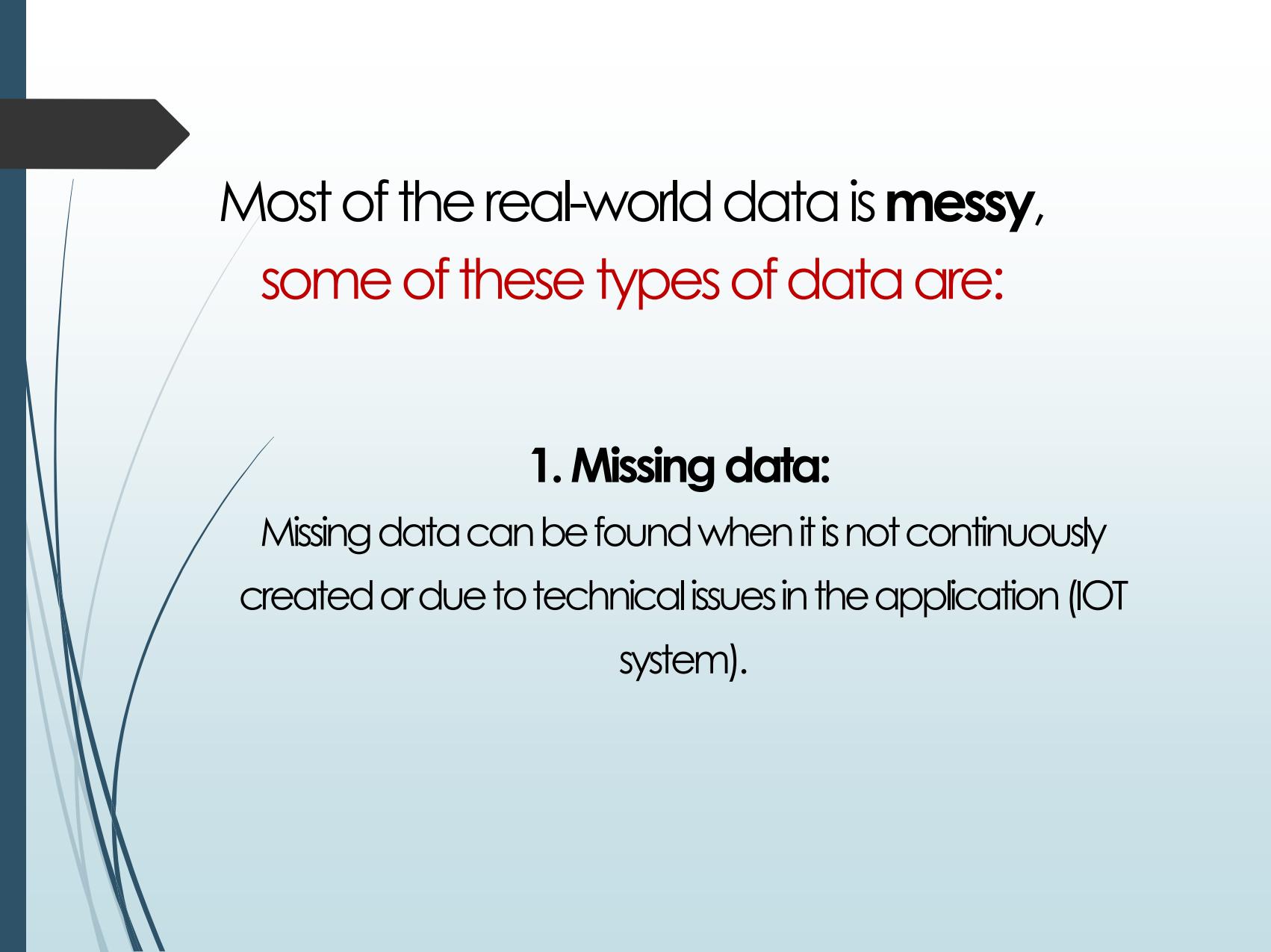
- The process of gathering data depends on the type of project we desire to make, if we want to make a ML project that **uses real-time data**, then we can build an IoT system that uses different sensors data.
- The data set can be collected from various sources such as a **file, database, sensor** and many other such sources but the collected data cannot be used directly for performing the analysis process as there might be a lot of missing data, extremely large values, unorganized text data or noisy data.
- Therefore, to solve this problem **Data Preparation** is done.

2. Data pre-processing

What is data pre-processing?

- **Data pre-processing** is one of the most important steps in machine learning.
- **Data pre-processing** is a process of cleaning the raw data i.e. the data is collected in the real world and is converted to a clean data set.
- It helps in building machine learning models more accurately.
- In **machine learning**, there is an 80/20 rule. Every data scientist should spend 80% time for data pre-processing and 20% time to actually perform the analysis.

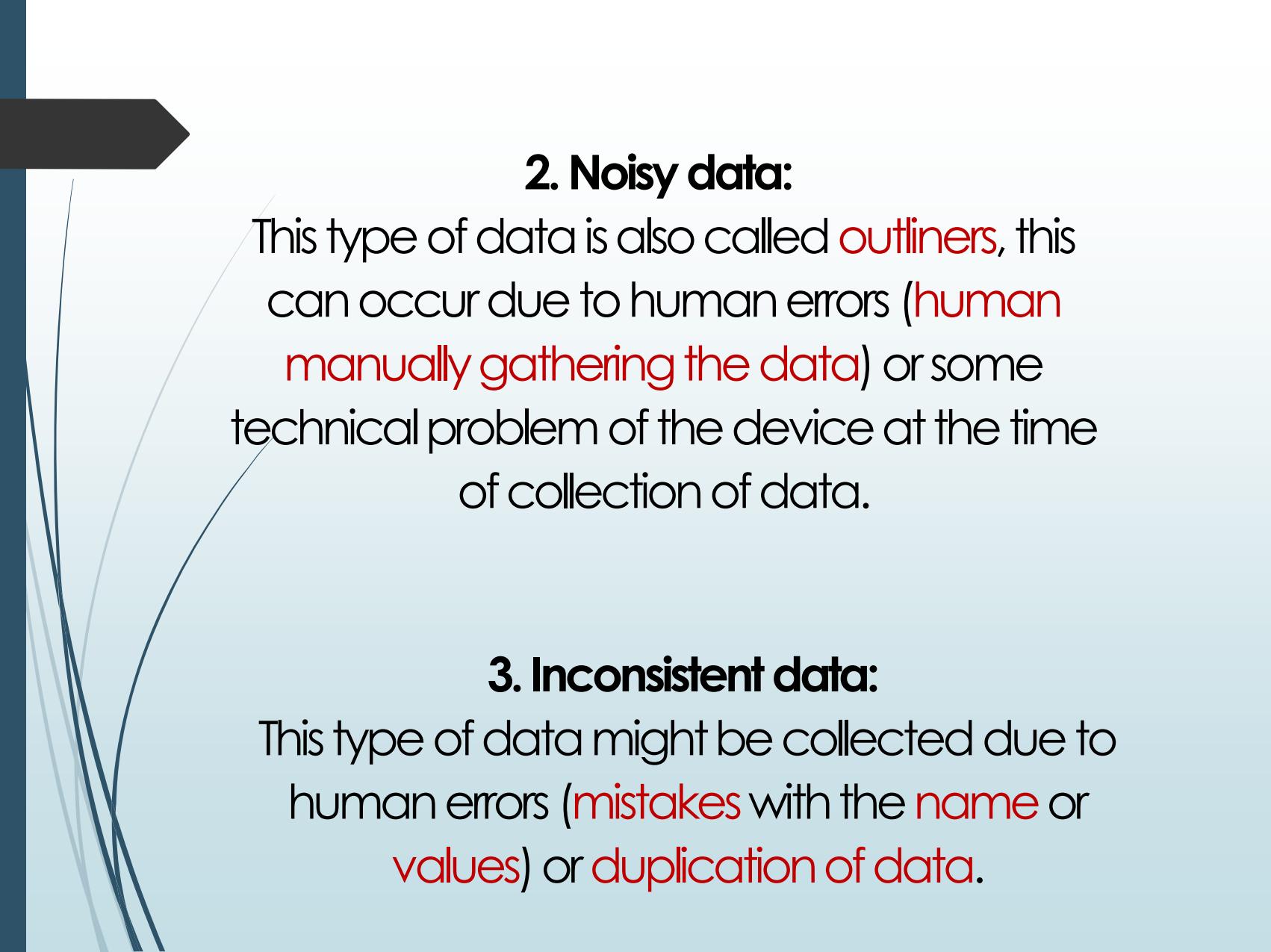
Therefore, certain steps are executed to convert the data into a small clean data set, this part of the process is called as **data pre-processing**.



Most of the real-world data is **messy**,
some of these types of data are:

1. Missing data:

Missing data can be found when it is not continuously created or due to technical issues in the application (IOT system).



