Module 1: Definitions and Key Concepts (60)

- What are AI, ML, and Deep Learning
- Differences and relationships between them
- Real-world applications of AI
- 📌 Work on real-world examples of AI or interactive quiz

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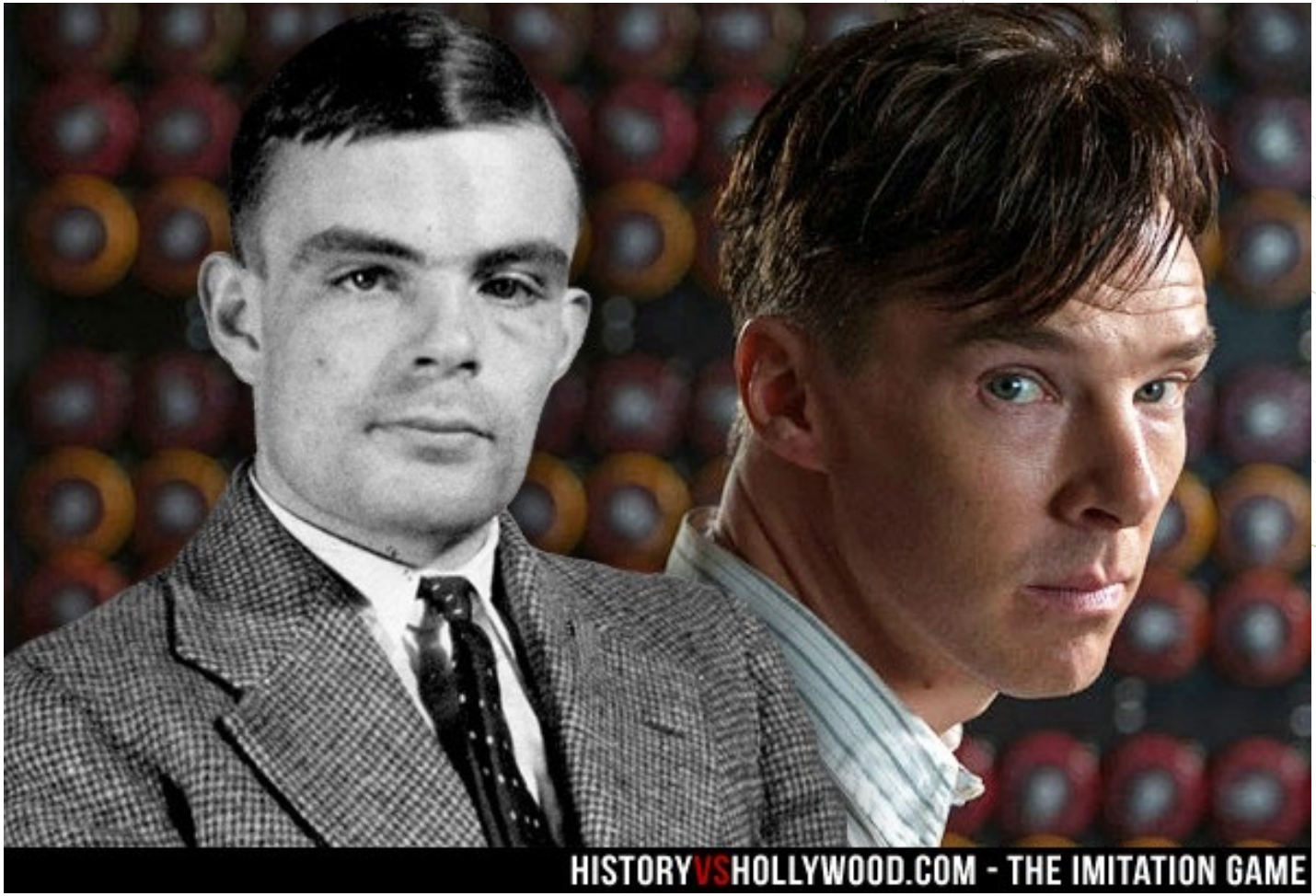
Ministero dell'Università e della Ricerca
Italiadomani

The Artificial Intelligence evolution

- In 1956 the term Artificial Intelligence was coined by John McCarthy
- *The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.*

The Turing test



The Turing test

Turing test

64 languages

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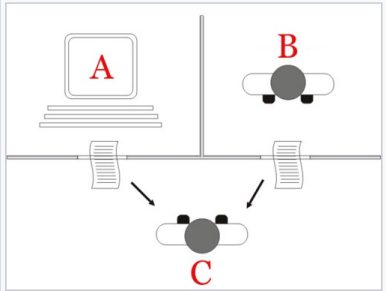
"Imitation game" redirects here. For the film, see The Imitation Game. For other uses, see Turing test (disambiguation).

The **Turing test**, originally called the **imitation game** by Alan Turing in 1949,[2] is a test of a machine's ability to exhibit intelligent behaviour equivalent to that of a human. In the test, a human evaluator judges a text transcript of a natural-language conversation between a human and a machine. The evaluator tries to identify the machine, and the machine passes if the evaluator cannot reliably tell them apart. The results would not depend on the machine's ability to answer questions correctly, only on how closely its answers resembled those of a human. Since the Turing test is a test of indistinguishability in performance capacity, the verbal version generalizes naturally to all of human performance capacity, verbal as well as nonverbal (robotic).[3]



