Introduction to Machine Learning

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Agenda

Motivation

AI history

What is Artificial intelligence(AI)?

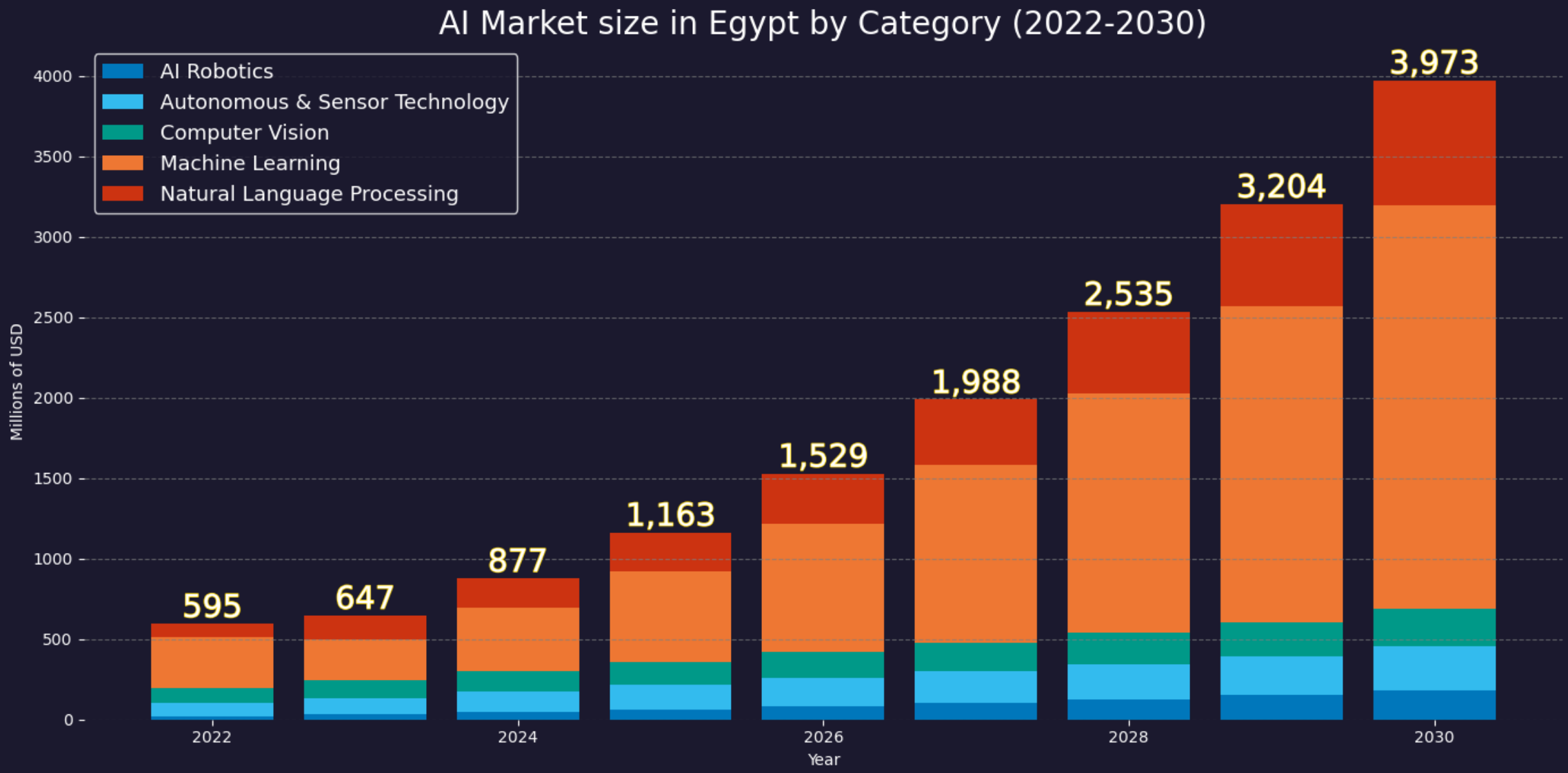
AI application and subfields of AI

Machine Learning

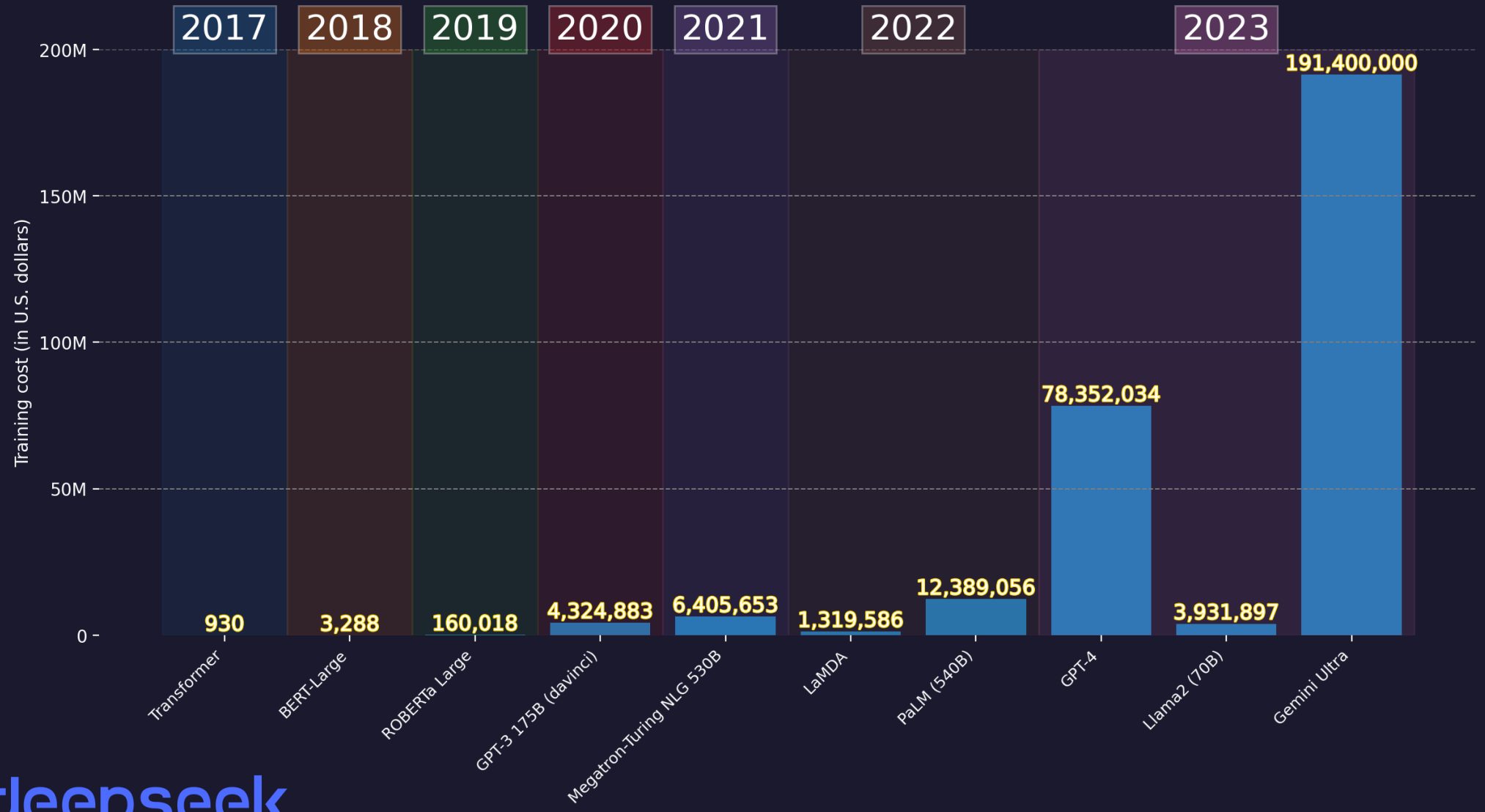
AI tools and how to maximize your benefits from?