2. Noisy data:

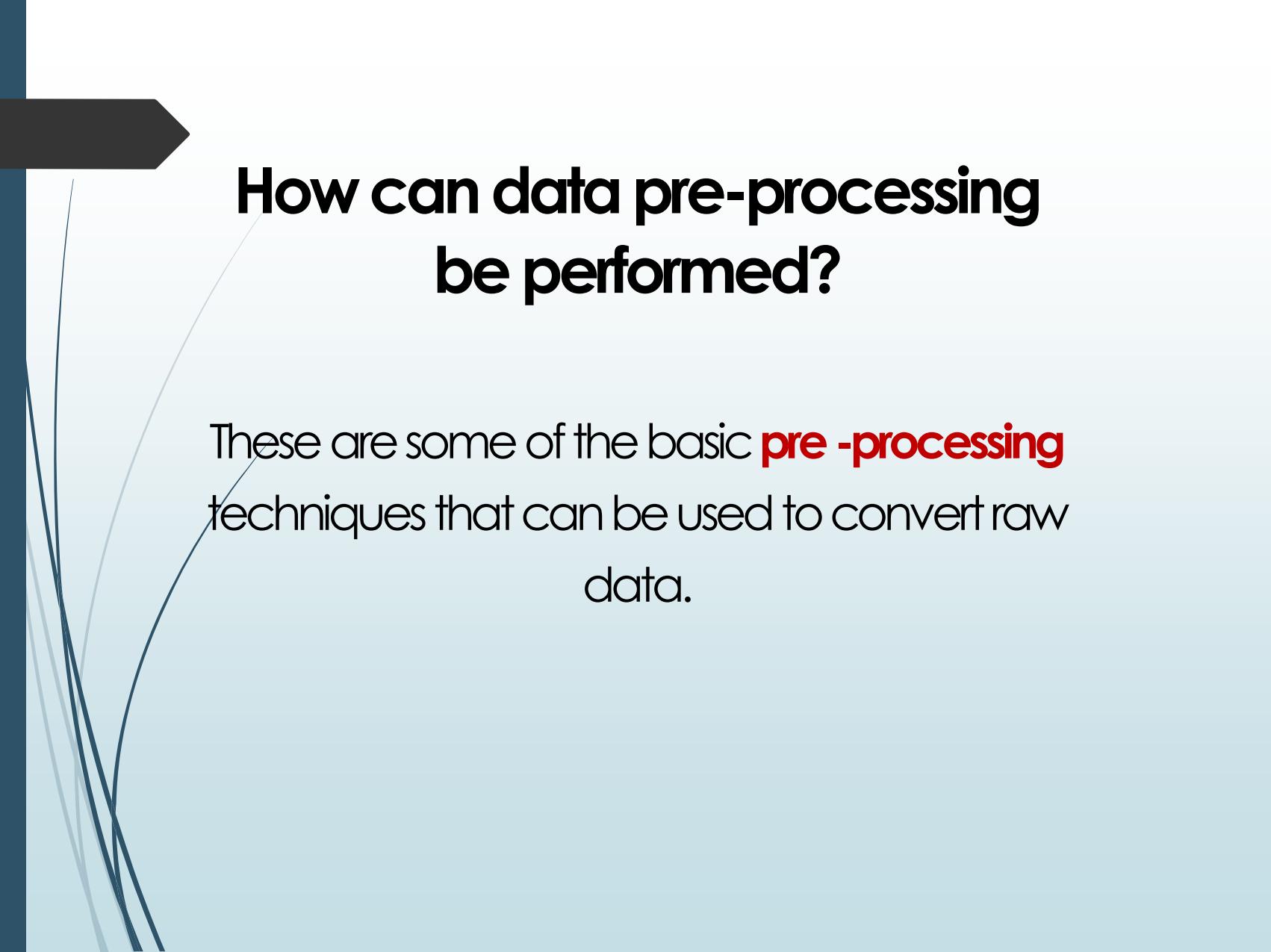
This type of data is also called **outliers**, this can occur due to human errors (**human manually gathering the data**) or some technical problem of the device at the time of collection of data.

3. Inconsistent data:

This type of data might be collected due to human errors (**mistakes with the name or values**) or duplication of data.

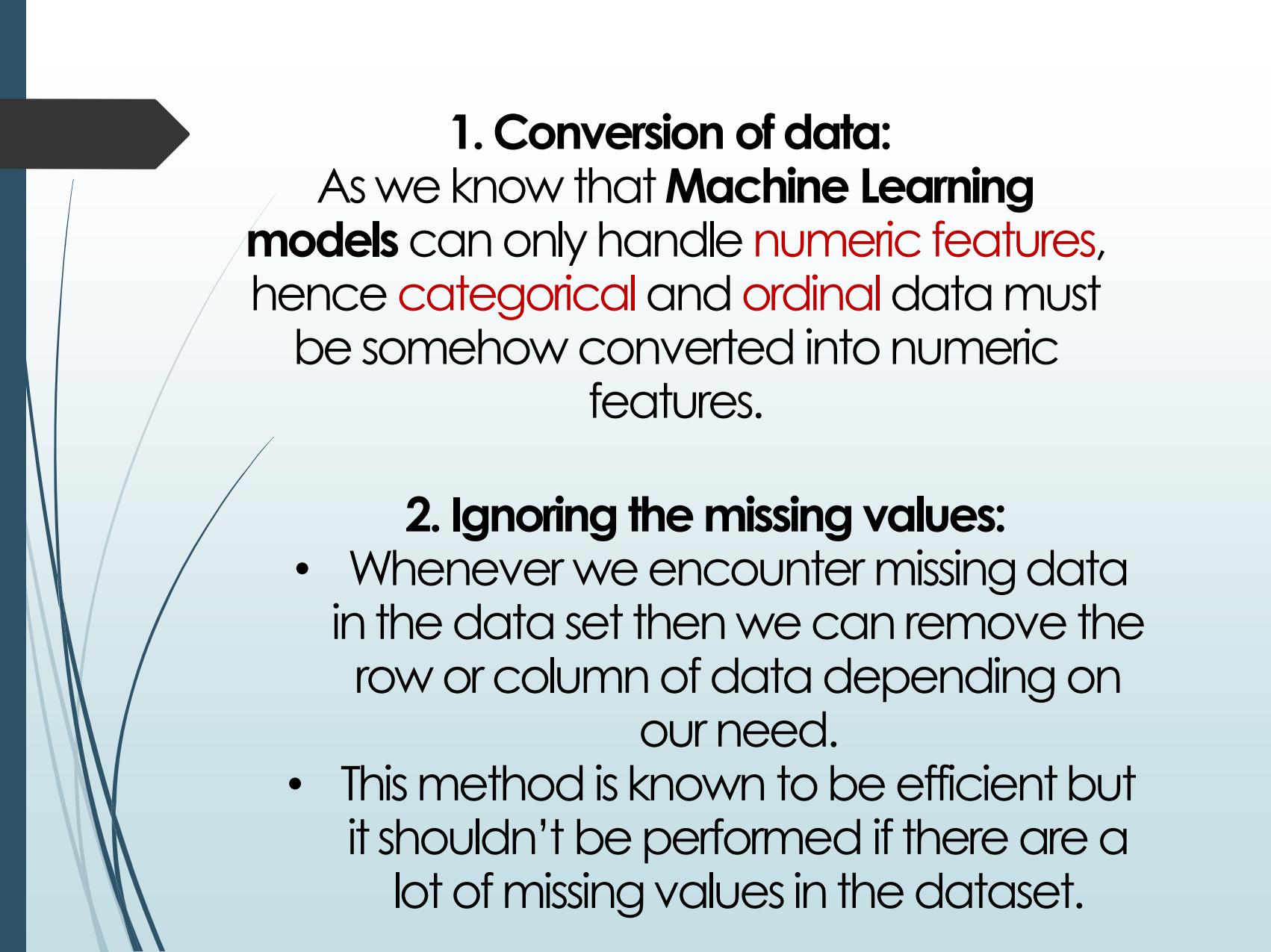
Another Three Types of Data

1. **Numeric** e.g. income, age
2. **Categorical** e.g. gender, nationality
3. **Ordinal** e.g. low/medium/high



How can data pre-processing be performed?

These are some of the basic **pre -processing** techniques that can be used to convert raw data.



1. Conversion of data:

As we know that **Machine Learning models** can only handle **numeric features**, hence **categorical** and **ordinal** data must be somehow converted into numeric features.

2. Ignoring the missing values:

- Whenever we encounter missing data in the data set then we can remove the row or column of data depending on our need.
- This method is known to be efficient but it shouldn't be performed if there are a lot of missing values in the dataset.