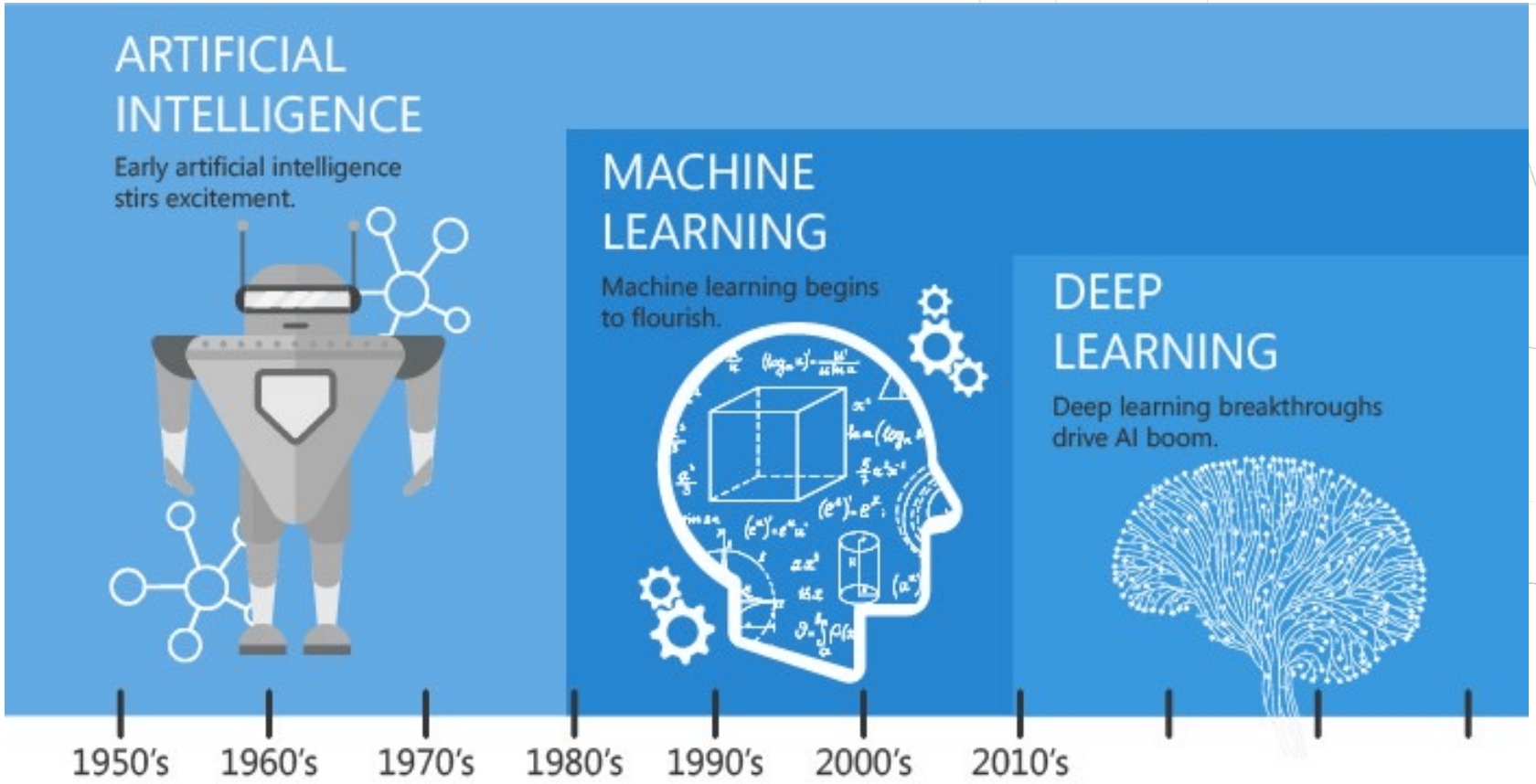
The "standard interpretation" of the Turing test, in which player C, the interrogator, is given the task of trying to determine which player – A or B – is a computer and which is a human. The interrogator is limited to using the responses to written questions to make the determination.[1]

The test was introduced by Turing in his 1950 paper "Computing Machinery and Intelligence" while working at the University of Manchester.[4] It opens with the words: "I propose to consider the question, 'Can machines think?'" Because "thinking" is difficult to define, Turing chooses to "replace the question by another, which is closely related to it and is expressed in relatively unambiguous words".[5] Turing describes the new form of the problem in terms of a three-person party game called the "imitation game", in which an interrogator asks

Part of a series on

Artificial intelligence (AI)

The AI evolution



Since an early flush of optimism in the 1950's, smaller subsets of artificial intelligence - first machine learning, then deep learning, a subset of machine learning - have created ever larger disruptions.

