

PROGRAMMING FOR MACHINE LEARNING

Lecture 1

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CONTENT

- What is Artificial Intelligence?
- Components of Intelligence
- Human Intelligence Vs. Machine Intelligence
- Definition of Machine Learning

**THIS MODULE
IS**

Programming for Machine Learning

What do you understand by this?



**WHAT IS
A.I.?**

AI IN POPULAR CULTURE

Artificial Intelligence in Movies

In movies, robots are able to talk, think, have emotions, and make decisions just like humans.



INACCURACY OF FICTION

- Fiction is not reality.
- Benefits storytelling and the shock factor.
- Unrealistic portrayal of Artificial Intelligence.
- Lack of background research.

ORIGINS OF ARTIFICIAL INTELLIGENCE

- John McCarthy was an American computer scientist and cognitive scientist who first to coin the term “Artificial Intelligence (AI)”.
- “The science and engineering of making intelligent machines, especially intelligent computer programs”.
- In 1956, while at the Massachusetts Institute of Technology, he described AI as a field within computer science, which is concerned with making computers behave like humans.

DEFINITION OF ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.

CHARACTERISTICS OF AI?

- The ability of a system to calculate, reason, perceive relationships.
- Learn from experience, store and retrieve information from memory, solve problems, comprehend complex ideas.
- Use natural language fluently.
- Adapt to new situations.

APPLICATIONS OF AI

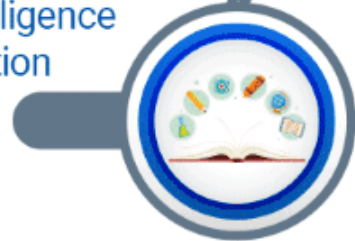
Artificial Intelligence
in HealthCare



Artificial Intelligence
in Business



Artificial Intelligence
in Education



Artificial Intelligence in
Autonomous Vehicles



Artificial Intelligence
in Social Media



Artificial Intelligence
for a Better World



Artificial Intelligence
in Tourism



COMPONENTS OF INTELLIGENCE

COMPONENTS OF ARTIFICIAL INTELLIGENCE



1. LEARNING

The activity of gaining knowledge or skill by studying, practising, being taught, or experiencing something.

LEARNING CATEGORISATION

1. **Auditory Learning**: learning by listening and hearing.
2. **Episodic Learning**: learning by remembering sequences of events.
3. **Motor Learning**: learning by precise movement of muscles.
4. **Observational Learning**: learning by watching and imitating others.
5. **Perceptual Learning**: learning by recognising stimuli that one has seen before.
6. **Spatial Learning**: learning through visual stimuli such as images, colours, maps, etc.

2. REASONING

The process that enables humans to provide the basis of judgement, decision making, and predictions.

3. PROBLEM SOLVING

- The process in which one perceives and tries to arrive at a desired solution from a present situation.
- Problem solving also includes decision making.
- Decision making is the process of selecting the best suitable option out of multiple alternatives to reach the desired goal.

4. PERCEPTION

- The process of acquiring, interpreting, selecting and organising sensory information.
- This is the process of *sensing* by sensory organs in humans.
- In Artificial Intelligence, the perception mechanism puts the data acquired by the sensors in an algorithm to produce a desired output based on the environmental predispositions.

5. LANGUAGE UNDERSTANDING

- This is sometimes termed as “*Linguistic Intelligence*”.
- Linguistic intelligence can be both verbal and non-verbal.
- It is one’s ability to use, comprehend, speak and write a language.
- This is important in interpersonal communication.

WHAT ARE INTELLIGENT SYSTEMS?