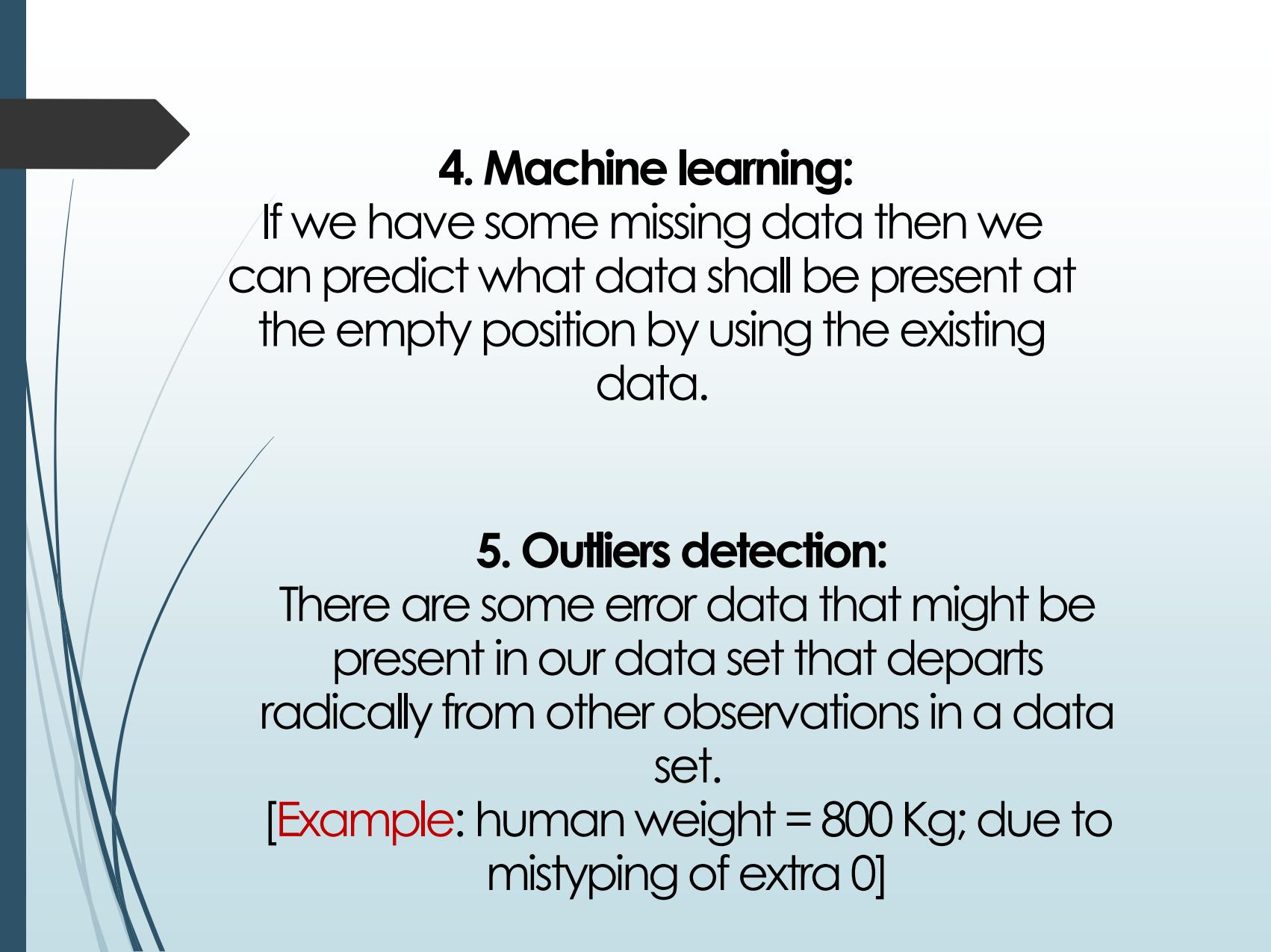


3. Filling the missing values:

Whenever we encounter missing data in the data set then we can fill the missing data manually, most commonly the mean, median or highest frequency value is used.

Topic #1:

- What mean, median or highest frequency value are? and
- How can they implement?



4. Machine learning:

If we have some missing data then we can predict what data shall be present at the empty position by using the existing data.

5. Outliers detection:

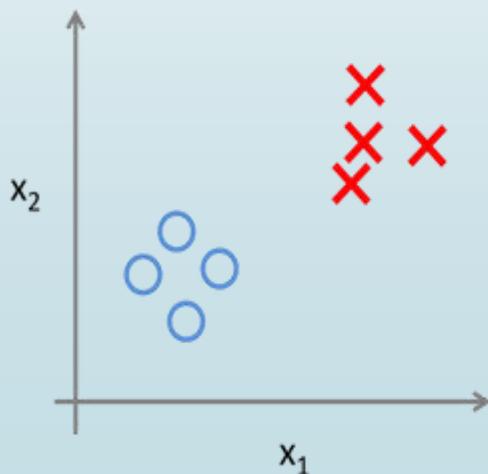
There are some error data that might be present in our data set that departs radically from other observations in a data set.

[**Example:** human weight = 800 Kg; due to mistyping of extra 0]

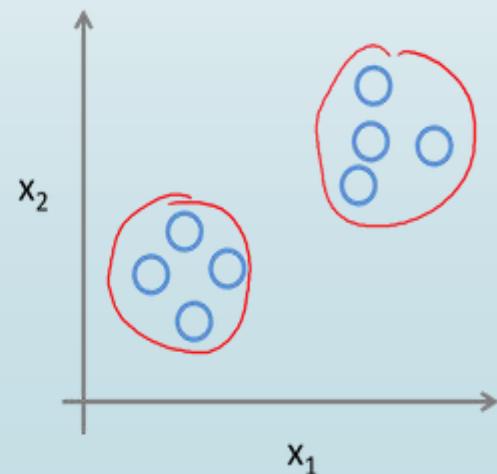
3. Researching the model that will be best for the type of data

Our main goal is to train the best performing model possible, using the pre-processed data.

Supervised Learning

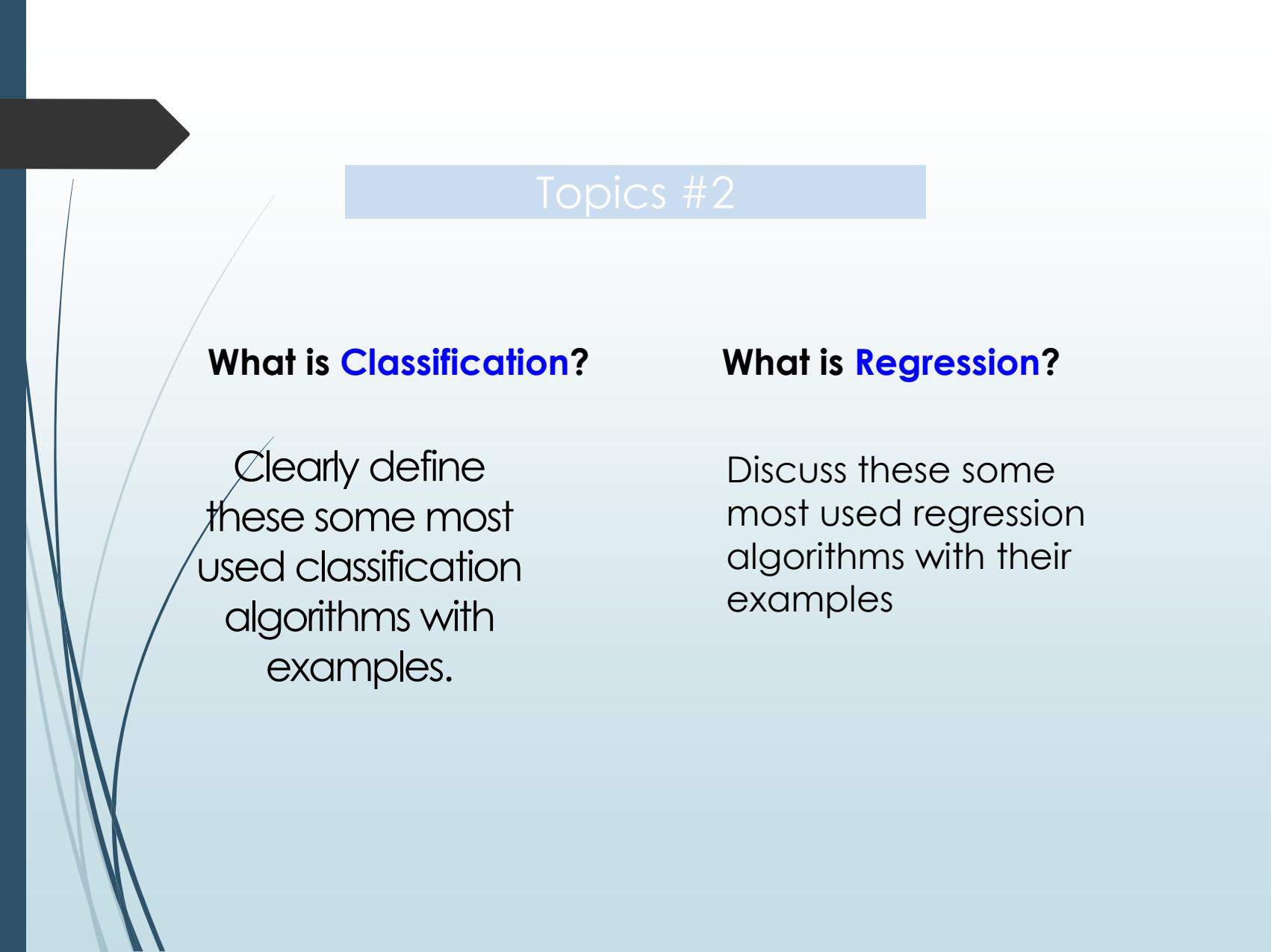


Unsupervised Learning



I. Supervised Learning:

- In **Supervised learning**, an AI system is presented with data which is **labelled**, which means that each data tagged with the correct label.
- The **supervised learning** is categorized into 2 other categories which are “**Classification**” and “**Regression**”.



Topics #2

What is Classification?

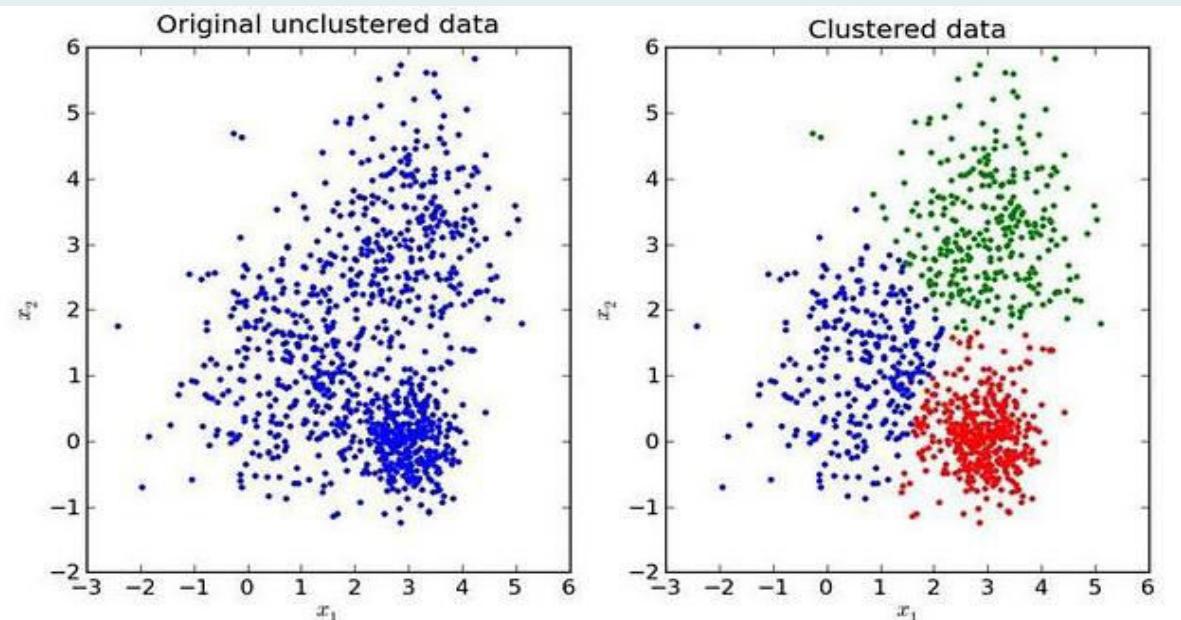
Clearly define these some most used classification algorithms with examples.