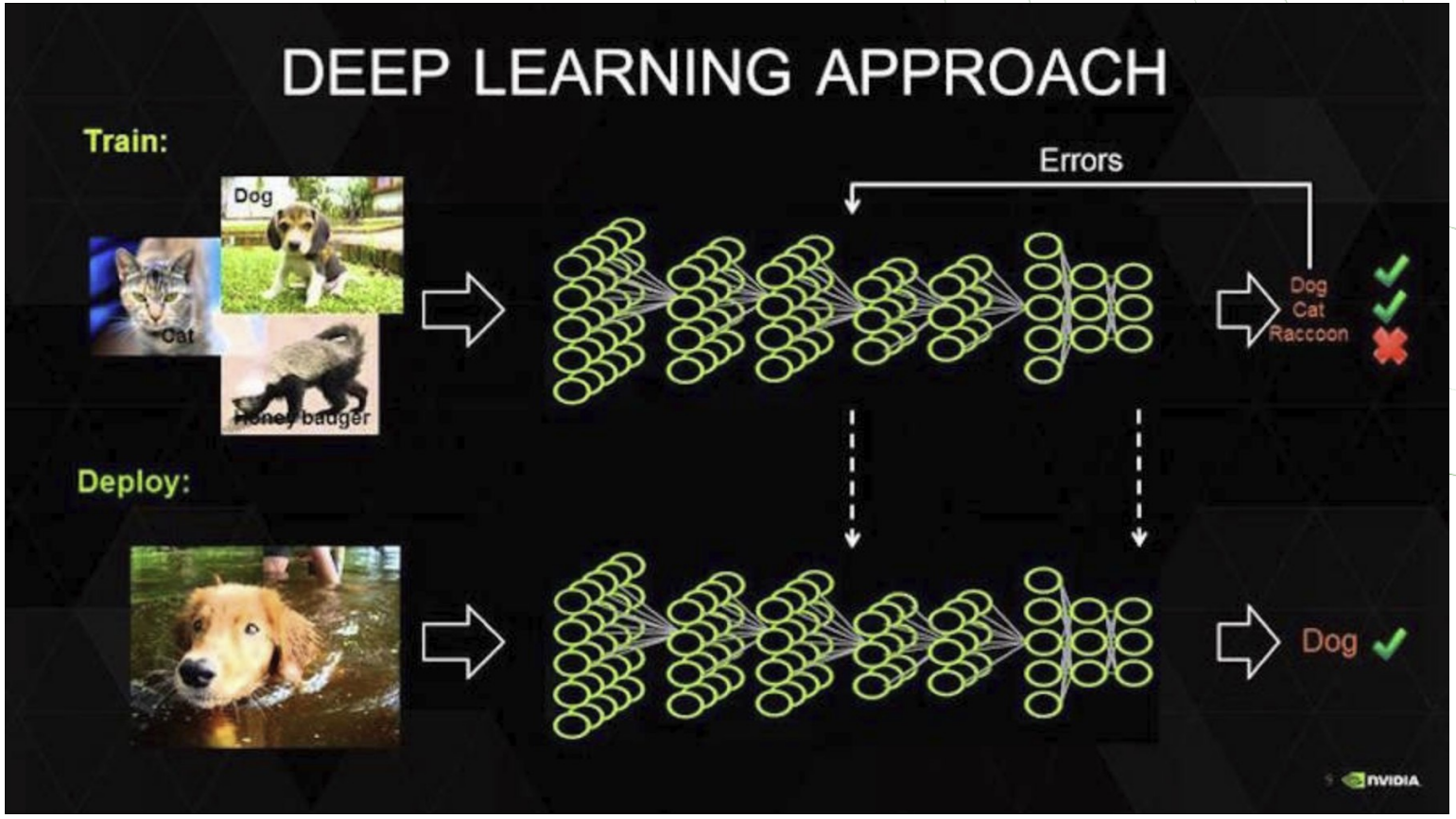
A new vision of Artificial Intelligence today

- Before: Intelligence was hardcoded into machines
- Today: Machines learn by observing Big Data
- BigData -> AI

The old vs the new school

- In the past, many attempts to make machines ”Intelligent”: Expert systems, Artificial Intelligence, etc.
- Today, Big data/Artificial Intelligence is about deriving math models (insights) from huge data bases
- Being able to observe and learn models leads to intelligent behaviour
  - IBM Watson
  - AlphaGo