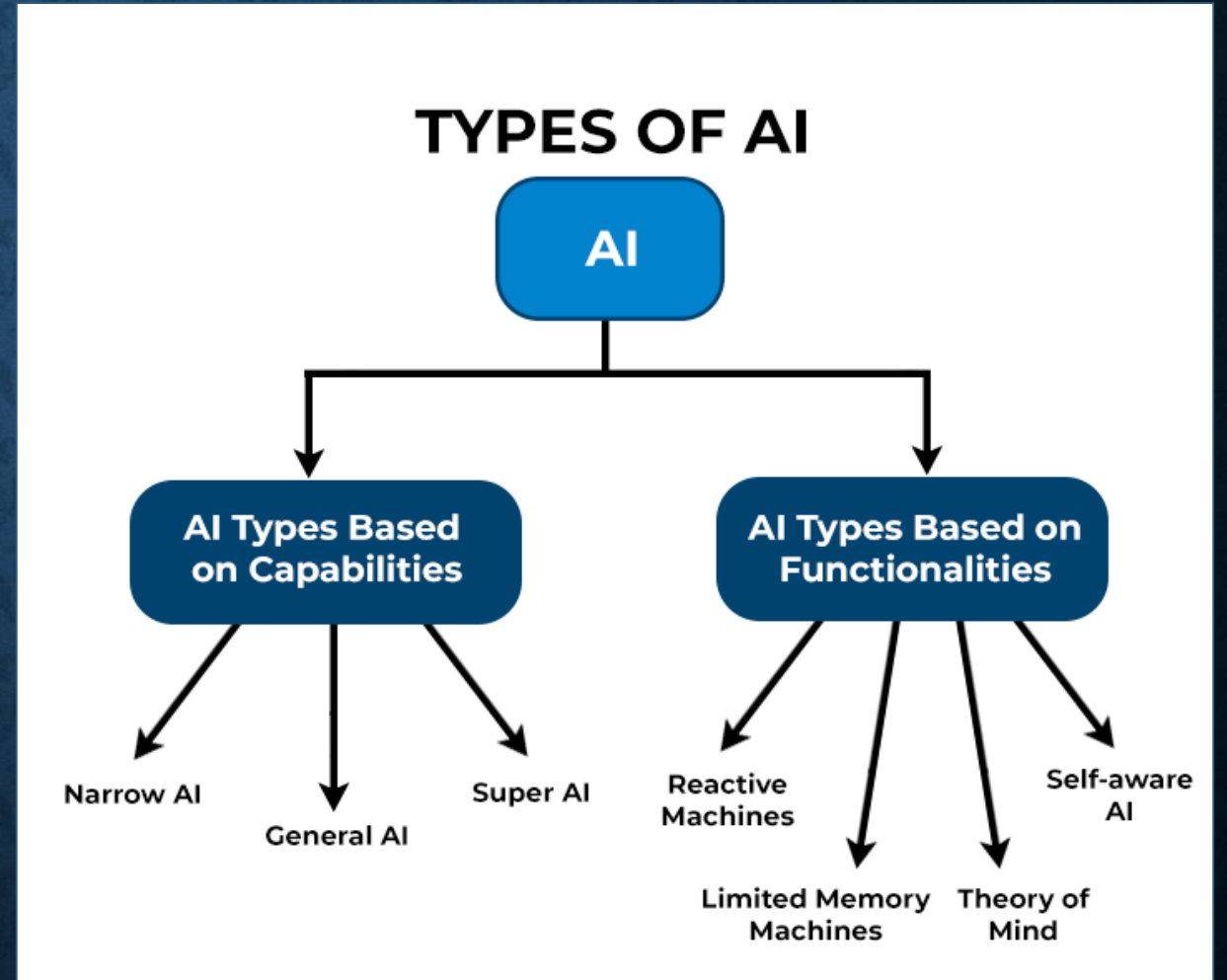
A system is artificially intelligent when it is equipped with at least one and at most of all forms of intelligence.

- Intelligence is conceptual.
- Intelligence is intangible.



TYPES OF AI

Artificial Intelligence can be classified based on either their capabilities or their functionalities.



CAPABILITY BASED AI

Artificial Narrow Intelligence (ANI)



Stage-1

Machine Learning

- ▶ Specialises in one area and solves one problem



Siri



Alexa



Cortana

Artificial General Intelligence (AGI)



Stage-2

Machine Intelligence

- ▶ Refers to a computer that is as smart as a human across the board

Artificial Super Intelligence (ASI)



Stage-3

Machine Consciousness

- ▶ An intellect that is much smarter than the best human brains in practically every field

FUNCTIONALITY BASED AI

TYPES OF AI

REACTIVE

Has no memory,
only responds to
different stimuli

LIMITED MEMORY

Uses memory to
learn and improve
its responses

THEORY OF MIND

Understands the
needs of other
intelligent entities

SELF-AWARE

Has human-like
intelligence and
self-awareness

BENEFITS OF AI

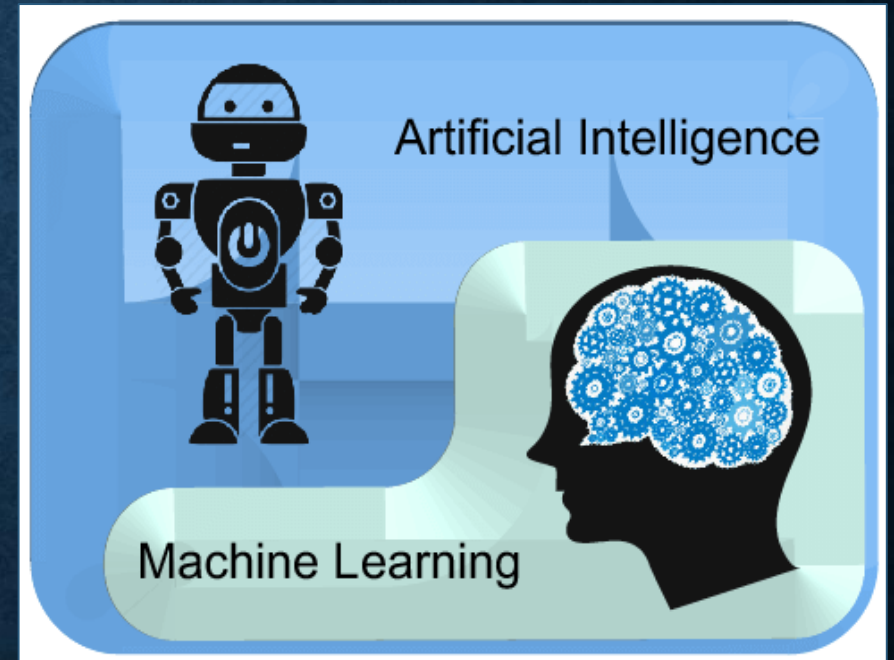


FUTURE OF AI?