What is Regression?

Discuss these some most used regression algorithms with their examples

II. Unsupervised Learning:

- In **unsupervised learning**, an AI system is presented with **unlabeled, un-categorized** data and the system's algorithms act on the data **without prior training**.
- **The output** is dependent upon the coded algorithms. Subjecting a system to unsupervised learning is one way of testing AI.
- The unsupervised learning is categorized into 2 other categories which are "**Clustering**" and "**Association**".





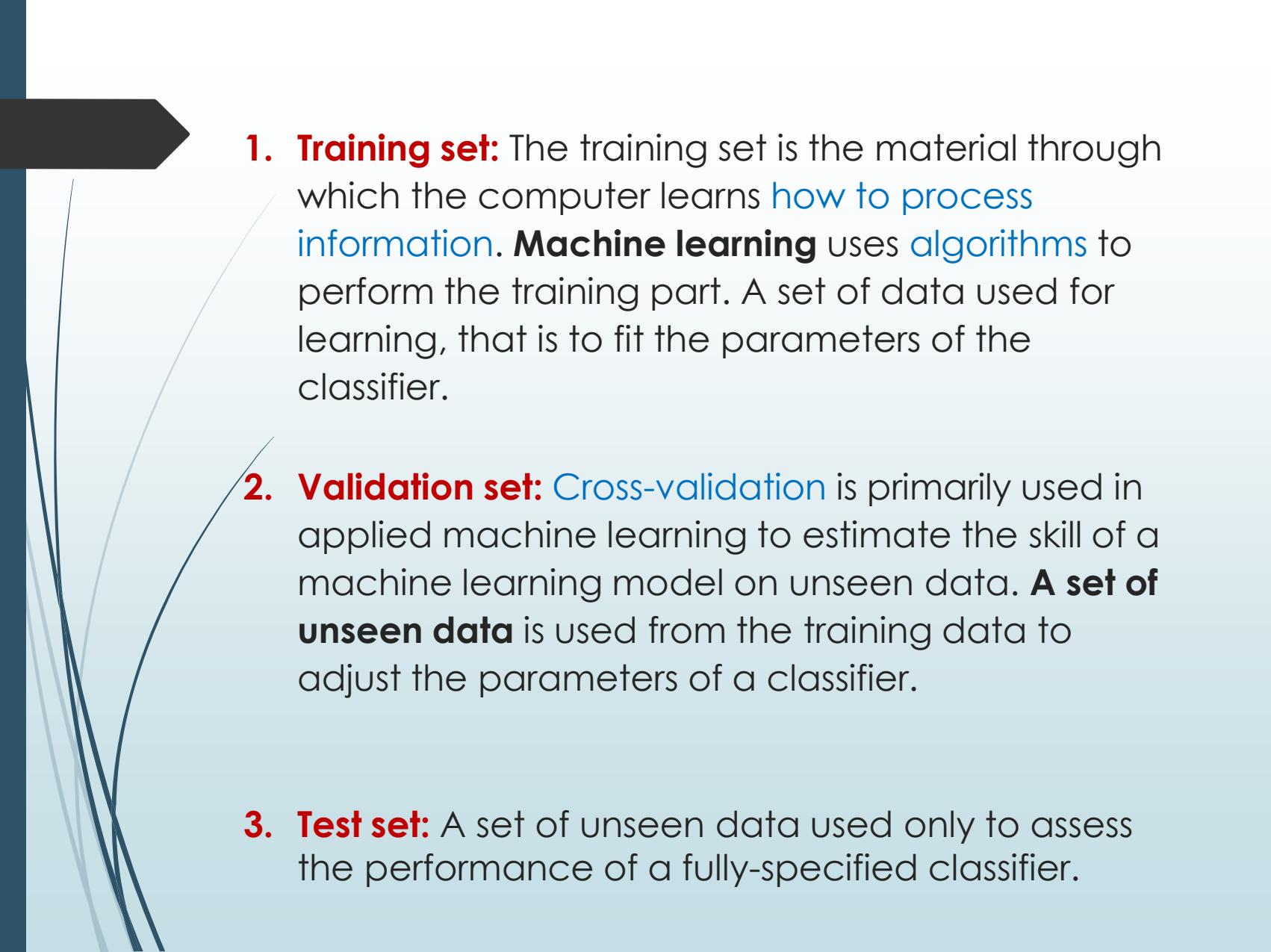
Topics #3

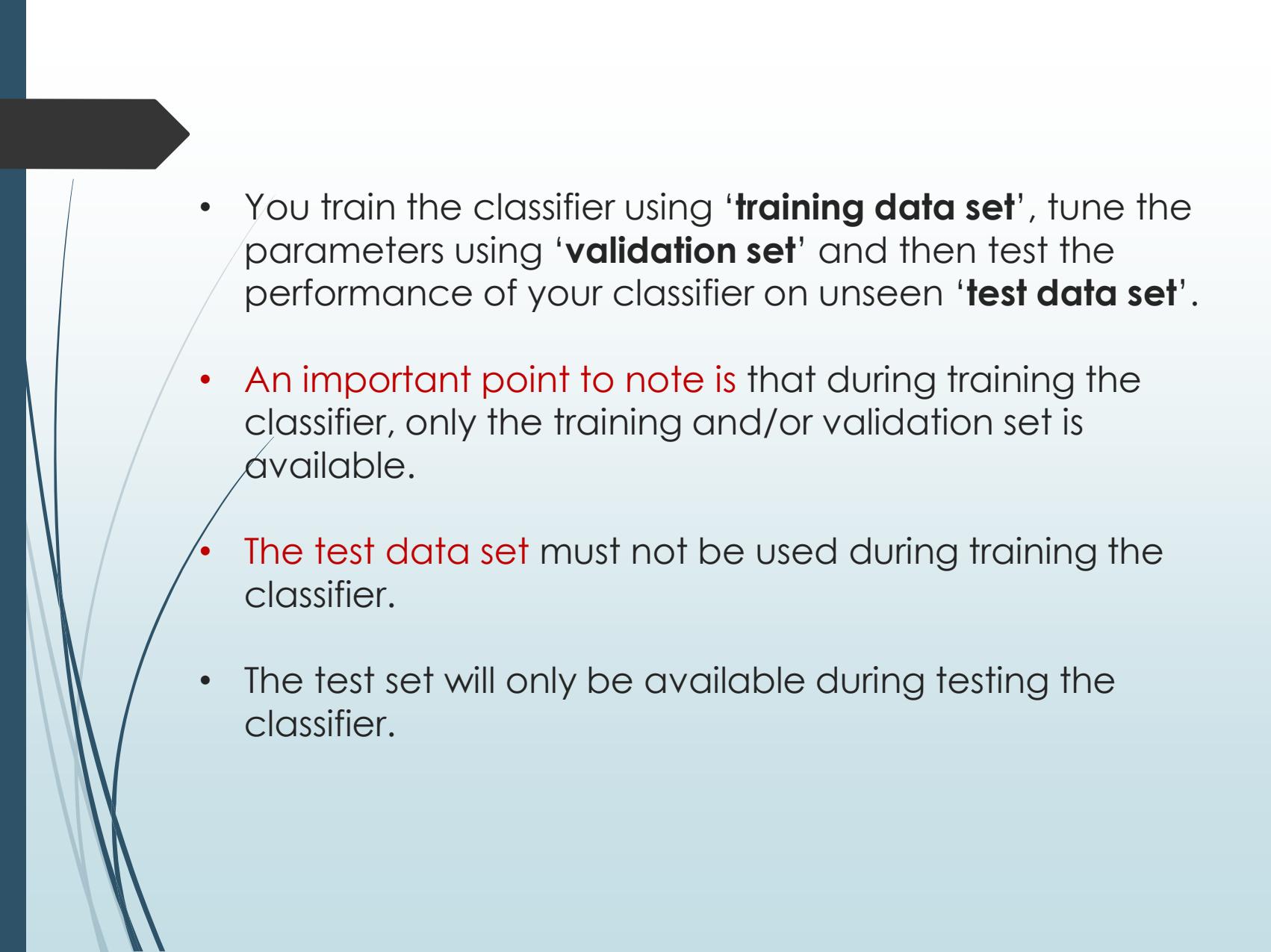
Compare and contrast Clustering
and Association with examples
each:

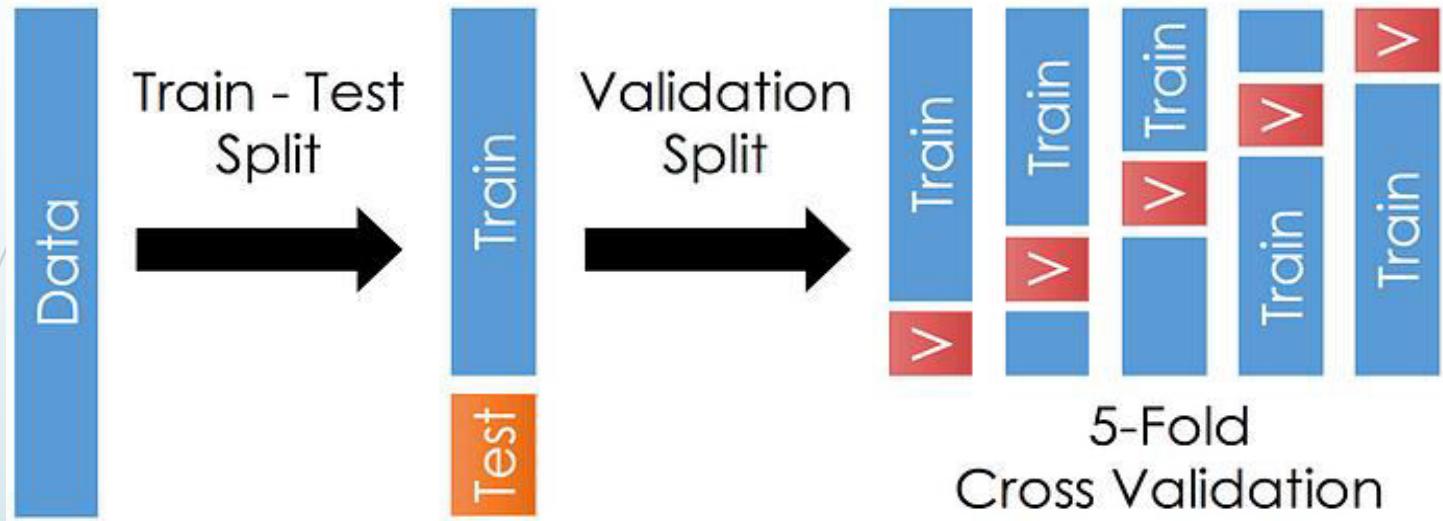
4. Training and testing the model on data