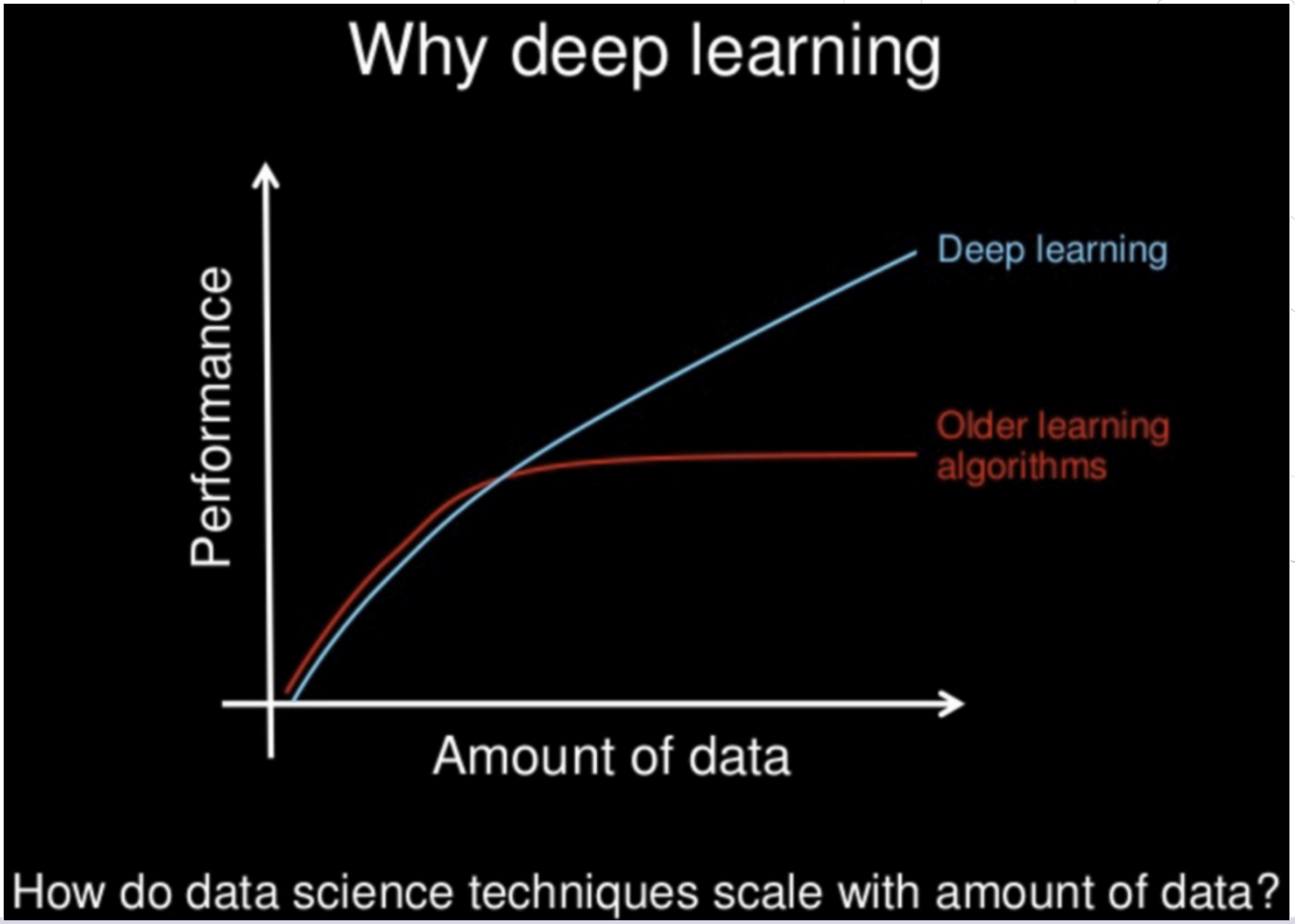
Deep Learning



Self learning example

- Learning to walk

Learning from data



In 1997

Alpha GO

- 3000 years old game
- Simple board
- Before 2016 it was considered to be impossible to model
- Many (many) more combinations compared to chess
- It was said:
  - ”the most elegant game that humans have ever invented”;
  - ”simple rules that give rise to endless complexity”;
  - ”more possible Go positions than there are atoms in the universe”
- Mostly based on intuition