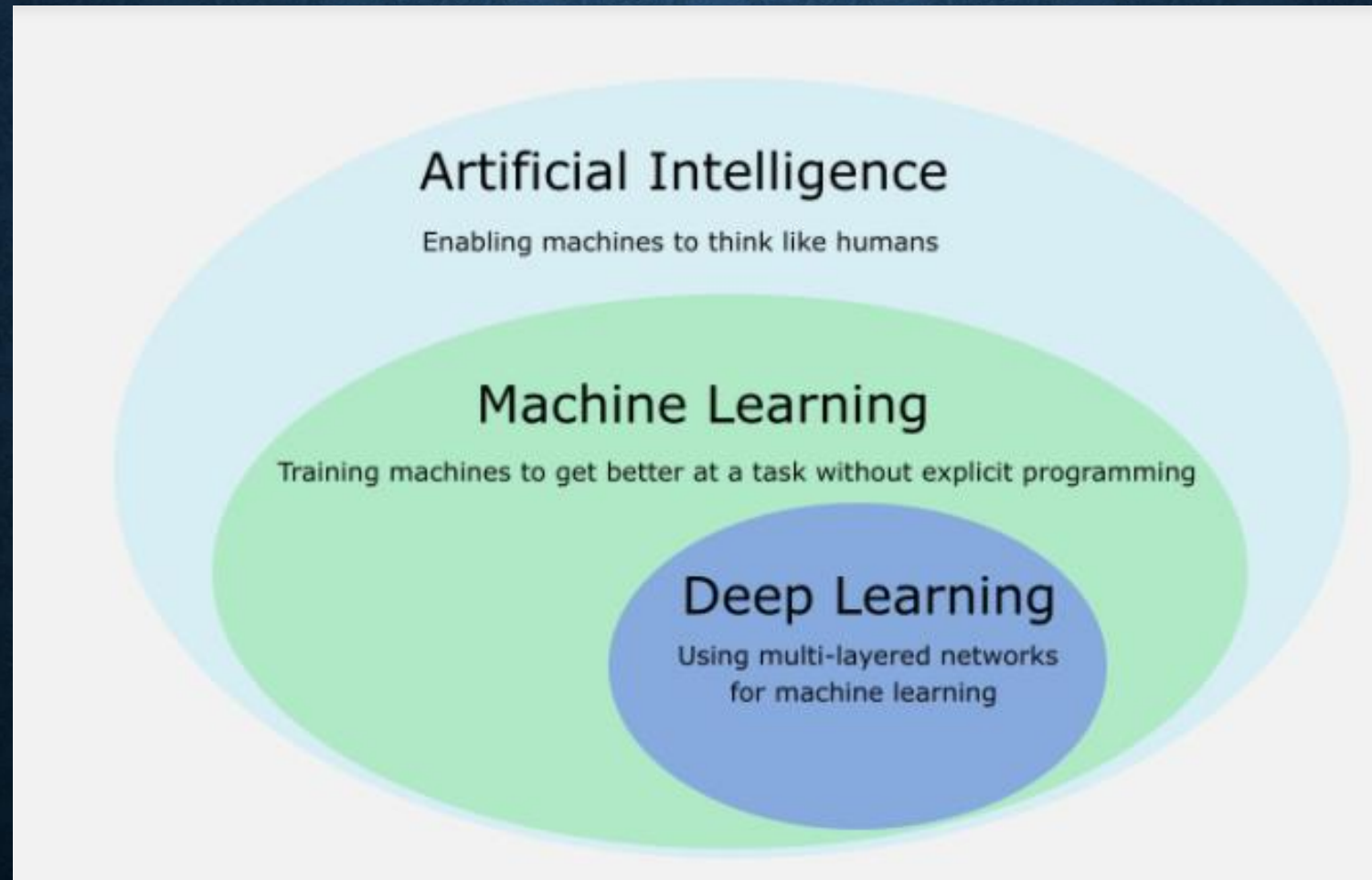
- **1. Entertainment**
- **2. Medicine**
- **3. Cybersecurity**
- **4. Vital Tasks**
- **5. Transportation**

HOW TO ACHIEVE ARTIFICIAL INTELLIGENCE?

- Answer → Machine Learning.
- AI is a wider concept used to create intelligent machines that can simulate human thinking capabilities and behaviour.
- Machine Learning is an application or subset of AI that allows machines to learn from data without being explicitly programmed.