Set the environment

Motivation : AI in Egypt



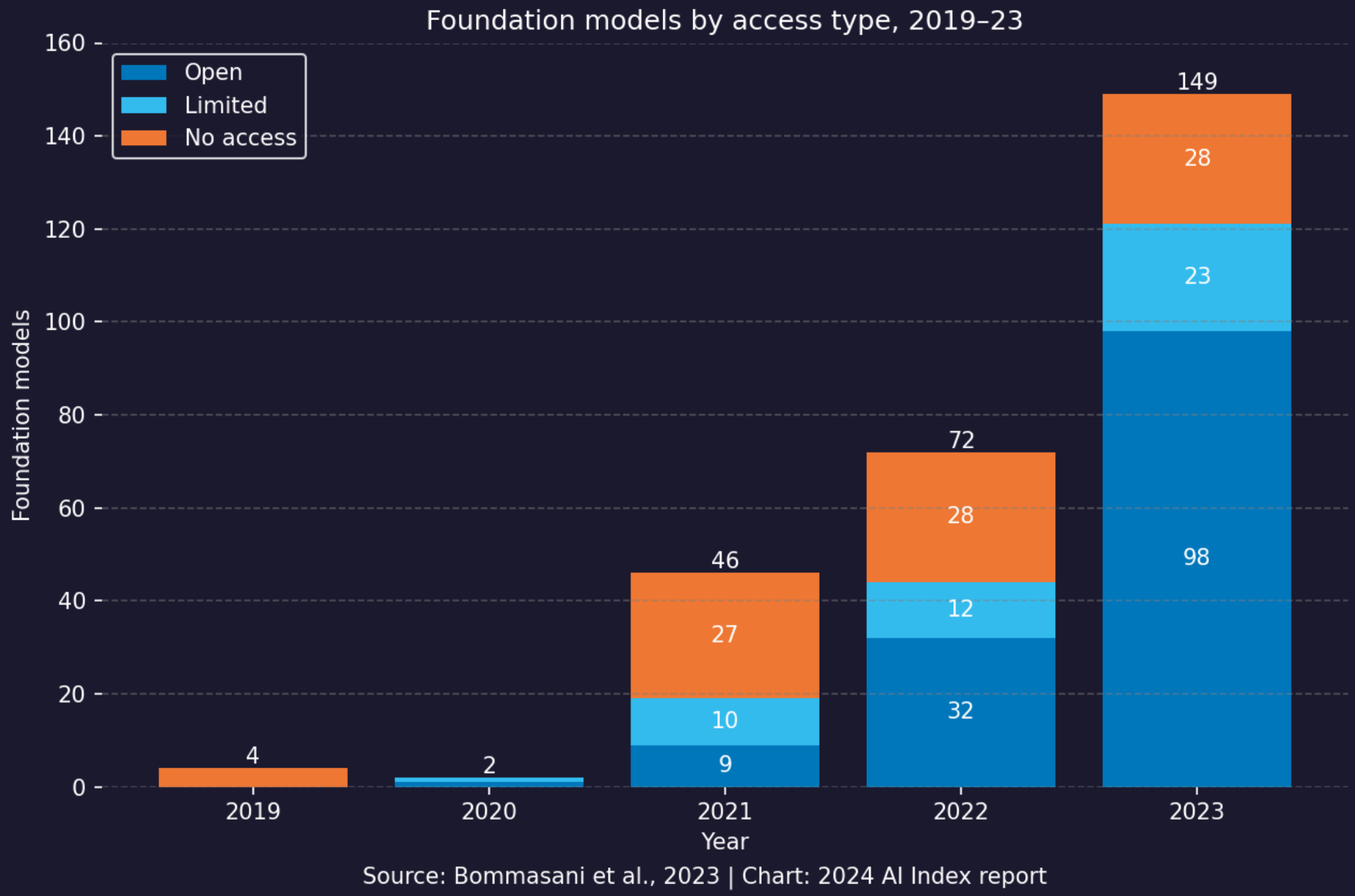
Motivation : Model cost



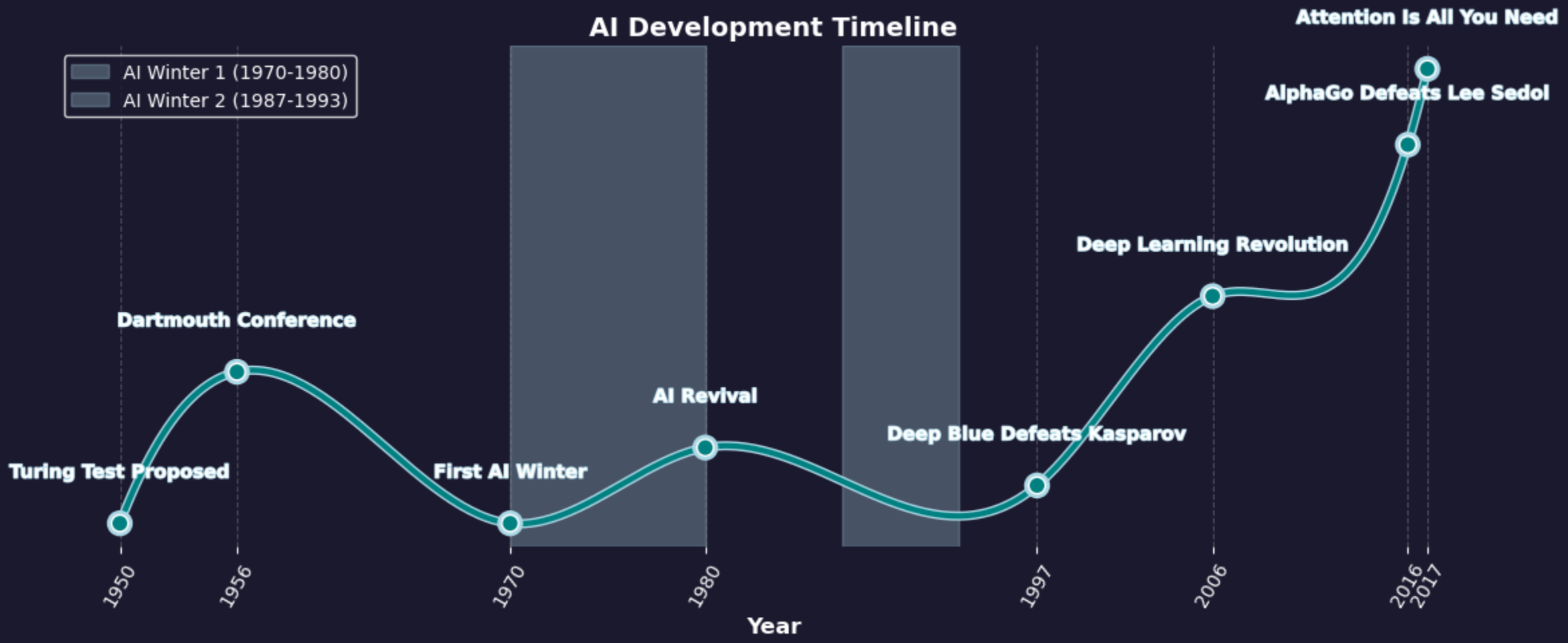
deepseek

Source: Epoch, 2023 | Chart: 2024 AI Index report

Motivation : AI solutions availability



AI history


AI Development Timeline
AI Winter 1 (1970-1980)
AI Winter 2 (1987-1993)
Turing Test Proposed
Dartmouth Conference
First AI Winter
AI Revival
Deep Blue Defeats Kasparov
Deep Learning Revolution
AlphaGo Defeats Lee Sedol
Attention Is All You Need
1950
1956
1970
1980
1997
2006
2016
2017
Year

AI history

- Turing Test Proposed (1950) – Alan Turing introduced a test to measure a machine's ability to exhibit human-like intelligence.
  - AI when machines can exhibit intelligent behavior indistinguishable from humans.
  - https://lmarena.ai/ (Chatbot Arena)
- Dartmouth Conference (1956) A summer workshop at Dartmouth College where scientists coined the term "Artificial Intelligence“.
- The First AI Winter (1970s) occurred due to unrealistic expectations about AI's capabilities at the time. When these ambitious promises failed to materialize, enthusiasm waned, funding was cut, and research progress stalled.