For training a model we initially split the model into 3 three sections which are

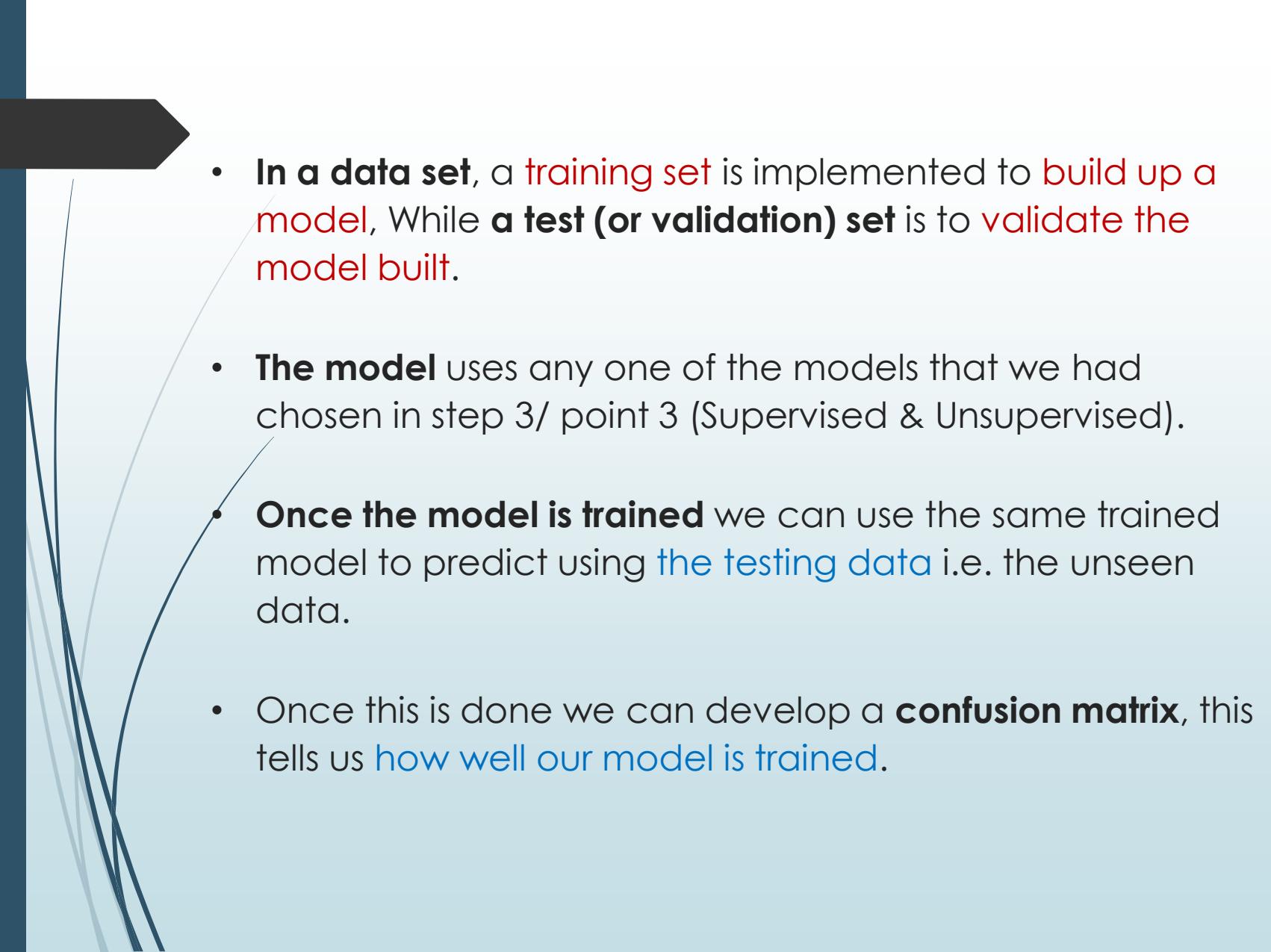
‘Training data’ ,
‘Validation data’ and
‘Testing data’.

- 
1. **Training set:** The training set is the material through which the computer learns **how to process information**. **Machine learning** uses **algorithms** to perform the training part. A set of data used for learning, that is to fit the parameters of the classifier.
 2. **Validation set:** Cross-validation is primarily used in applied machine learning to estimate the skill of a machine learning model on unseen data. **A set of unseen data** is used from the training data to adjust the parameters of a classifier.
 3. **Test set:** A set of unseen data used only to assess the performance of a fully-specified classifier.

- 
- You train the classifier using '**training data set**', tune the parameters using '**validation set**' and then test the performance of your classifier on unseen '**test data set**'.
 - An important point to note is that during training the classifier, only the training and/or validation set is available.
 - The test data set must not be used during training the classifier.
 - The test set will only be available during testing the classifier.



Once the data is divided into the 3 given segments we can start the training process.

- 
- In a **data set**, a **training set** is implemented to **build up a model**, While **a test (or validation) set** is to **validate the model built**.
 - **The model** uses any one of the models that we had chosen in step 3/ point 3 (Supervised & Unsupervised).
 - **Once the model is trained** we can use the same trained model to predict using **the testing data** i.e. the unseen data.
 - Once this is done we can develop a **confusion matrix**, this tells us **how well our model is trained**.

Confusion matrix

- A confusion matrix has **4 parameters**, which are: '**True positives**', '**True Negatives**', '**False Positives**' and '**False Negative**'.
- We prefer that we get more values in the **True negatives** and **true positives** to get a more accurate model.
- The size of the Confusion matrix completely depends upon the number of classes.

		Actual Values	
		Positive (1)	Negative (0)
Predicted Values	Positive (1)	TP	FP
	Negative (0)	FN	TN

n=165	Predicted: NO	Predicted: YES
Actual: NO	50	10
Actual: YES	5	100



Confusion Matrix Parameters

- **True positives** : These are cases in which we predicted TRUE and our predicted output is correct.
- **True negatives** : We predicted FALSE and our predicted output is correct.
- **False positives** : We predicted TRUE, but the actual predicted output is FALSE.
- **False negatives** : We predicted FALSE, but the actual predicted output is TRUE.



We can also find out the accuracy of the model using the confusion matrix.

Accuracy = $(\text{True Positives} + \text{True Negatives}) / (\text{Total number of classes})$

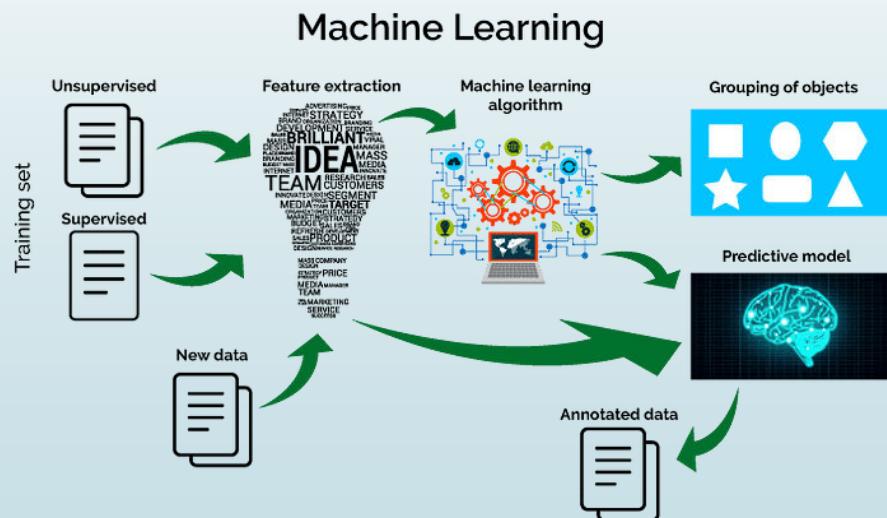
i.e. for the above example:

Accuracy = $(100 + 50) / 165 = 0.9090$ (90.9% accuracy)

5. Evaluation

Model Evaluation is an integral part of the model development process. It helps to find the best model that represents our data and how well the chosen model will work in the future.

To improve the model, we might tune the hyper-parameters of the model and try to improve the accuracy and also looking at the confusion matrix to try to increase the number of **true positives** and **true negatives**.