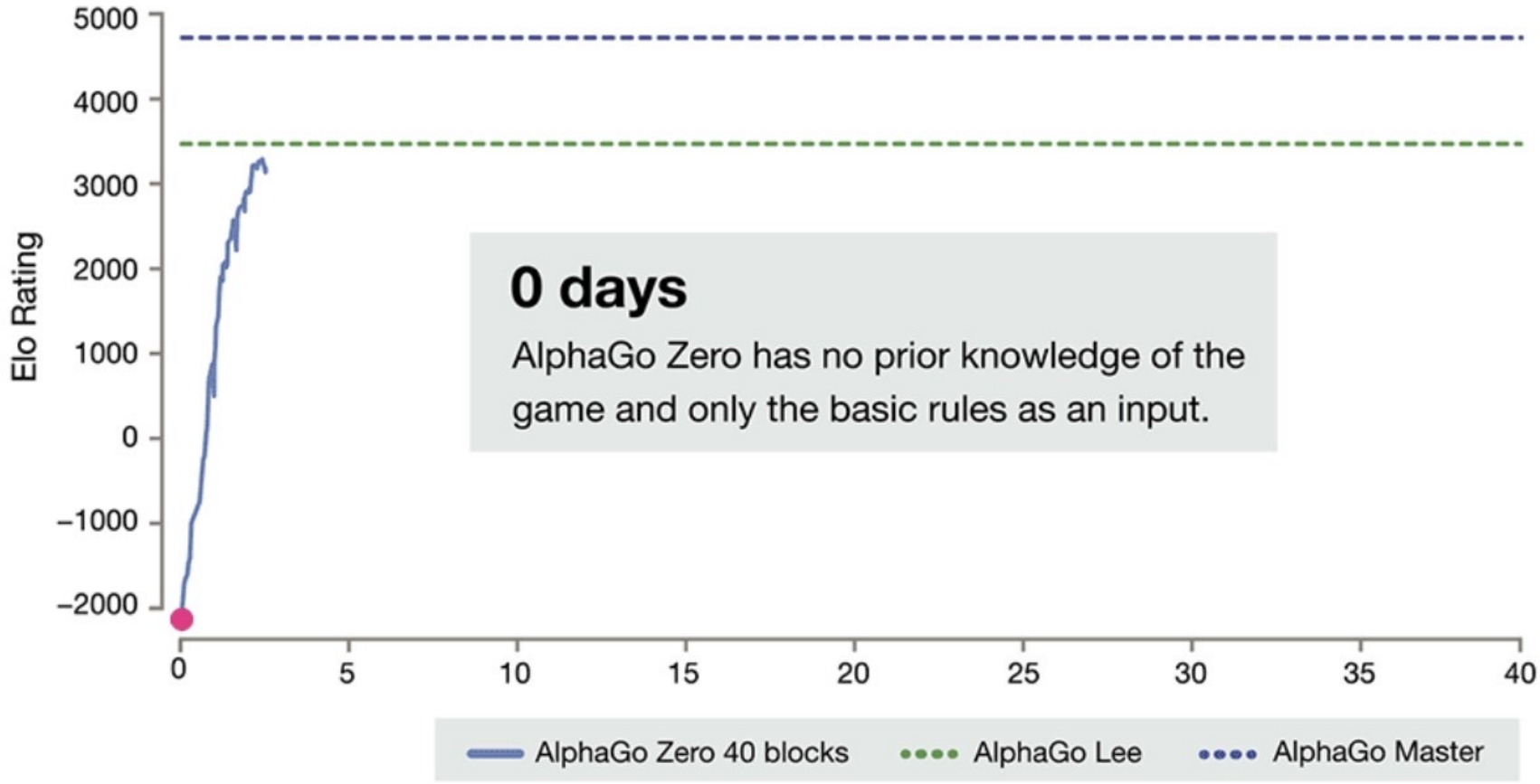
In 2016

It gets better

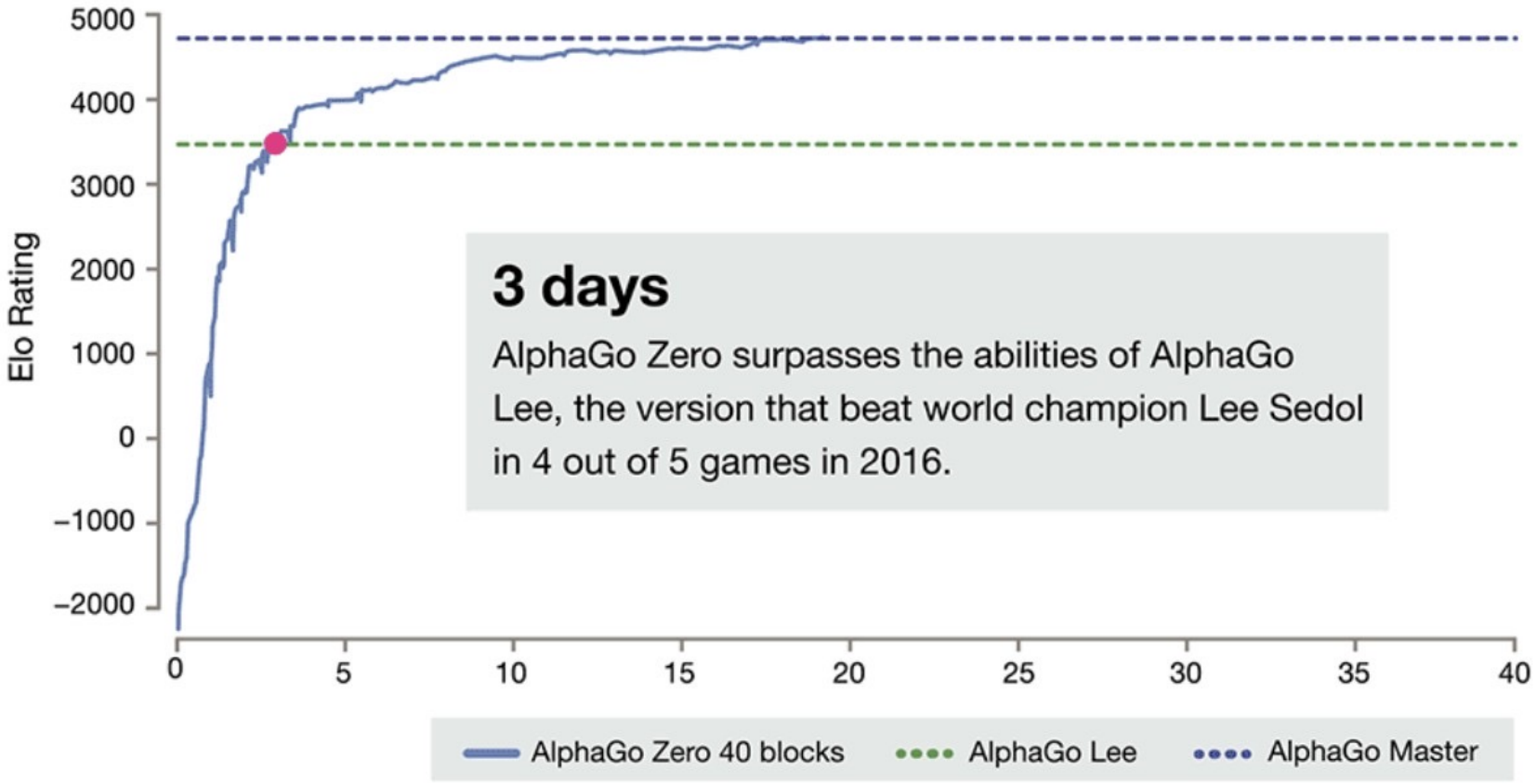
- In 2018 AlphaGo-Zero
- A new version based on Deep Learning techniques

Previous versions of AlphaGo initially trained on thousands of human amateur and professional games to learn how to play Go. AlphaGo Zero skips this step and learns to play simply by playing games against itself, starting from completely random play. In doing so, it quickly surpassed human level of play and defeated the previously published champion-defeating version of AlphaGo by 100 games to 0.

At the beginning



After 3 days


5000
4000
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0
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−2000
Elo Rating
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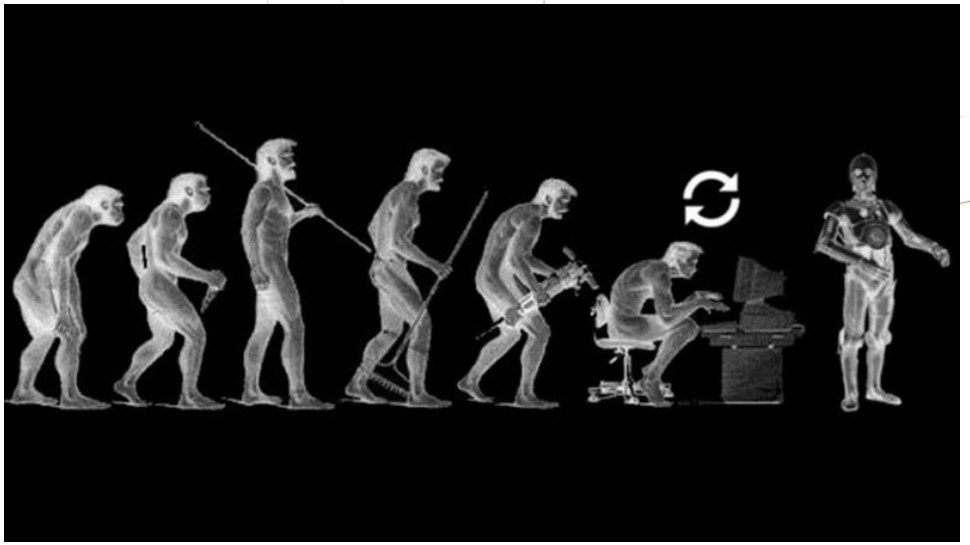
5
10
15
20
25
30
35
40
3 days
AlphaGo Zero surpasses the abilities of AlphaGo Lee, the version that beat world champion Lee Sedol in 4 out of 5 games in 2016.
AlphaGo Zero 40 blocks
AlphaGo Lee
AlphaGo Master

After 21 days

After 40 days

The old vs the new school

- CYC vs Watson
- Two (very) different approaches
- CYC was “embedding” knowledge
- Watson is able to “learn” from huge amount of data



CYC

Cyc

From Wikipedia, the free encyclopedia

For other uses, see CYC (disambiguation).