AI history

- The Second AI Winter (1987–1990s) occurred due to the limitations of expert systems, which had been heavily funded in the 1980s.

- These systems were expensive, difficult to scale, and failed to deliver practical, widespread applications. As a result, interest in AI declined, funding was reduced, and many AI projects were abandoned.

- Expert system was rule-based approaches (IF-THEN) rules and some stored facts (fact-based)
  - **IF** patient has fever **AND** sore throat **THEN** diagnosis is flu
  - It can use (it doesn't learn from data, it was just programing and logic base)
    - **Forward Chaining** moves forward from known facts to derive conclusions
    - **Backward Chaining** works backward from a goal to verify the facts supporting it.

AI history

- AI Revival (1990s–2000s) – Advances in machine learning and computing power reignited AI research.
  - More computation power (CPUs/GPUs)
  - More data to use

- In 1997, IBM's supercomputer Deep Blue made history by defeating the world chess champion Garry Kasparov in a six-game match.
  - Kasparov won the first game but lost the second.
  - Games three through five ended in draws.
  - In Game Six, Deep Blue played aggressively and defeated Kasparov decisively after just 19 moves.
  - Since then humans lost chess to computers 😔 no we try to make computers mimic human levels

AI history

● BOT maia1 1538 1633 1406

Maia is a human-like neural network chess engine. This version was trained by learning from over 10 million Lichess games between 1100s. Maia Chess is an ongoing research project aiming to make a more human-friendly, useful, and fun chess AI. For more information go to maiachess.com. You can also play against @maia5 and @maia9. Developed by @ashtonanderson, @sidsen and @reidmcy.

PLAY

● BOT maia5 1598 1653 1529

Maia is a human-like neural network chess engine. This version was trained by learning from over 10 million Lichess games between 1500s. Maia Chess is an ongoing research project aiming to make a more human-friendly, useful, and fun chess AI. For more information go to maiachess.com. You can also play @maia1 and @maia9. Developed by @ashtonanderson, @sidsen and @reidmcy.

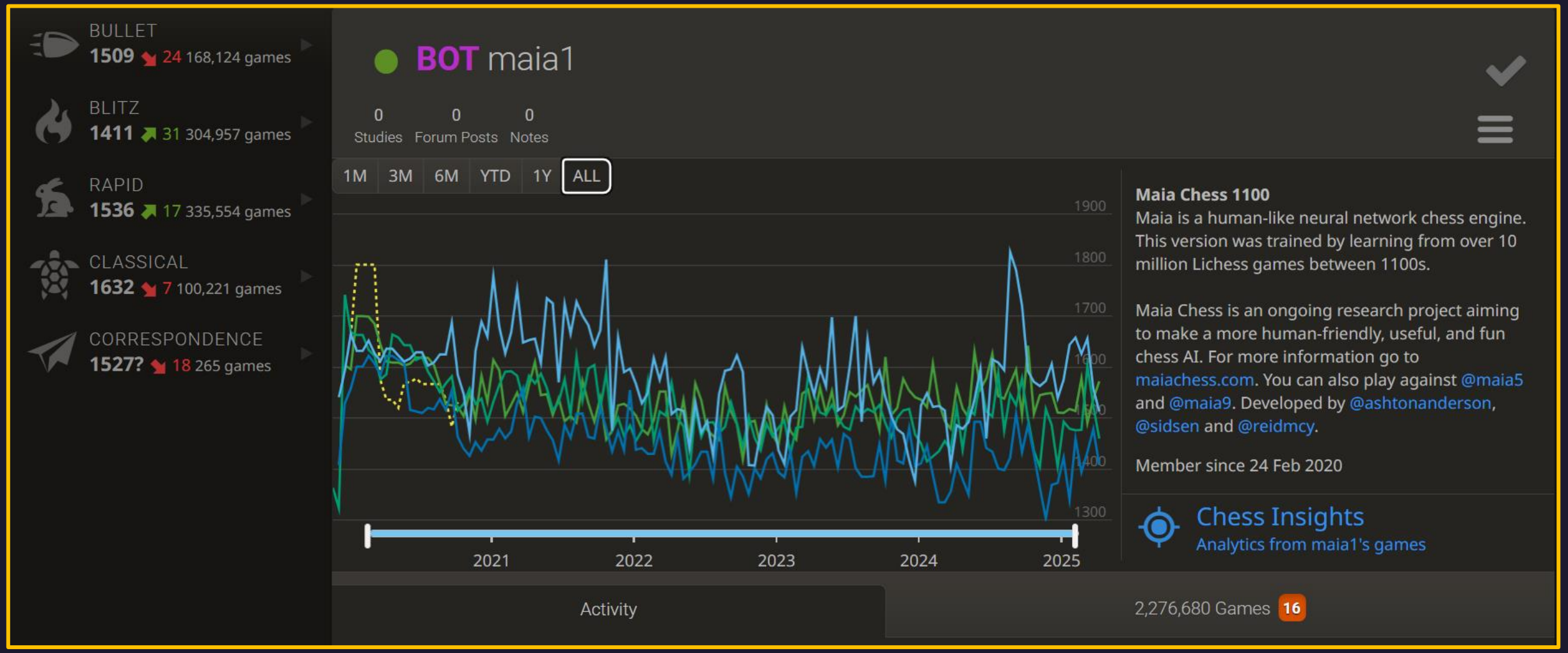
PLAY

● BOT maia9 1674 1572 1702

Maia is a human-like neural network chess engine. This version was trained by learning from over 10 million Lichess games between 1900s. Maia Chess is an ongoing research project aiming to make a more human-friendly, useful, and fun chess AI. For more information go to maiachess.com. You can also play @maia1 and @maia5. Developed by @ashtonanderson, @sidsen and @reidmcy.

PLAY

AI history


BULLET
1509 24 168,124 games
BLITZ
1411 31 304,957 games
RAPID
1536 17 335,554 games
CLASSICAL
1632 7 100,221 games
CORRESPONDENCE
1527? 18 265 games
BOT maia1
0 Studies
0 Forum Posts
0 Notes
1M 3M 6M YTD 1Y ALL
1900
1800
1700
1600
1500
1400
1300
2021
2022
2023
2024
2025
Maia Chess 1100
Maia is a human-like neural network chess engine. This version was trained by learning from over 10 million Lichess games between 1100s.
Maia Chess is an ongoing research project aiming to make a more human-friendly, useful, and fun chess AI. For more information go to maiachess.com. You can also play against @maia5 and @maia9. Developed by @ashtonanderson, @sidsen and @reidmcy.
Member since 24 Feb 2020
Chess Insights
Analytics from maia1's games
Activity
2,276,680 Games 16

AI history

- In 2016, AlphaGo won four out of five games against Lee Sedol. The only game Lee won was Game 4.