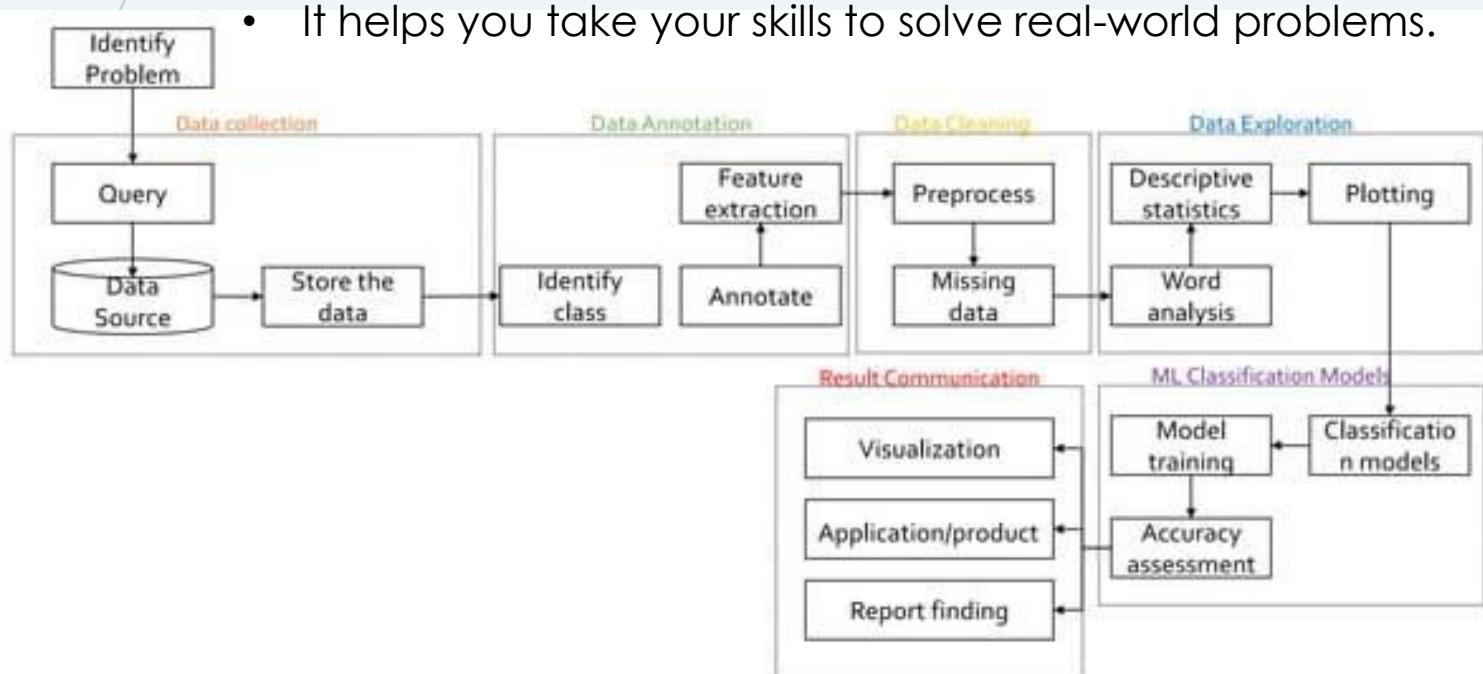




3.2. Workflow of a data science project

Data science project work flow

- A data science project is a practical application of your skills.
- A typical data science project allows you to use skills in data collection, cleaning, exploratory data analysis, visualization, programming, machine learning, and so on.
- It helps you take your skills to solve real-world problems.





Step 1: Identify the problem/ research questions

- What are you interested in understanding that can help with expanding the common knowledge.
- What previous work has done that you can improve.
- **For my project:**
 - I want to understand how misinformation is manifested in social media in the discussion of a controversial topic.
 - What sparked my interest was how people easily believed information found in Twitter without fact checking.
 - Hopefully my work can help people be more cautious when browsing Twitter and limit the spread of false information by thinking before retweeting something.
 - Maybe there is something in the tweet itself that can help someone identify the falsehood/truthfulness of the information, i.e. the URL shared, the user etc.

Step 2: Data Collection

- **Build the query:** For Twitter, you need to identify the keywords and the time range.
 - The choice of keywords matters: bootstrapping etc.
- **Source of Twitter data collection:**
 - Paid firehose access: Crimson hexagon
 - Free access: Twitter API
- **Storing the data:**
 - Excel files as csv
 - Databases

Every second, on average, around 6,000 tweets are tweeted on Twitter, corresponding to over 350,000 tweets sent per minute, 500 million tweets per day and around 200 billion tweets per year.

Step 3: Data Annotation

- **Identify classes:** *(this coarsened to your research question)*
 - binary (positive, negative | for, against etc.)
 - Multi-class (types of evidence, types of users etc.)
- **Annotate:**
 - Human (build the codebook, train humans, inter-annotator agreement - Cohen's Kappa etc.)
 - Automatic
- **Feature extraction:**
 - Linguistics (LIWC, MPQA)
 - Syntactic (POS tags)
 - Twitter related (# followers, #retweets)

Step 4: Data Cleaning

- **Preprocessing:**
 - Remove hashtags
 - Remove mentions
 - Remove links
 - Remove retweets
 - Lowercase letter
- **Handling missing data:**
 - Drop missing data
 - Fill empty spaces with NA



Step 5: Data Exploration

- Descriptive statistics (i.e. mean, SD etc.)
- Plot different variables
- Word analysis
- Etc.

Step 6: ML Classification Models

- **Types of classification models:**
 - Linear Classifiers: Logistic Regression, Naive Bayes Classifier
 - SVM, DT, etc.
- **Training the model/ data partitioning:**
 - 60% test, 40% train
 - N-fold cross validation
- **Accuracy assessment and error analysis:**
 - F₁ measure
 - AUC
 - Confusion metrics



Step 7: Result Communication

1. Visualization:

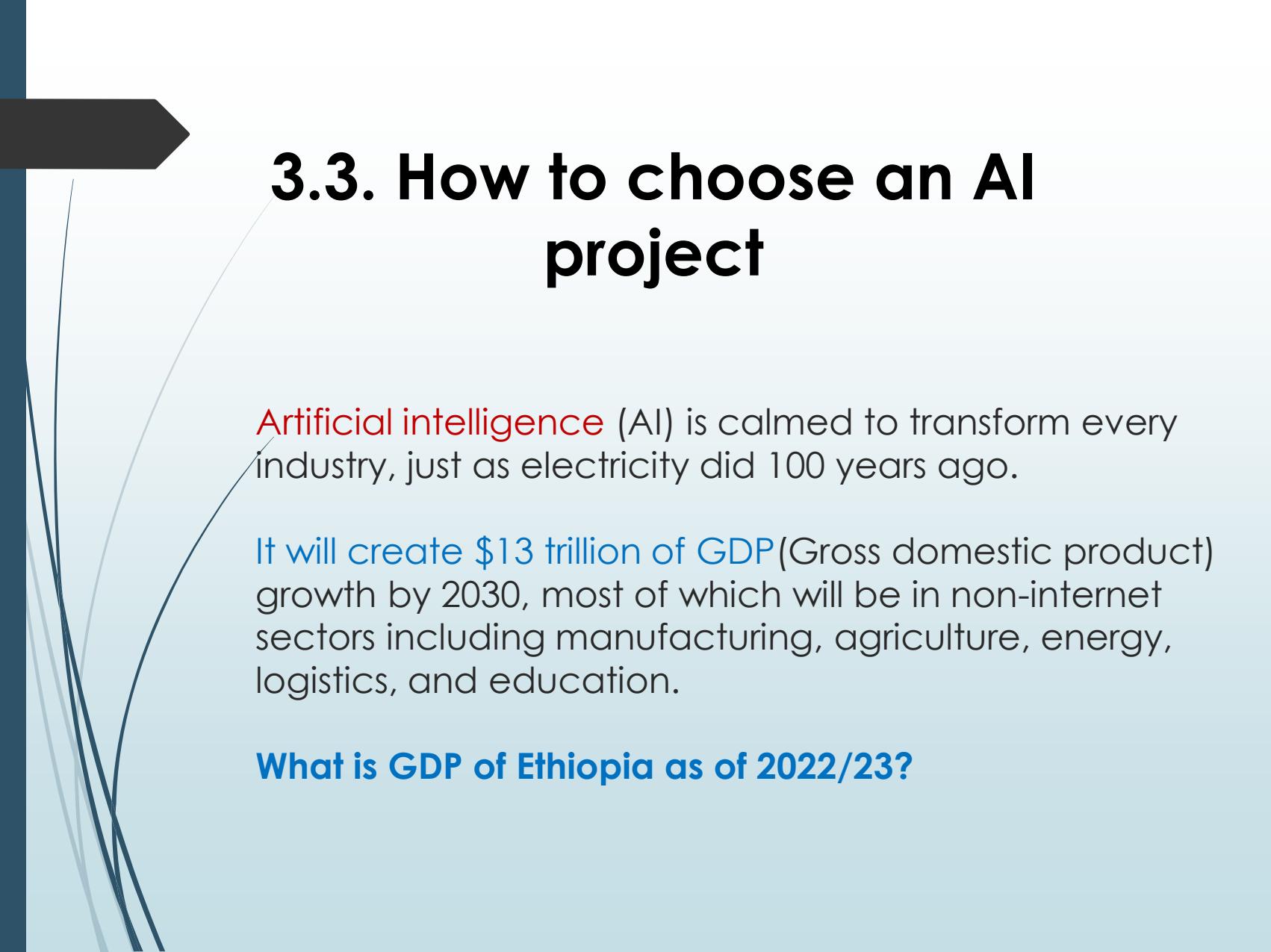
- matplotlib

2. Application:

- Products

3. Report finding:

- Conference/journal papers
- Presentations



3.3. How to choose an AI project

Artificial intelligence (AI) is poised to transform every industry, just as electricity did 100 years ago.

It will create \$13 trillion of GDP (Gross domestic product) growth by 2030, most of which will be in non-internet sectors including manufacturing, agriculture, energy, logistics, and education.

What is GDP of Ethiopia as of 2022/23?



What's the best way to choose AI project ideas?

1. Identify your goals
2. Research existing solutions
3. Generate and prioritize ideas
4. Define your scope and MVP
5. Apply agile methods
6. Here's what else to consider



1. Identify your goals

Before you start looking for AI project ideas, you need to have a clear vision of:

- What you want to achieve?
- What are your learning objectives, career aspirations, or personal passions?
- How do you want to use AI to solve a problem, create a product, or advance a field?

Having a **specific** and **realistic** goal will help you focus your search and filter out irrelevant or impractical ideas.



2. Research existing solutions

Once you have a goal in mind, You need to do some research on what already exists in the domain you are interested in.