Cyc (/ˈsaɪk/) is the world's longest-lived artificial intelligence project,[*citation needed*] attempting to assemble a comprehensive ontology and knowledge base that spans the basic concepts and "rules of thumb" about how the world works (think common sense knowledge but focusing more on things that rarely get written down or said, in contrast with facts one might find somewhere on the internet or retrieve via a search engine or Wikipedia), with the goal of enabling AI applications to perform human-like reasoning and be less "brittle" when confronted with novel situations that were not preconceived.

Douglas Lenat began the project in July 1984 at MCC, where he was Principal Scientist 1984–1994, and then, since January 1995, has been under active development by the Cycorp company, where he is the CEO.

Contents [hide]

Cyc

Original author(s)	Douglas Lenat
Developer(s)	**Cycorp, Inc.**
Initial release	1984; 35 years ago
Stable release	6.1 / 27 November 2017; 15 months ago
Written in	Lisp, CycL
Type	Ontology and Knowledge Base and Knowledge Representation Language and Inference engine
Website	www.cyc.com

Watson


PIENSE
THINK
DENKE
PENSER
$24,000
Who is Stoker?
((FOR ONE WELCOME OUR NEW COMPUTER OVERLORDS))
$1,000
$77,147
Who is Bram Stoker?
$ 17,973
$21,600
WHO IS BRAM STOKER?
$5600

Jeopardy

Oscar Wilde said of this title place "The warder is despair"	At the beginning of "A Tale of Two Cities", these 2 kings sit on the thrones of England & France	Around 1912, while recovering in a sanatorium, this former seaman decided to become a playwright
The accompanying text to this book was published separately as "Ornithological Biography" in the 1830s	In May 1973 Sports Illustrated ran one of his short stories under the title "A Day of Wine and Roses"	This author & biochemist who died in 1992 has at least one book in all 10 main Dewey Decimal categories
The Prague tombstone of this German-language writer who died in 1924 is inscribed in Hebrew	D.H. Lawrence called him "an adventurer into the vaults and... horrible underground passages of the human soul"	In 1935 she sent a telegram to a Macmillan editor: "Please send manuscript back I've changed my mind"

IBM Watson vs. Ken Jennings & Brad Rutter

📅 **Date**: February 14–16, 2011

📍 **Show**: *Jeopardy!* (special three-day exhibition match)

Watson at work

WIRED Technology | Science | Culture | Gear | Business |

Credit **IBM**

IBM's Watson -- the language-fluent computer that beat the best human champions at a game of the US TV show *Jeopardy!* -- is being turned into a tool for medical diagnosis. Its ability to absorb and analyse vast quantities of data is, IBM claims, better than that of human doctors, and its deployment through the cloud could also reduce healthcare costs.

Watson at work

Two years ago, IBM announced that Watson had "learned" the same amount of knowledge as the average second-year medical student. For the last year, IBM, Sloan-Kettering and Wellpoint have been working to teach Watson how to understand and accumulate complicated peer-reviewed medical knowledge relating to oncology. That's just lung, prostate and breast cancers to begin with, but with others to come in the next few years). Watson's ingestion of more than 600,000 pieces of medical evidence, more than two million pages from medical journals and the further ability to search through up to 1.5 million patient records for further information gives it a breadth of knowledge no human doctor can match.

Watson at work

According to Sloan-Kettering, only around 20 percent of the knowledge that human doctors use when diagnosing patients and deciding on treatments relies on trial-based evidence. It would take at least 160 hours of reading a week just to keep up with new medical knowledge as it's published, let alone consider its relevance or apply it practically. Watson's ability to absorb this information faster than any human should, in theory, fix a flaw in the current healthcare model. Wellpoint's Samuel Nessbaum has claimed that, in tests, Watson's successful diagnosis rate for lung cancer is 90 percent, compared to 50 percent for human doctors.

What is Artificial Intelligence (AI)?

- Many Interpretations
- Artificial General Intelligence (aka. Strong AI or Full AI)
  - General intelligent actions
  - Discerning problems
  - Acting as humans would
  - … up to self-consciousness
- Restricted AI (aka. Weak or Applied AI or Narrow AI)
  - Implementing intelligence in specific applications or problem solving tasks
  - No full cognitive abilities

What Is Artificial Intelligence (AI)?

- Mimics human intelligence
- Applications: **speech recognition**, **robotics**, **decision-making**
- Types: Narrow, General, Superintelligence

What Is Machine Learning (ML)?