> “I thought AlphaGo was based on probability calculation and that it was merely a machine. But when I saw this move, I changed my mind. Surely, AlphaGo is creative.
>
> LEE SEDOL
> WINNER OF 18 WORLD GO TITLES

- AlphaGo, an AI system that combines deep neural networks with advanced search algorithms.
- the “policy network” selects the next move to play. The other the “value network” predicts the winner of the game.

Beyond Games

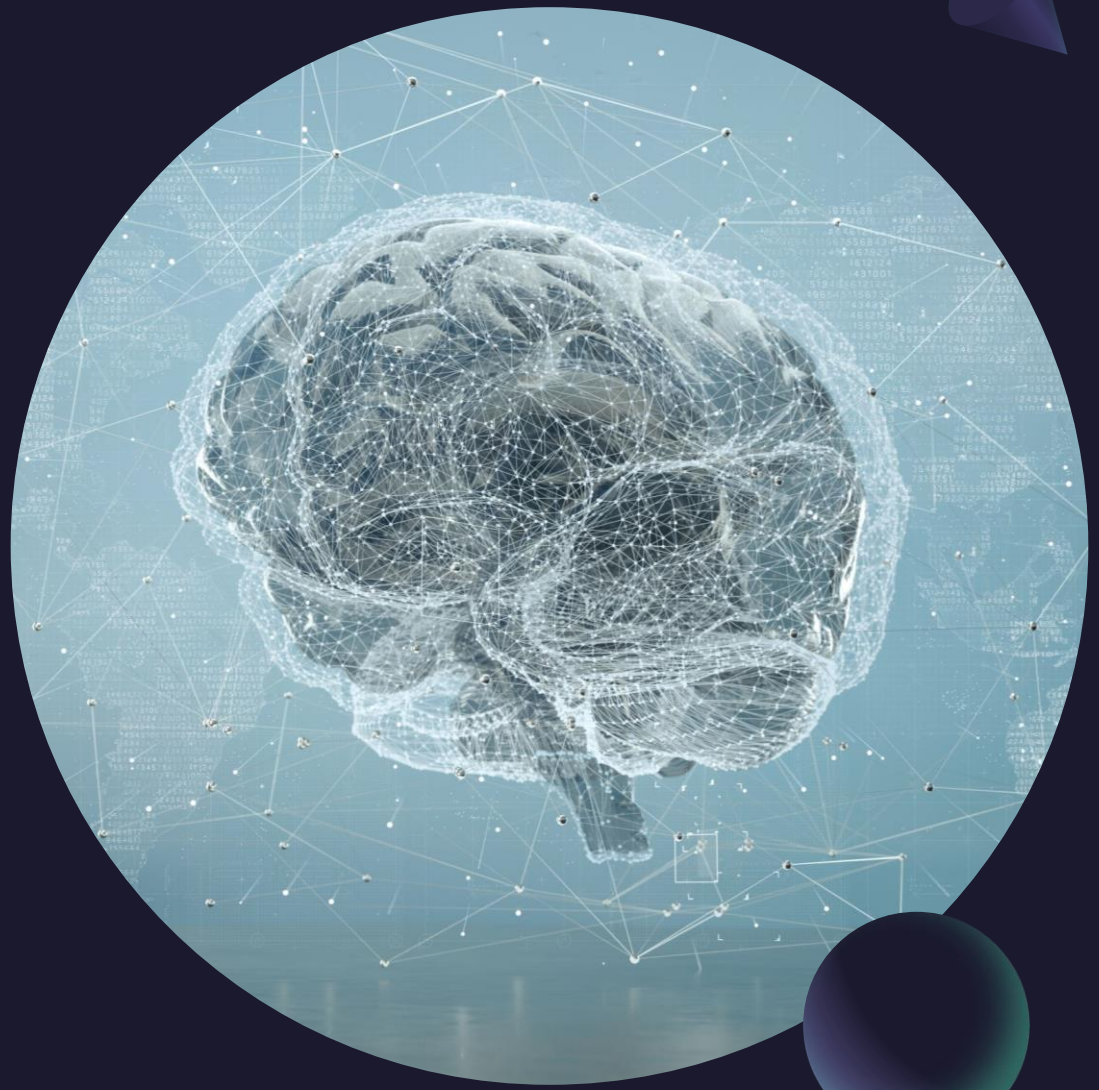
- This proved AI can learn and be creative from data or the environment, the steps we took in games can be generalized to other fields.
- AlphaFold : predicts protein structures with high accuracy, aiding drug discovery and biological research.
- AlphaChip : design computer chips layout, starting from a blank grid, AlphaChip places one circuit component at a time until it’s done placing all the components. Then it’s rewarded based on the quality of the final layout.
- AlphaTensor: AI system for discovering novel, efficient, and provably correct algorithms for fundamental tasks such as matrix multiplication.

What is Artificial intelligence (AI)?

- Intelligence
- Artificial intelligence definition
- Week AI vs Strong AI (Types based on ability)
- Types of AI (based on functionalities)
- Summary diagram

Intelligence

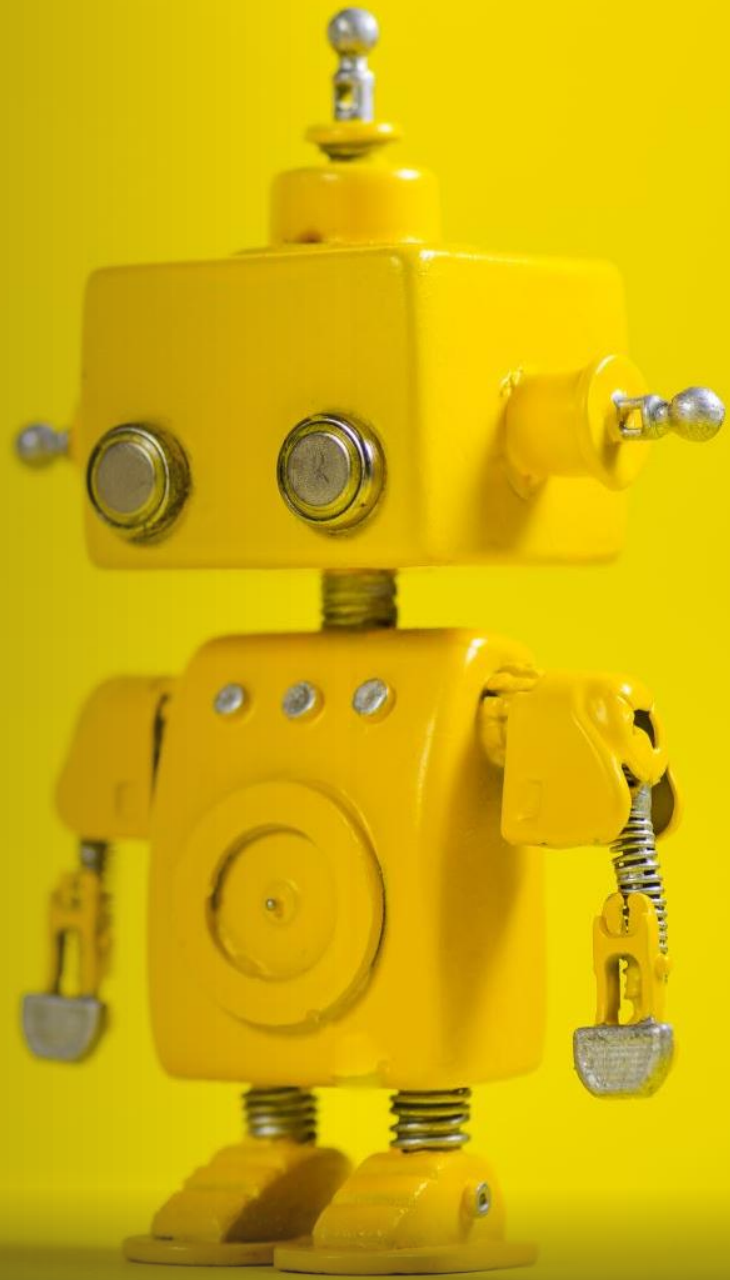
- **might be** defined as the ability to learn and perform suitable techniques to solve problems and achieve goals



- A fully pre-programmed factory robot can perform its tasks effectively, being adaptable, precise, and reliable.
- However, this robot is not considered intelligent because it lacks the ability to learn or adapt on its own.
- Intelligence extends beyond following instructions and includes the capacity to learn, adapt, and make decisions in various situations.