- What are the current challenges, trends, and gaps in the field?
- What are the best practices, tools, and frameworks for AI development?
- What are the ethical, legal, and social implications of AI?

By learning from existing solutions, you can **avoid reinventing the wheel**, find inspiration, and identify opportunities for improvement or innovation.

3. Generate and prioritize ideas

After you have done some research, you can start generating and prioritizing your AI project ideas.

- You can use **various techniques**, such as: **brainstorming**, **mind mapping**, or **SCAMPER** (Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse), to come up with as **many ideas as possible**.
- Then, you **can apply some criteria**, such as **feasibility**, **relevance**, **impact**, **novelty**, or **interest**, to **rank your ideas and select the most promising ones**.
- You **can also get feedback** from **peers**, **mentors**, or **experts** to **validate and refine** your ideas.

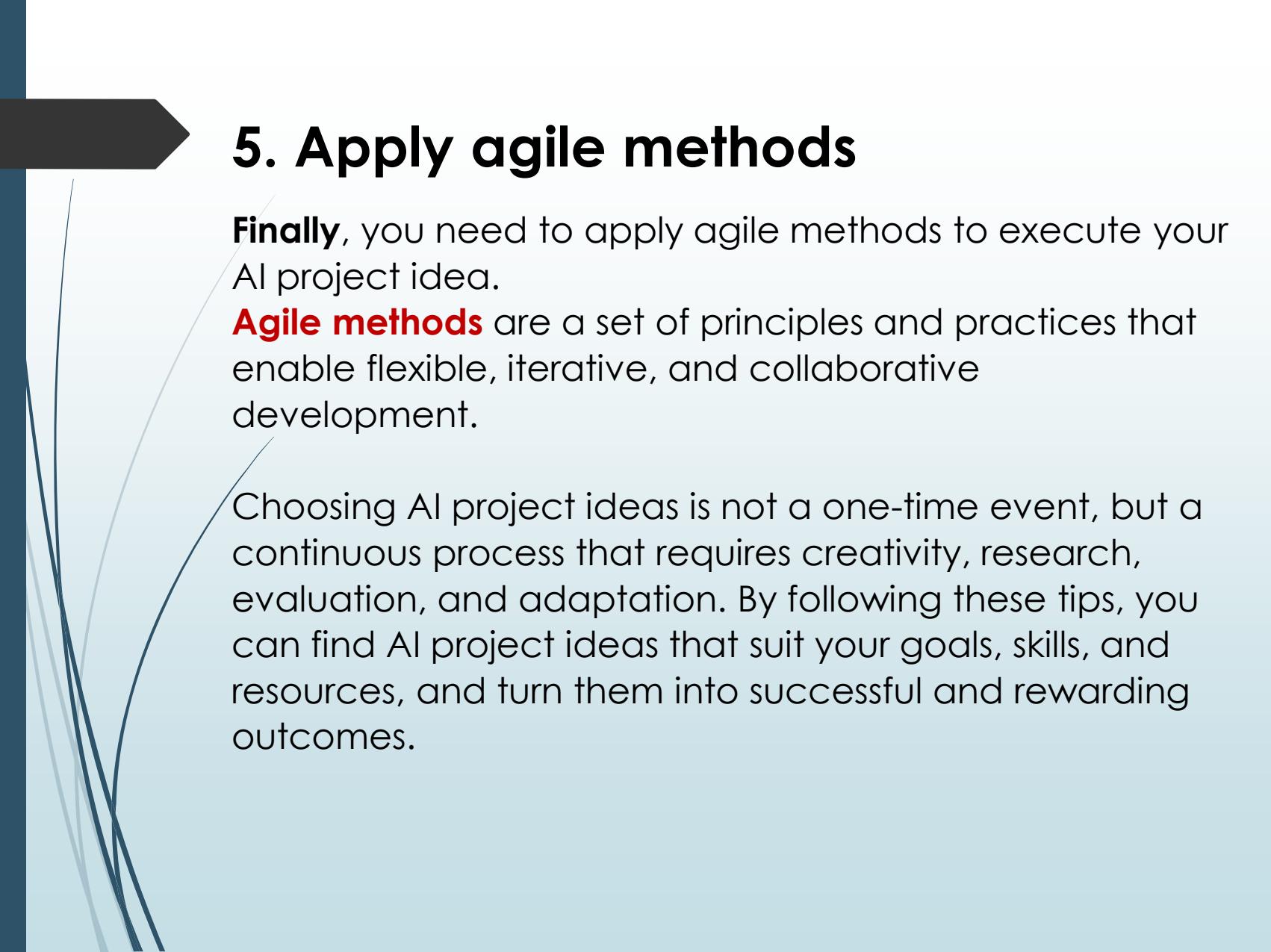


4. Define your scope and MVP

Once you have chosen your AI project idea, you need to define its scope and MVP (minimum viable product).

The scope is the set of features and functions that your project will deliver, while the MVP is the simplest version of your project that can demonstrate its value and test its assumptions.

By **defining your scope and MVP, you can avoid scope creep, manage your time and resources, and plan your development process.**



5. Apply agile methods

Finally, you need to apply agile methods to execute your AI project idea.

Agile methods are a set of principles and practices that enable flexible, iterative, and collaborative development.

Choosing AI project ideas is not a one-time event, but a continuous process that requires creativity, research, evaluation, and adaptation. By following these tips, you can find AI project ideas that suit your goals, skills, and resources, and turn them into successful and rewarding outcomes.



6. Here's what else to consider

This is a space to share examples, stories, or insights that don't fit into any of the previous sections.

- What else would you like to add?

3.4. Python Technical tools for AI

Artificial Intelligence has facilitated the processing of a large amount of data and its use in the industry. The number of tools and frameworks available to data scientists and developers has increased with the growth of AI and ML.



Python (programming language) is a high-level, general-purpose programming language.

Its design philosophy emphasizes code readability with the use of significant indentation.



Artificial Intelligence Tools & Frameworks you need to know

1. Scikit Learn
2. TensorFlow
3. Theano
4. Caffe
5. MxNet
6. Keras
7. PyTorch
8. CNTK
9. Auto ML
10. OpenNN
11. H2O: Open Source AI Platform
12. Google ML Kit

Topics #4

Discuss the above tools



Chapter Four **The Ethics of Artificial Intelligence**

4.1. Ethical Challenges of AI



Ethical Considerations:

- ▶ One of the primary challenges surrounding AI is ethical decision-making.
- ▶ As AI systems become increasingly autonomous, questions arise about accountability, bias, and privacy.
- ▶ Ensuring that AI operates in a fair and responsible manner remains a pressing concern.

Job Disruption: AI-powered automation has the potential to reshape the job market.

- ▶ While it eliminates some routine tasks, it also creates new roles and demands new skill sets.
- ▶ The transition may lead to job displacement and requires proactive measures to upskill and reskill the workforce.

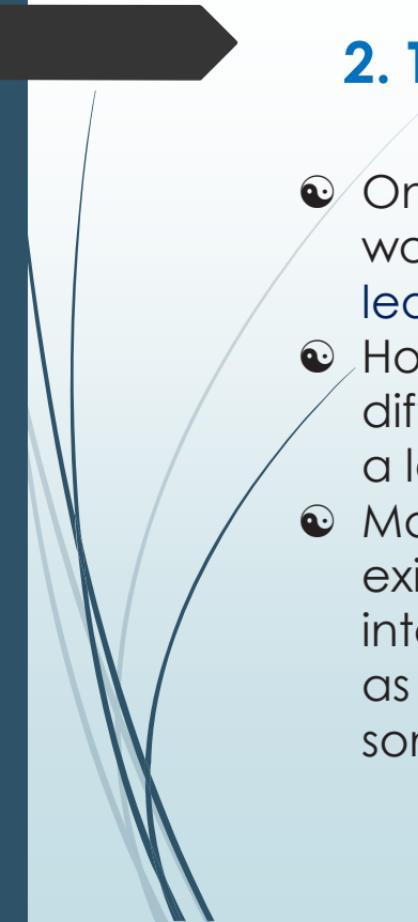


Top Common Challenges in AI

- There are several Artificial Intelligence problems, and we are going to address these challenges and how to solve them.
 1. Computing Power
 2. Trust Deficit
 3. Limited Knowledge
 4. Human-level
 5. Data Privacy and Security
 6. The Bias Problem
 7. Data Scarcity

1. Computing Power

- ⦿ The amount of power these power-hungry algorithms use is a factor keeping most developers away.
- ⦿ Machine Learning and Deep Learning are the **stepping stones** of this AI, and they demand an ever-increasing number of cores and GPUs to work efficiently.
- ⦿ They require a supercomputer's computing power, and yes, supercomputers aren't cheap.
- ⦿ **Although**, due to the availability of Cloud Computing and parallel processing systems developers work on AI systems more effectively, they come at a price.
- ⦿ **Not everyone** can afford that with an increase in the inflow of extraordinary amounts of data and rapidly increasing complex algorithms.



2. Trust Deficit

- ⦿ One of the most important factors that are a cause of worry for the AI is the unknown nature of how deep learning models predict the output.
- ⦿ How a specific set of inputs can devise a solution for different kinds of problems is difficult to understand for a layman.
- ⦿ Many people in the world don't even know the use or existence of Artificial Intelligence, and how it is integrated into everyday items they interact with such as **smartphones**, **Smart TVs**, **Banking**, and **even cars** (at some level of automation).

3. Limited Knowledge

- ⦿ Although there are many places in the market where we can use AI as a better alternative to the traditional systems.
- ⦿ The real problem is **the knowledge of AI**. Apart from technology fans, college students, and researchers, there are only a limited number of people who are aware of the potential of AI.
- ⦿ **For example**, there are many SMEs (Small and Medium Enterprises) which can have their work scheduled or learn innovative ways to increase their production, manage resources, sell and manage products online, learn and understand consumer behavior and react to the market effectively and efficiently.
- ⦿ They are also not aware of service providers such as Google Cloud, Amazon Web Services, and others in the tech industry.