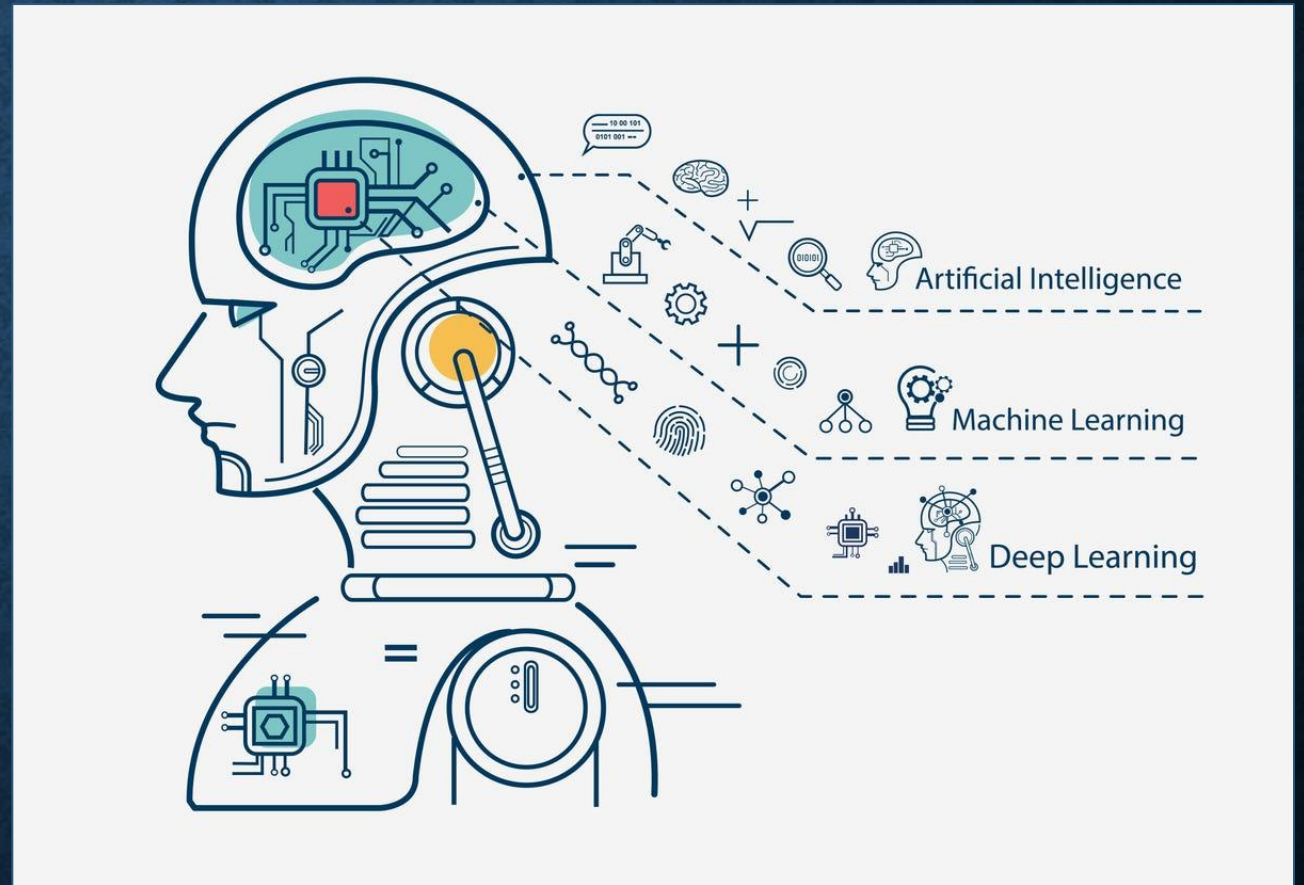


RELATIONSHIP BETWEEN ML AND AI



RELATIONSHIP BETWEEN ML AND AI

- Think of a large building with three floors.
- The 1st level is Deep Learning and on top of it there is Machine Learning. This is the 2nd level.
- Above Machine Learning, we have the 3rd and final level which is Artificial Intelligence.



DEFINITION OF MACHINE LEARNING

- Conventional Definition:

- Machine learning is the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data.