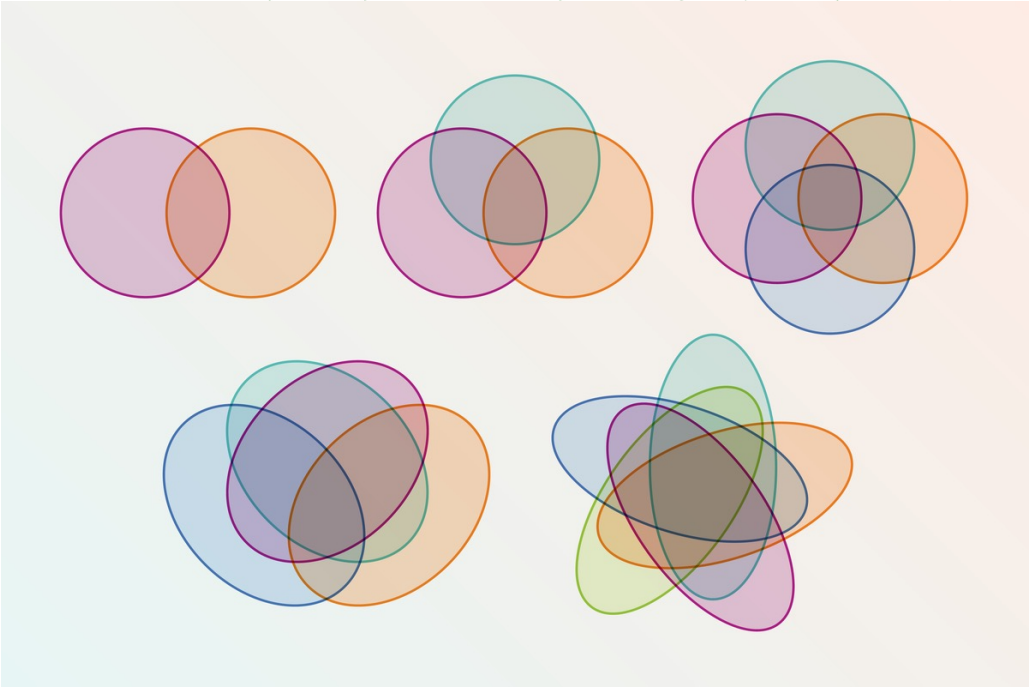
- Subset of AI
- Learns patterns from data
- Example: teaching a machine to fish

What Is Deep Learning (DL)?

- Subset of ML
- Uses neural networks with many layers
- Works best with large datasets

The Relationship: AI > ML > DL

- Hierarchical structure
- DL is part of ML, which is part of AI



Key Differences Between AI, ML, and DL

- Scope
- Data needs
- Algorithm type
- Hardware requirements

Real-World Applications of AI

- Healthcare: diagnosis, drug discovery
- Finance: fraud detection
- Retail: recommendations, chatbots
- Manufacturing: predictive maintenance

Deep Learning in Action

- Self-driving cars
- Face recognition
- Chatbots like ChatGPT
- Image generation (e.g., DALL·E)