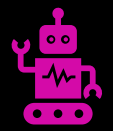
Artificial intelligence(AI)

- the science and engineering of making intelligent machines “simulation of human intelligence”
- AI is when a machine can do things that human minds can do, like perceiving(understanding), reasoning, learning, interacting with the world, solving problems, and being creative.



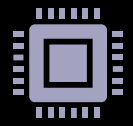
Weak AI

Weak AI refers to AI systems **designed for specific tasks** and lacks general intelligence.



Examples of weak AI include voice assistants, recommendation algorithms, image recognition systems ,Deep Blue, the chess-playing computer, and self-driving cars that use sensors to detect obstacles.

Weak AI excels at its designated functions but operates within predefined boundaries.

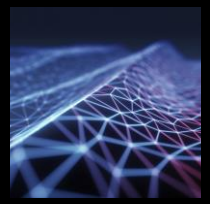


Weak AI **cannot generalize** beyond its specialized domain and is limited to the tasks it is programmed for.

Strong AI

Strong AI, also known as general AI, aims to possess human-level or superior intelligence across various tasks.

It would be capable of understanding, reasoning, learning, and solving complex problems like humans do.



However, the development of strong AI remains largely theoretical and has not been realized thus far

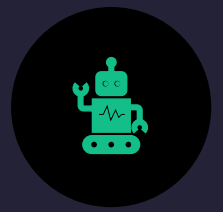
Types of AI

Based on functionalities

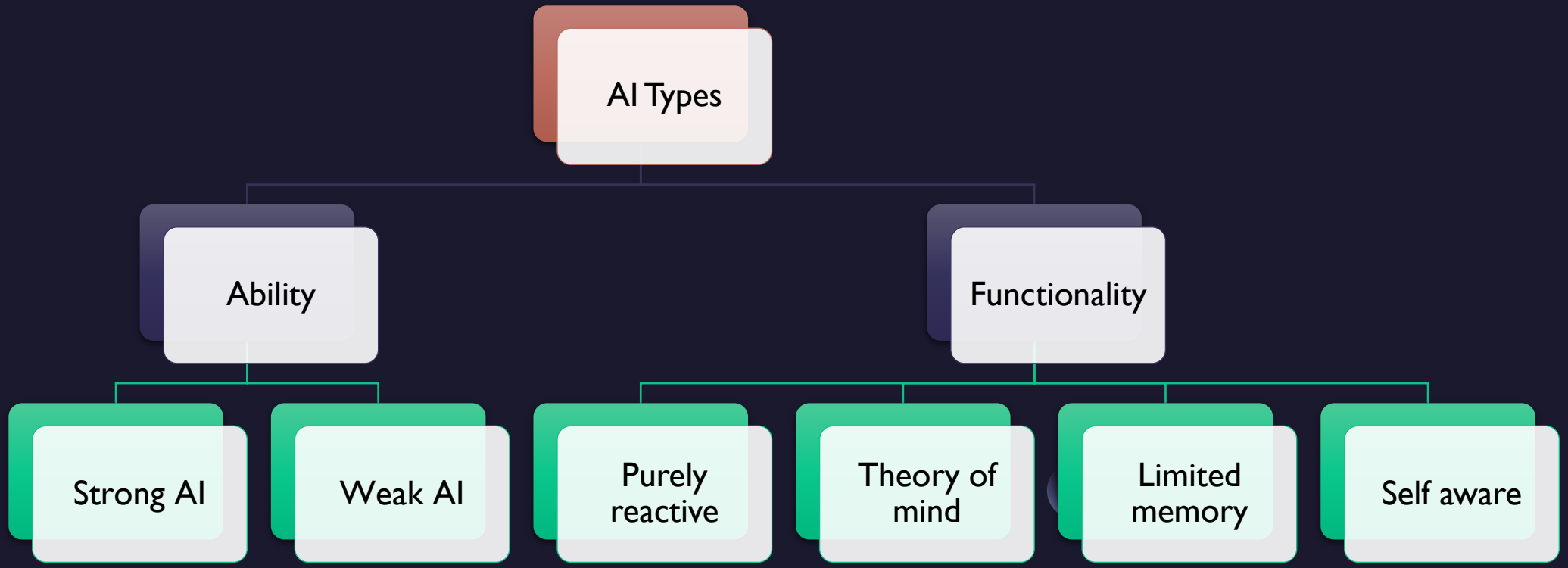
PURELY REACTIVE MACHINES SPECIALIZE IN ONE FIELD AND DO NOT HAVE MEMORY. THEY MAKE DECISIONS BASED ON CURRENT OBSERVATIONS, LIKE IN A CHESS GAME.

LIMITED MEMORY MACHINES COLLECT AND UTILIZE PREVIOUS DATA BUT HAVE MINIMAL MEMORY CAPACITY. THEY CAN MAKE PROPER DECISIONS, LIKE SUGGESTING A RESTAURANT BASED ON LOCATION DATA.

MACHINES WITH A **THEORY OF MIND** WOULD UNDERSTAND THOUGHTS, EMOTIONS, AND SOCIAL INTERACTIONS, BUT SUCH MACHINES HAVE NOT BEEN CREATED YET.



SELF-AWARE MACHINES, CONSIDERED THE FUTURE GENERATION, WILL BE INTELLIGENT, SENTIENT, AND CONSCIOUS.


AI Types
Ability
Functionality
Strong AI
Weak AI
Purely reactive
Theory of mind
Limited memory
Self aware

AI applications and subfields of AI

- AI applications
- AI subfields

AI applications

Applications

Predictive maintenance

Predictive maintenance is crucial for industries relying on equipment.