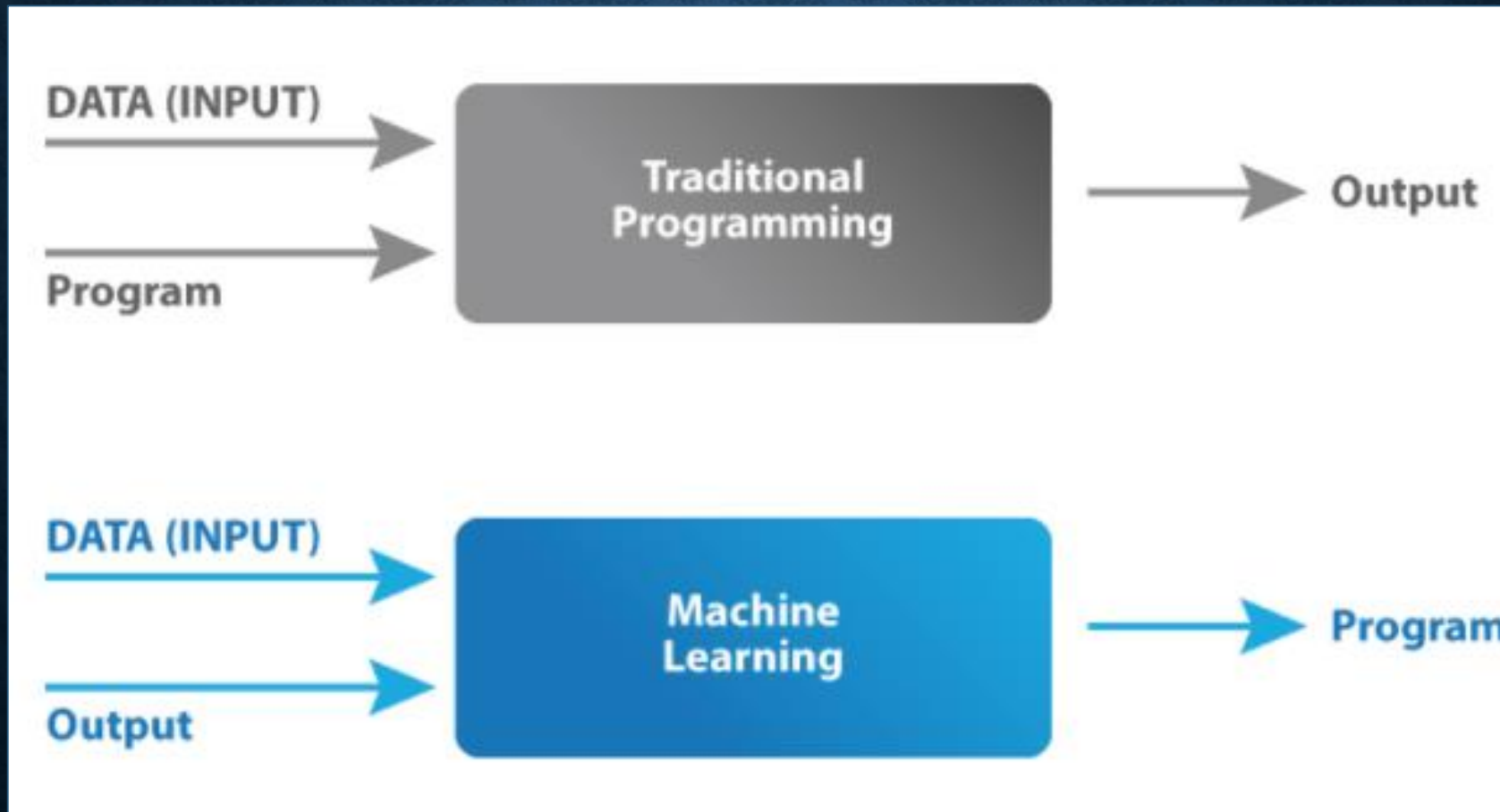
- Simple Definition:

- Machine Learning enables a computer to automatically learn from data, improve its performance from past experiences and predict things without being programmed to do so.

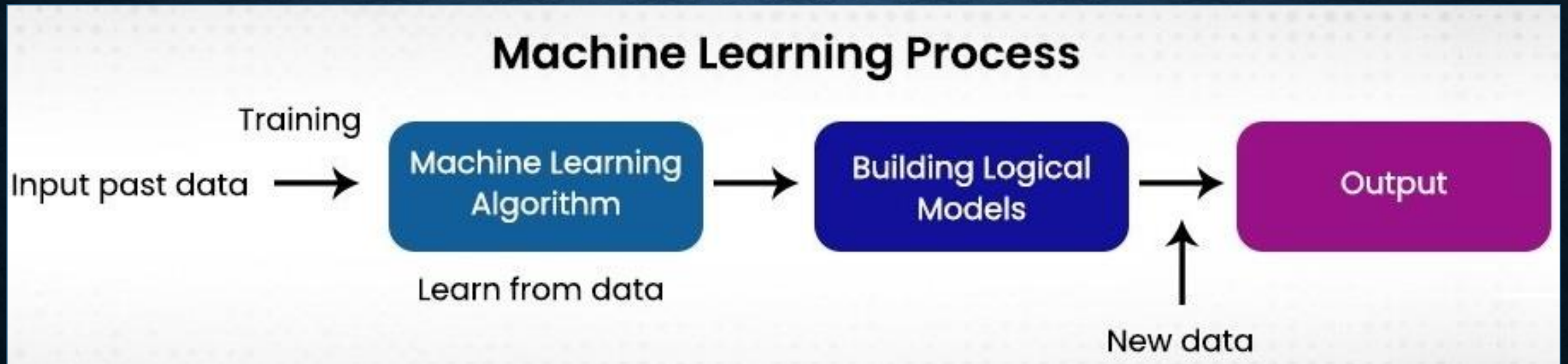
WHAT IS MACHINE LEARNING?

- Introduced by Arthur Samuel in 1959.
- Machine Learning is a subset of Artificial Intelligence that is concerned with the development of algorithms.
- These algorithms allow a machine to independently learn from past data and experience, i.e. their learning process is autonomous.