Myths and Misconceptions

- AI is not conscious
- DL isn't always the best option
- Data is key

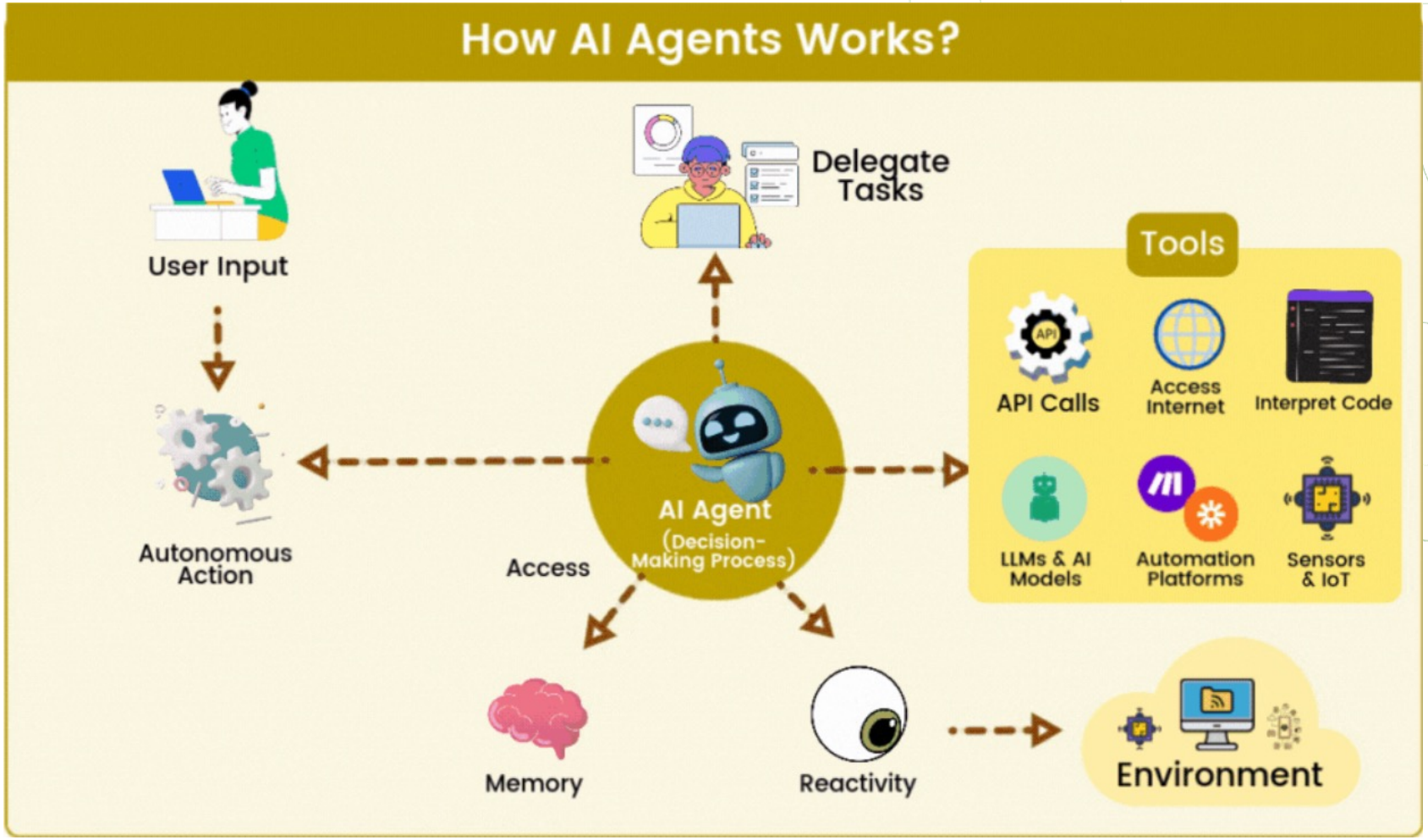
Challenges and Considerations

- Data quality and bias
- Explainability
- Ethics and responsible AI

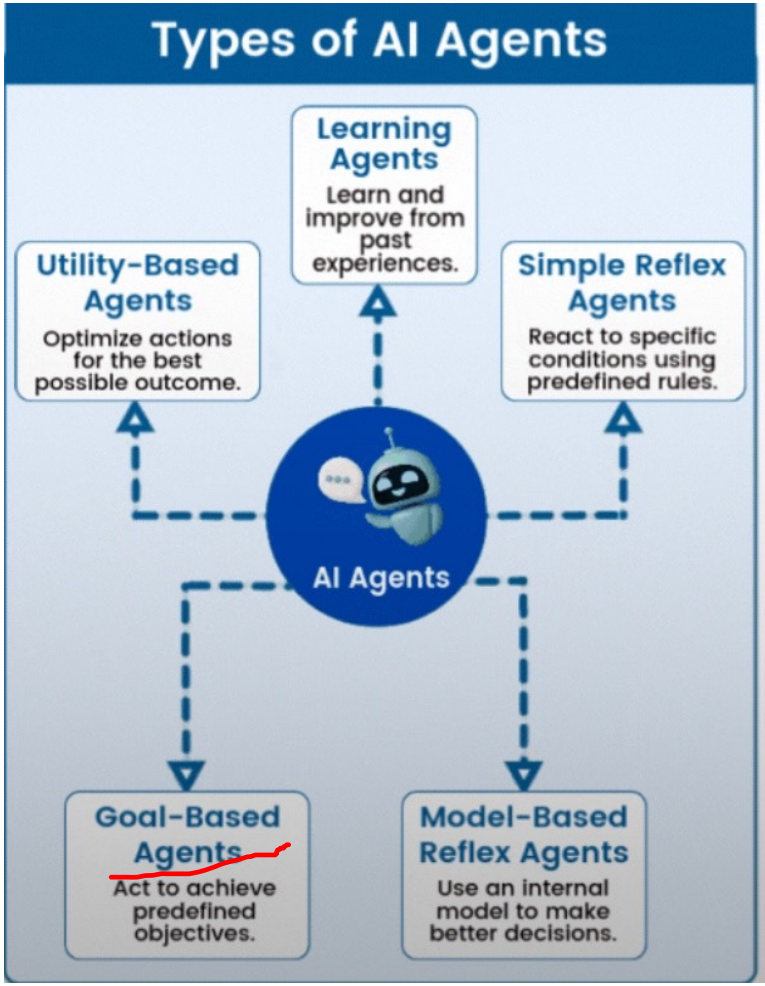
Future Trends

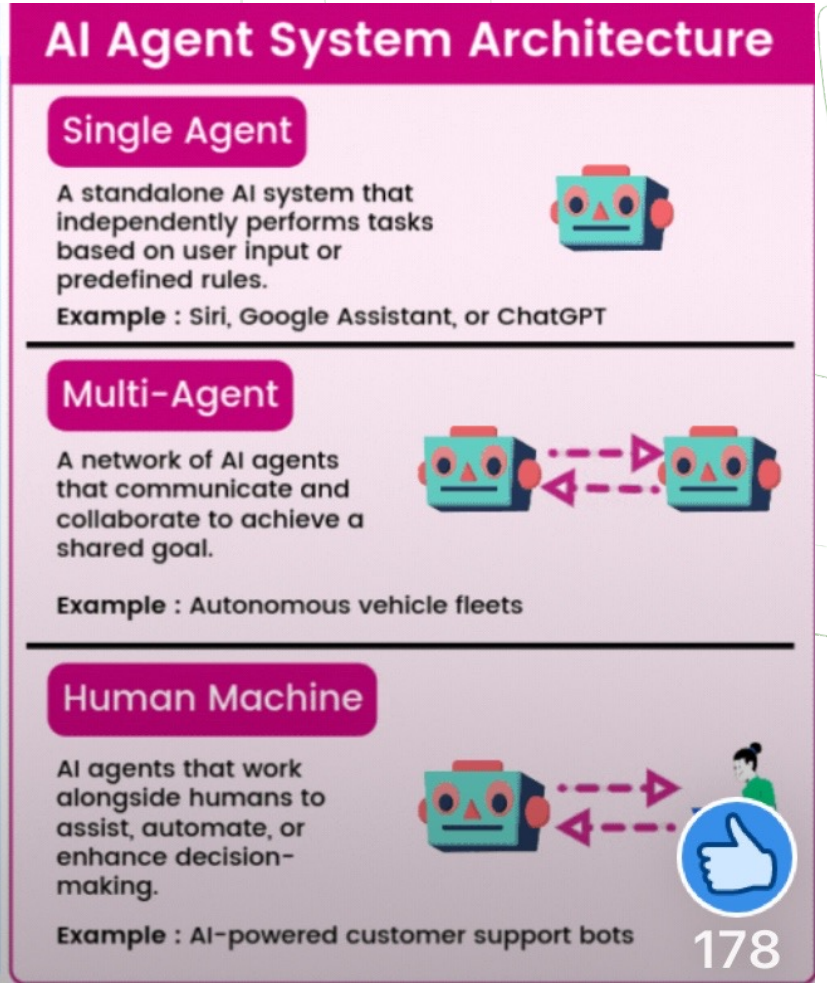
- Generative AI
- AI for everyone (low-code/no-code)
- Autonomous systems and AGI

What is an AI Agent ?



What is an AI Agent ?





Summary and Takeaways

- AI, ML, DL defined and compared
- How they relate
- Real-world impact