It involves projecting when maintenance will be required to prevent breakdowns, minimize downtime, and reduce costs

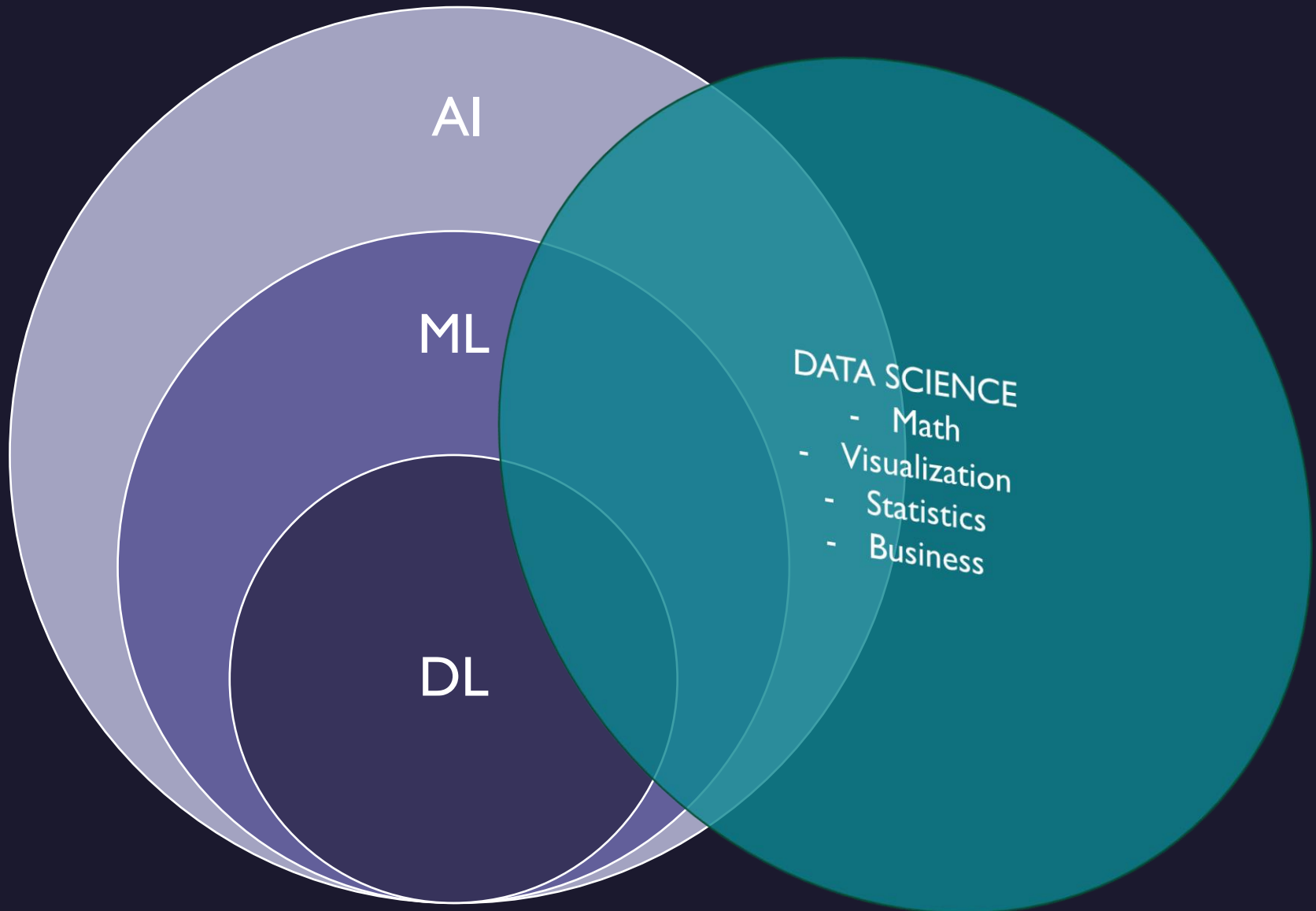
Logistics optimization

AI can be utilized to optimize logistics and achieve cost reduction.

Real-time forecasts and behavioral coaching enabled by AI can contribute to cost reduction.

AI can optimize the routing of delivery traffic, leading to improved fuel efficiency and reduced delivery times.

AI Subfields




AI
ML
DL

Machine Learning

*Machine learning is a method of teaching computers **to learn from data**, without being explicitly programmed. It is a subset of artificial intelligence that involves the development of algorithms that can analyze and identify patterns in data, and use that knowledge to make decisions or predictions*

Machine Learning

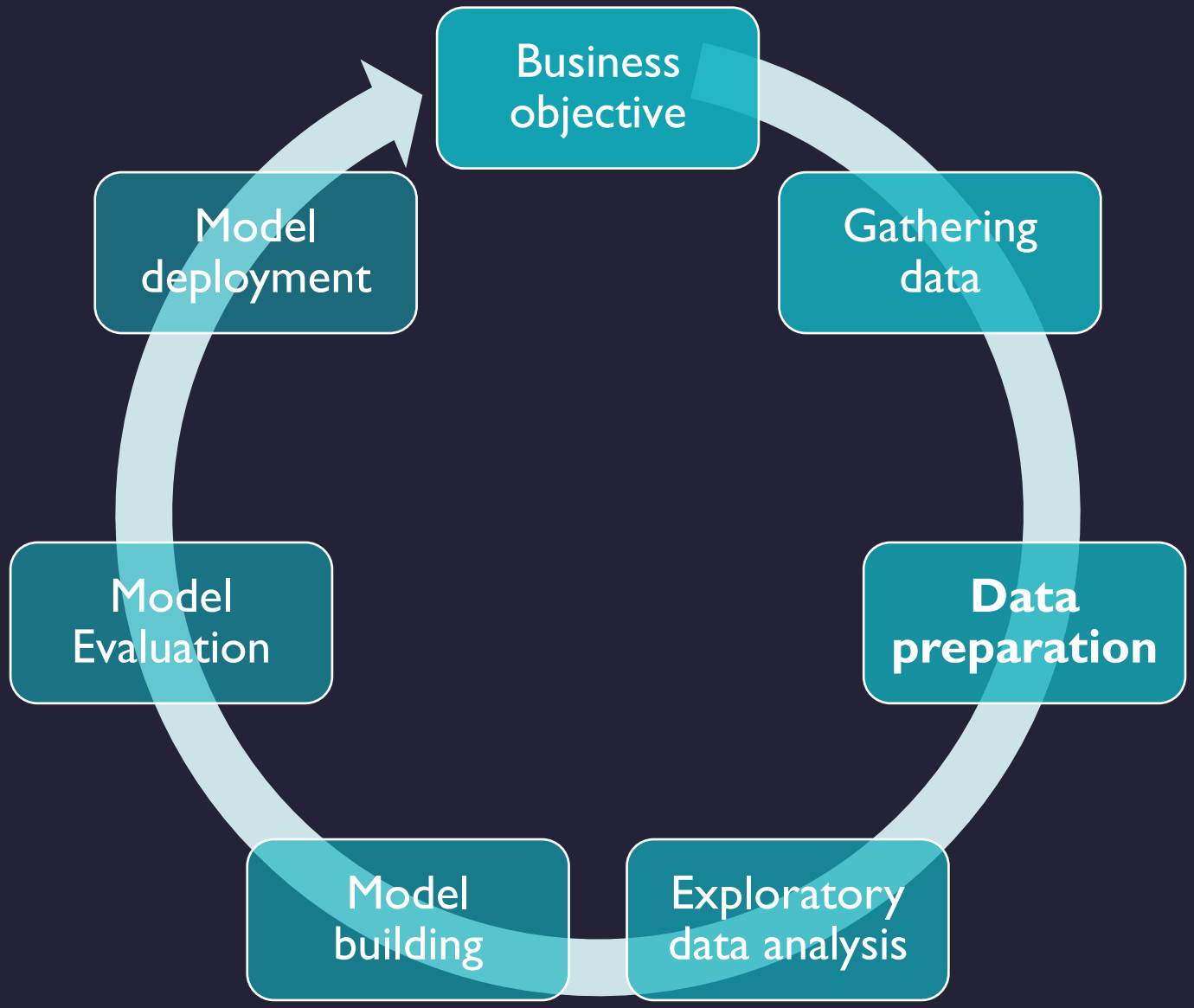
- More about ML definition
- ML lifecycle
- Types of Machine Learning tasks
- Data

More about ML definition

A computer program is said to learn from **experience E** with respect to some **task T** and some **performance measure P,** if its performance on T, as measured by P, **improves** with experience E
—*Tom Mitchell, 1997* "more formal mathematical definition"