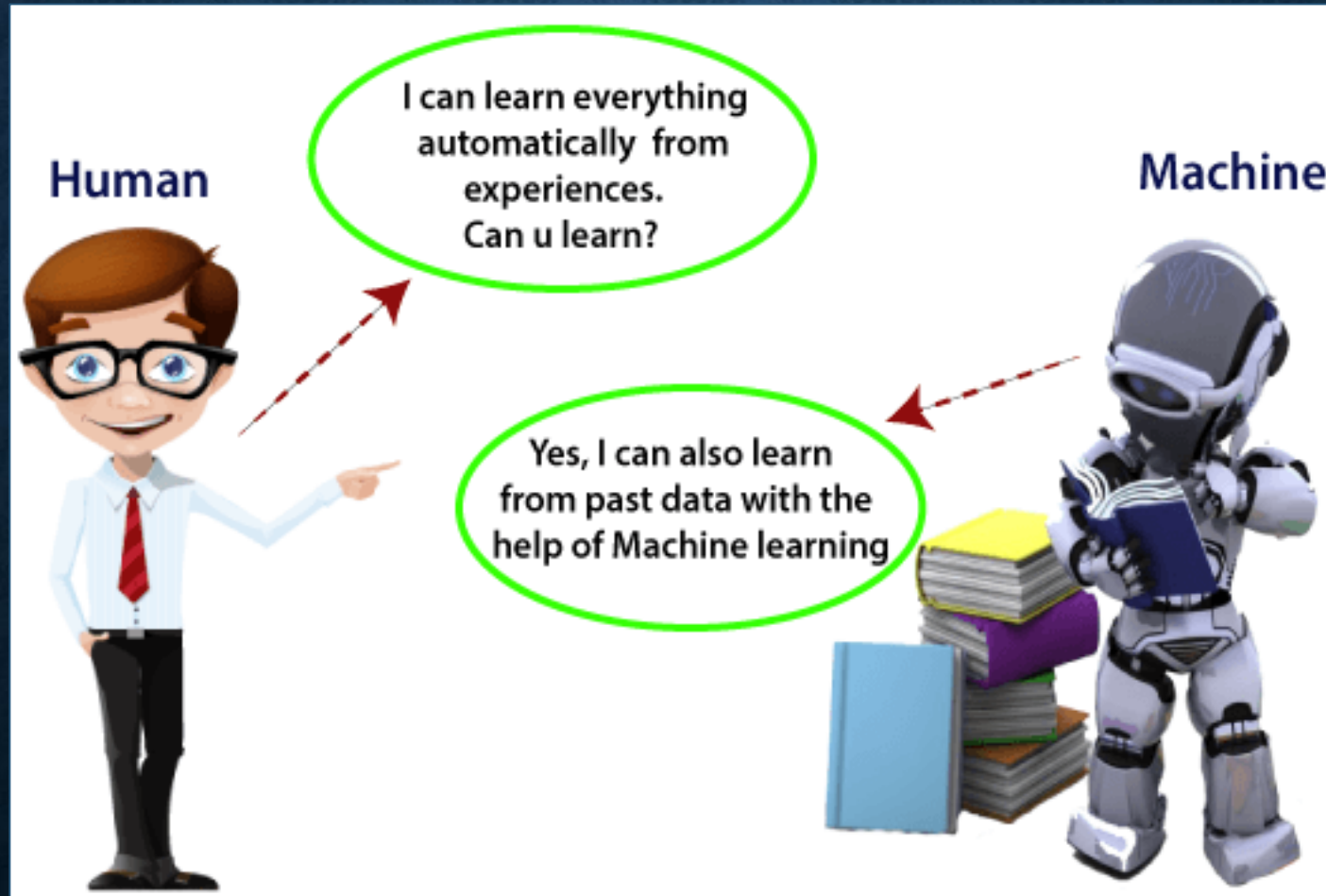
ML VS TRADITIONAL PROGRAMMING



HIGH LEVEL ML PROCESS



MACHINE LEARNING?



HUMAN INTELLIGENCE VS. MACHINE INTELLIGENCE

- Humans perceive by patterns whereas the machines perceive by set of rules and data.
- Humans can figure out the complete object even if some part of it is missing or distorted; whereas the machines cannot do it correctly.