4. Human-level

- ⦿ This is one of the most important challenges in AI, one that has kept researchers on edge for AI services in companies and start-ups.
- ⦿ These companies might be boasting of above 90% accuracy, but humans can do better in all of these scenarios.
- ⦿ **For example**, let our model predict whether the image is of a dog or a cat. The human can predict the correct output nearly every time, cleaning up a fabulous accuracy of above 99%.
- ⦿ For a deep learning model to perform a similar performance would require extraordinary fine-tuning, hyper-parameter optimization, large dataset, and a well-defined and accurate algorithm, along with robust computing power, uninterrupted training on train data and testing on test data.

5. Data Privacy and Security

- ⦿ The main factor on which all the deep and machine learning models are based on is the **availability of data and resources to train them.**
- ⦿ **Yes**, we have data, but as this data is generated from millions of users around the globe, there are chances this data can be used for bad purposes.
- ⦿ **For example**, let us suppose a medical service provider offers services to 1 million people in a city, and due to a cyber-attack, the personal data of all the one million users fall in the hands of everyone on the dark web.
- ⦿ This data includes data about diseases, health problems, medical history, and much more.

6. The Bias Problem

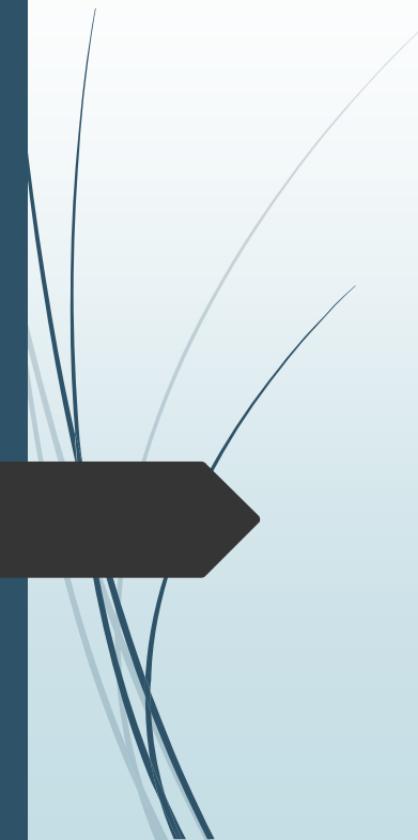
- ⦿ The good or bad nature of an AI system really depends on the amount of data they are trained on.
- ⦿ **Hence**, the ability to gain good data is the solution to good AI systems in the future.
- ⦿ **But, in reality**, the everyday data the organizations collect is poor and holds no significance of its own.
- ⦿ They are biased, and only somehow define the nature and specifications of a limited number of people with common interests based on religion, ethnicity, gender, community, and other racial biases.
- ⦿ The real change can be brought only by defining some algorithms that can efficiently track these problems.

7. Data Scarcity

- ⦿ With major companies such as Google, Facebook, and Apple facing charges regarding unethical use of user data generated, various countries such as India are using strict IT rules to restrict the flow.
- ⦿ **As a result**, these companies now face the problem of using local data for developing applications for the world, and that would result in bias.
- ⦿ The data is a very important aspect of AI, and labeled data is used to train machines to learn and make predictions.
- ⦿ Some companies are trying to innovate new methodologies and are focused on creating AI models that can give accurate results despite the scarcity of data.
- ⦿ With biased information, the entire system could become blemished.

Conclusion

- ⦿ Although these challenges in AI seem very depressing and devastating for mankind, through the collective effort of people, we can bring about these changes very effectively.
- ⦿ According to Microsoft, the next generation of engineers has to upskill themselves in these cutting edge new technologies to stand a chance to work with organizations of future and in order to prepare you.
- ⦿ **upGrad** has been offering programs on these cutting edge technologies with many of our student working in Google, Microsoft, Amazon and Visa and many another fortune 500 companies.



4.2. AI and Employment: Misplaced Fears



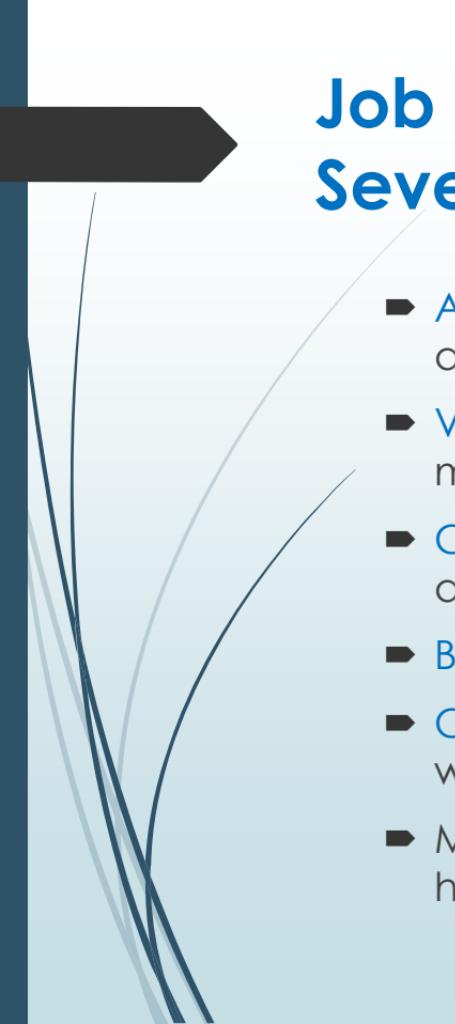
AI: A Creator of Mass Unemployment?

- Governments may be tempted to focus on the benefits of technological progress, while largely ignoring its negative impacts.
- Low-income countries are particularly exposed unless policymakers have a clear understanding of the risks and potential of these new technologies.



Concern About Quality of Jobs? Nothing New and Nothing About AI

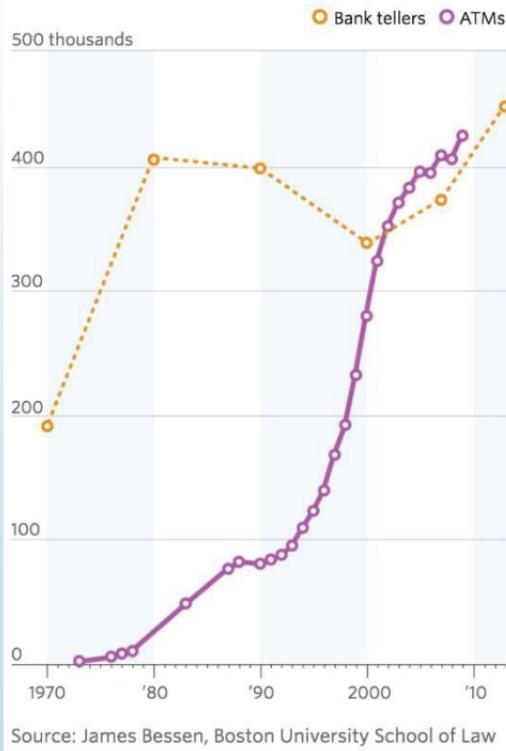
- ▶ Concern about polarization, hollowing out of the middle jobs, a familiar theme for last 15 years
- ▶ Concern about rising inequality a familiar theme for last 40 years
- ▶ Concerns for more than 40 years: mismatch of jobs by skill and location, low pay for unskilled workers
- ▶ New concern, shrinkage of labor's income share
- ▶ Surprising but true: 2006-16 skill mix increased – more good than bad jobs were created



Job Displacement Varies from Severe to Minor

- ▶ Airline and hotel reservations system replaced most travel agents
- ▶ Voice recognition and language translation have replaced many transcribers and translators
- ▶ Computer phone menus replaced some customer service agents
- ▶ Bar-code scanning didn't replace check-out clerks
- ▶ Computerized radiology scans have not displaced radiologists, who still are required to sign off
- ▶ Most spending on AI is in marketing, but marketing analyst jobs have flourished

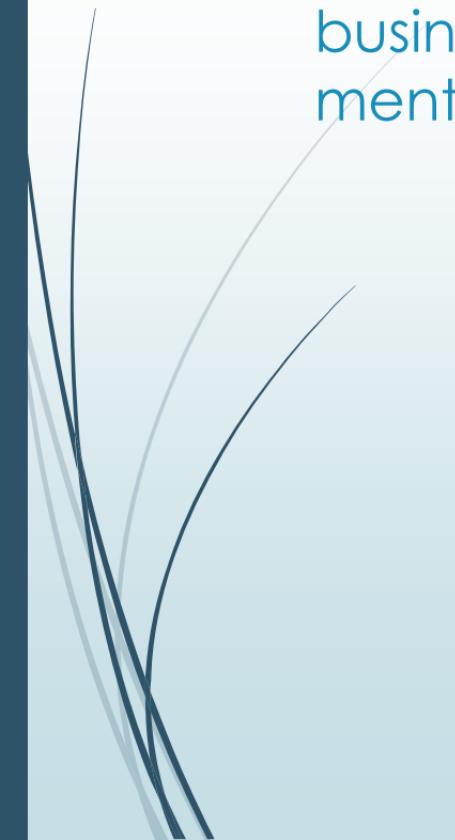
ATM Machines and Bank Teller Jobs





How AI Can Improve Businesses In the Coming Years?

- ▶ **Large companies** like Apple and Google have invested heavily in developing AI. Beyond those businesses, AI is frequently underused in other sectors, including manufacturing, education, retail, and healthcare.
- ▶ As of 2022, 37% of businesses have already employed AI services and continue to do so.
- ▶ According to a [study](#), the AI industry will earn \$126 billion every year by 2025.
- ▶ According to [Forbes](#), AI will become a \$15.7 trillion industry by 2030, and investments will hit approximately \$500 billion by 2024.



Here are **3 ways** in which AI can help scale businesses and overcome the above-mentioned problems with AI

- ▶ Utilize the already existing AI technologies
- ▶ Keep updating AI technologies regularly
- ▶ Take advantage of the latest technology