- Learn from data and histories
- Improve with experience
- Iteratively enhance a model that can be used to predict outcomes of questions

ML lifecycle



Types of ML tasks

ML task

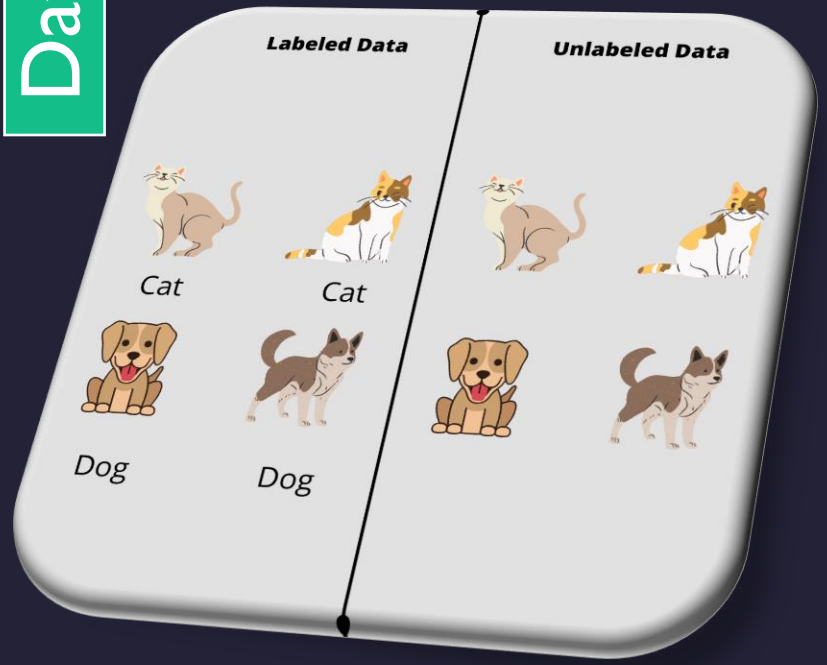
Supervised
- Classification
- Regression

Unsupervised
- Clustering
- Segmentation
- Dimension reduction

Reinforcement
- Decision process
- Reward system
- Recommendation system

Data can be !

- Labeled (Supervised)
- Not labeled (Unsupervised)



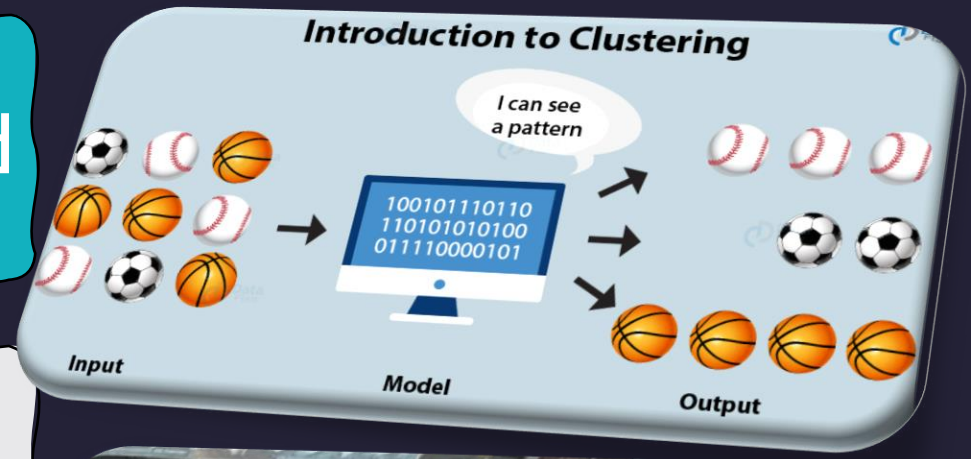
Types of ML tasks supervised

Supervised

- Classification (sunny, cloudy,..)
- Regression (33°)