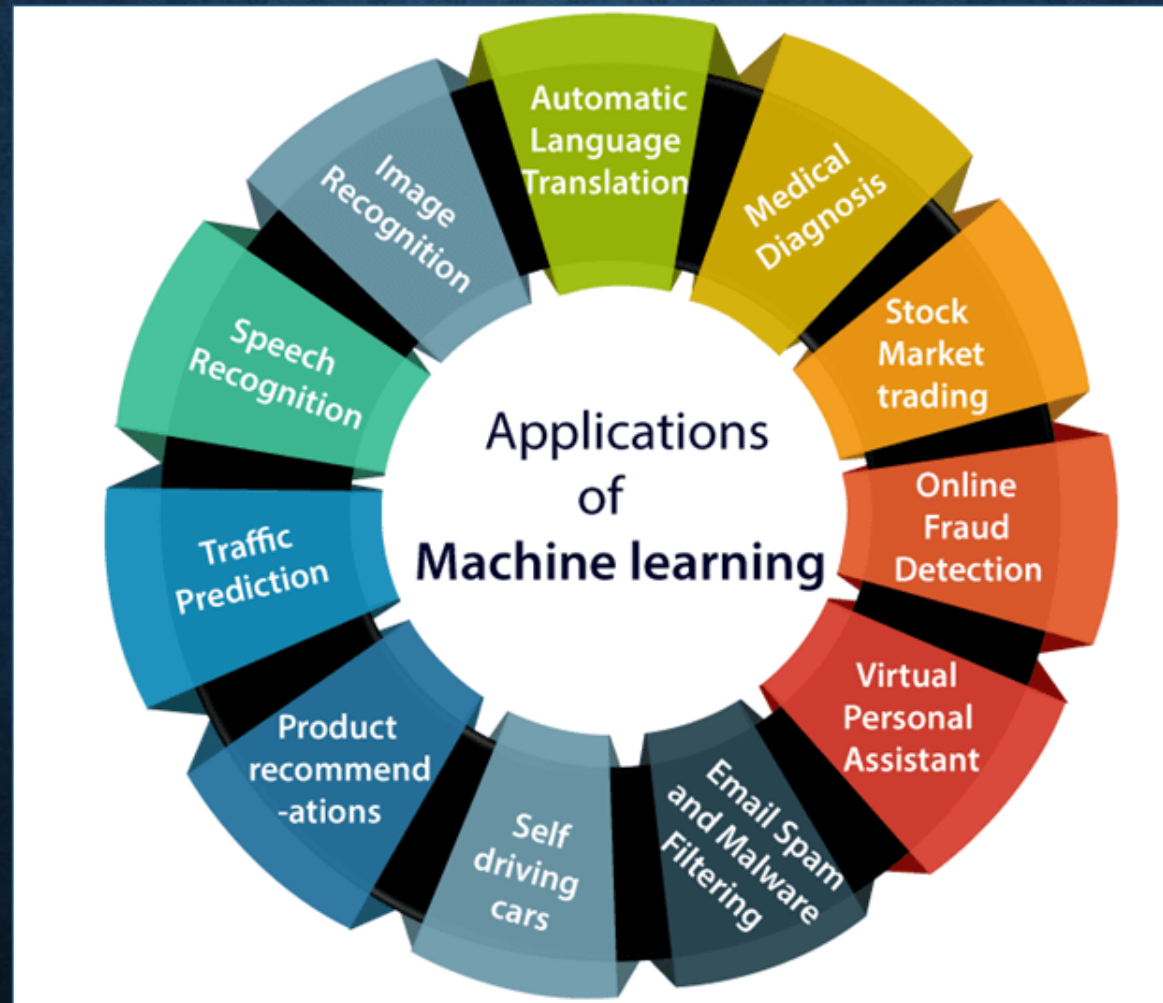
HUMAN INTELLIGENCE VS. MACHINE INTELLIGENCE

- Remember from before:

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.

- On the other hand:
- *Human intelligence has made it possible for human beings to, naturally, perform tasks such as visual perception, speech recognition, decision-making, and translation between languages.*

APPLICATIONS OF MACHINE LEARNING

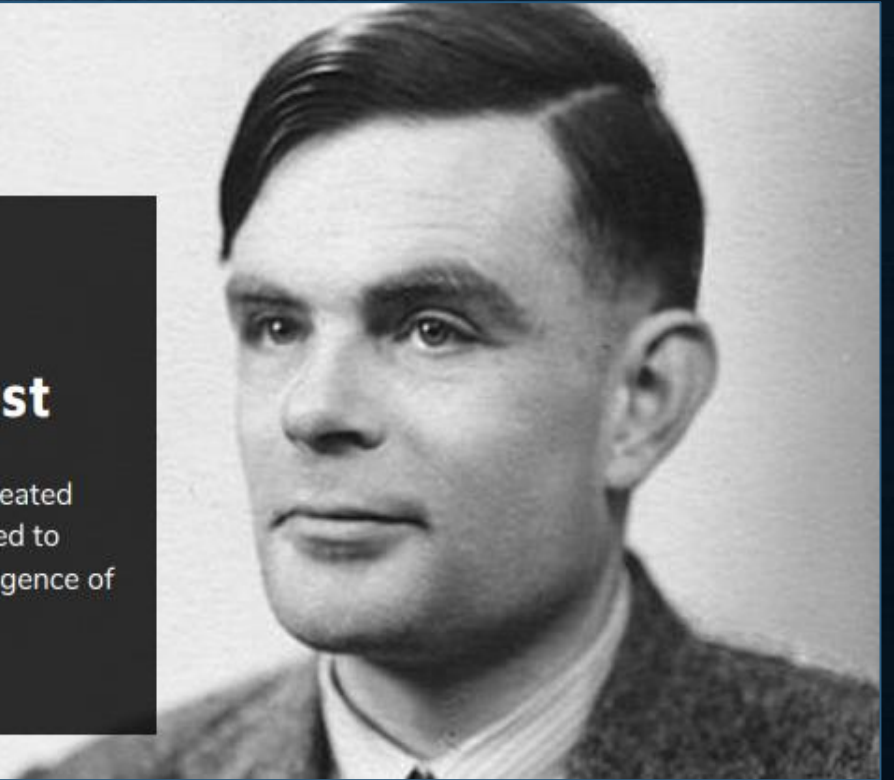


ALAN TURING

- Alan Turing was a British mathematician who lived in the early 20th century.
- He is most well known for his contributions in cryptography and his machine “the bombe” that cracked the German Enigma code during World War II.
- Another of his inventions is the *Turing Test*.

The Turing Test

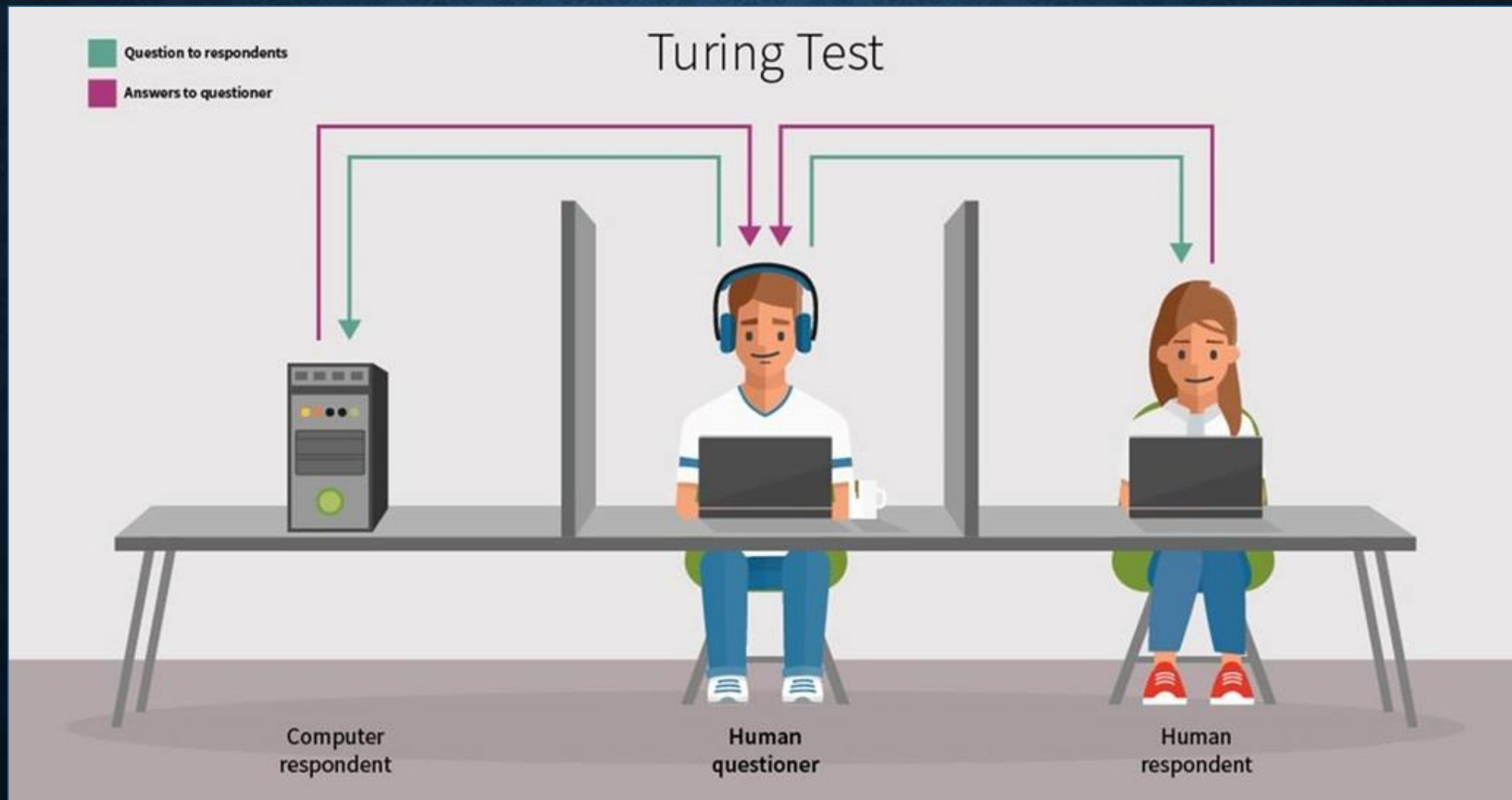
In the 1950s Alan Turing created the Turing Test which is used to determine the level of intelligence of a computer.



THE TURING TEST

- The Turing Test requires three terminals, each of which is physically separated from the other two.
- One terminal is operated by a computer, while the other two are operated by humans.
- During the test, one of the humans functions as the questioner, while the second human and the computer function as respondents.
- The questioner interrogates the respondents within a specific subject area, using a specified format and context.
- The questioner is then asked to decide which respondent was human and which was a computer.

ILLUSTRATION OF THE TURING TEST



LIMITATIONS OF THE TURING TEST

- Only Yes or No answers pertained to a narrow field of knowledge.
- No open-ended and conversational answers.
- Alternatives to Turing Test are:
 1. **Reverse Turing Test**: where a human tries to convince a computer that it is not a computer. An example of this is a CAPTCHA.
 2. **The Lovelace Test 2.0**: which is a test made to detect AI by examining its ability to create art.
 3. **The Marcus Test**: A program that can 'watch' a television show is tested by being asked meaningful questions about the show's content.

QUESTIONS TIME