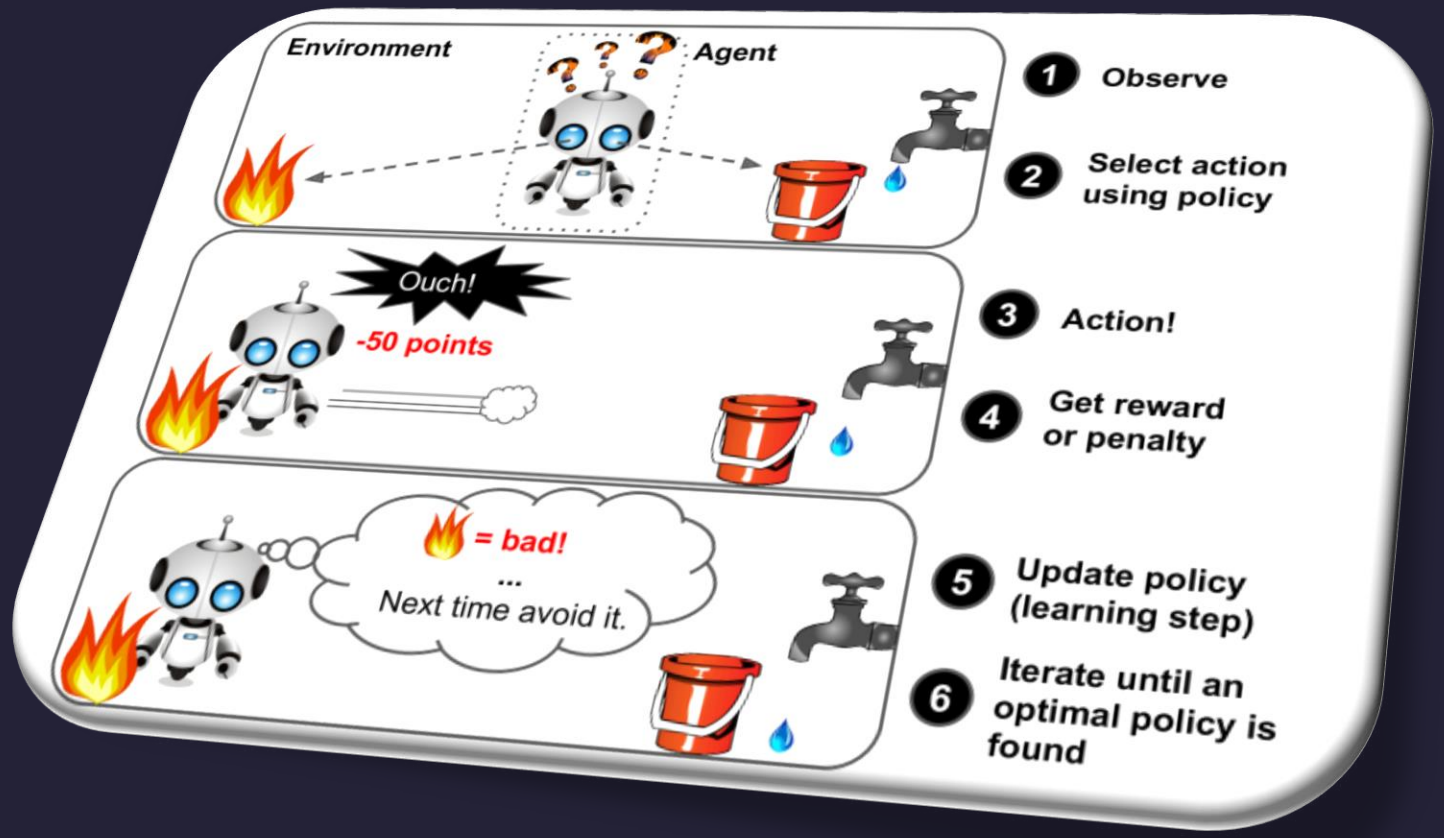
Types of ML tasks unsupervised

- Unsupervised
  - Clustering
  - Segmentation
  - Dimension reduction

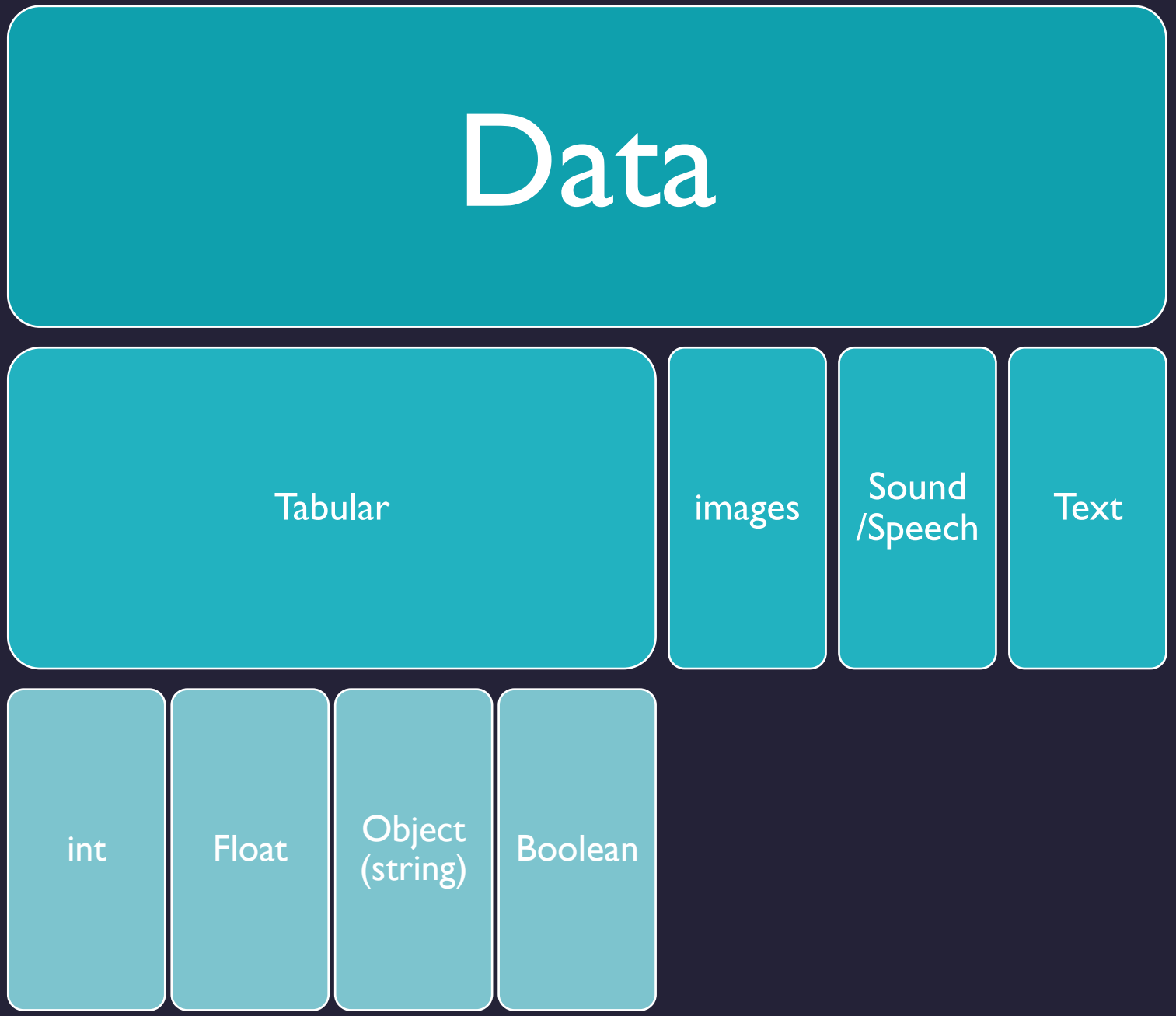


Types of ML tasks Reinforcement

Reinforcement



Data types

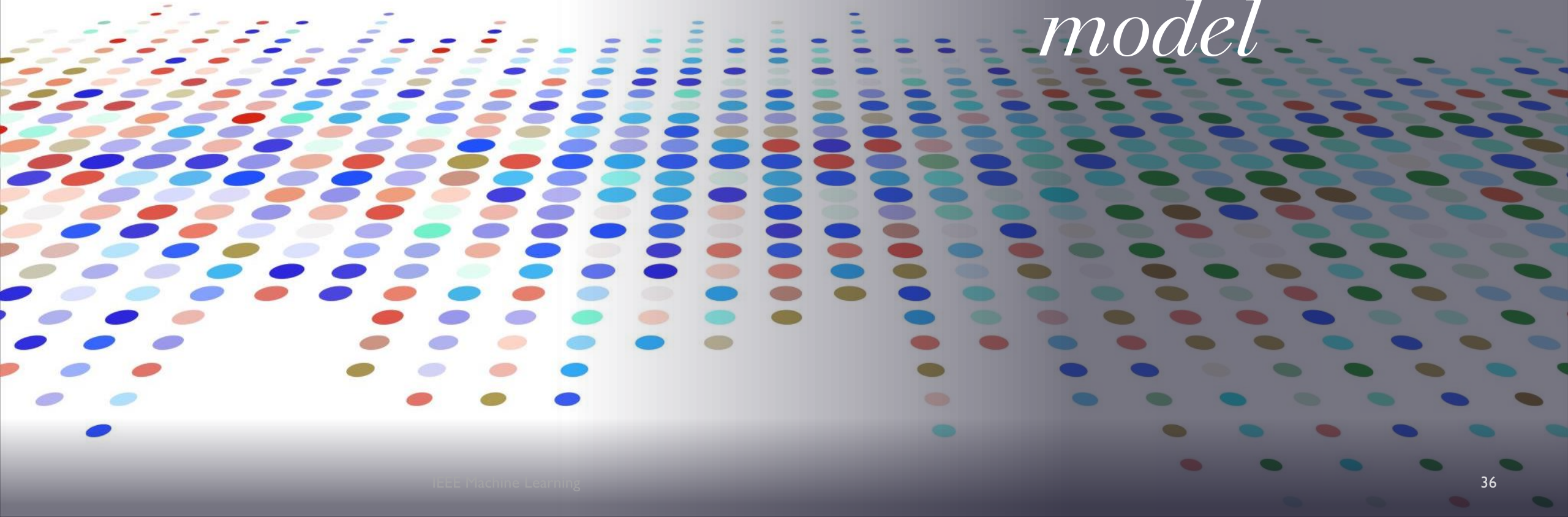

Data
Tabular
images
Sound /Speech
Text
int
Float
Object (string)
Boolean

Data tabular

index	feature 1	feature 2	feature 3	Label
0	4.5	Practice	1.7	Yes
1	3.2	Doesn't	4.4	Yes
2	2.1	Practice	2.5	No
3	4.5	Practice	1.7	Yes

- N observation (Rows) in this case 4
- 4 columns , 3 of them features predictors to help us predict the Label (target)
- Different types of preemptive data in the table
- Real data would be larger
- X denotes the matrix of all x features just matrix without the label
- Label denoted y as a vector **True labels**
- Our prediction would be donated as $\hat{Y}$ (y hat) **predicted labels**

Let's Build our *first ML model*



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See 👀

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